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CGG

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Environment plan

Gippsland marine seismic survey

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Acronyms and abbreviations

Acronym/abbreviation	Description
3D	Three Dimensional
AA	Access Authority
ADIOS2	Automated Data Inquiry for Oil Spills
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIMS	Australian Inter-service Incident Management System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
AMSA RCC	Australian Maritime Safety Authority Rescue Coordination Centre
ANZECC	Australia New Zealand Environment and Conservation Council
APPEA	Australian Petroleum Production and Exploration Association
AQIS	Australian Quarantine Inspection Service
ARMCANZ	Australian National Health and Medical Research Council
ARPA	Automatic Radar Plotting Aid
ASBTIA	Australian Southern Bluefin Tuna Industry Association
ATSB	Australian Transport Safety Bureau
AUSCOAST	Australian Coastguard
BIA	Biologically Important Area
BOD	Biochemical Oxygen Demand
BoM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CA	Control Agency
CAMBA	China–Australia Migratory Birds Agreement
CEO	Chief Executive Officer
CFA	Commonwealth Fisheries Association
CITES	Convention on International Trade in Endangered Species of Wildlife and Flora 1973
CM	Control Measure
CMS	Convention of Migratory Species
CoC	Chain of Custody
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea 1972
CSIRO	Commonwealth Scientific and Industrial Research Organisation
cui	Cubic inches
CV	Curriculum vitae
DAWR	Department of Agriculture and Water Resources (Commonwealth)
dB	Decibel
DEC	Department of Environment and Conservation (Western Australia) (now DBCA)
DEDJTR	Department of Economic Development, Jobs, Transport and Resources (Victoria)
DEH	Department of Environment and Heritage (Commonwealth) (now DoEE)

Acronym/abbreviation	Description
DELWP	Department of Environment, Land, Water and Planning (Victoria)
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth) (now DoEE)
DEWNR	Department for Environment Water and Natural Resources (South Australia)
DNP	Director of National Parks
DoA	Department of Agriculture (Commonwealth) (now DAWR)
DoEE	Department of the Environment and Energy(Commonwealth)
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tasmania)
DPTI	Department of Planning, Transport and Infrastructure (South Australia)
DSD	Department of State Development (South Australia)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth) (now DoEE)
ECD	Ecological Character Description
EIA	Environmental Impact Assessment
EMBA	Environment that May Be Affected
EMS	Environmental Management System
EP	Environment Plan
EPA	Environmental Protection Authority (Western Australia) (now DWER)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPBC Regulations	Environment Protection and Biodiversity Conservation Regulations 2000
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERP	Emergency Response Plan
ESD	Ecological Sustainable Development
ESDSC	Ecological Sustainable Development Steering Committee
FRDC	Fisheries Research and Development Cooperation
GHG	Greenhouse Gas
GMP	Garbage Management Plan
GP	Good Practice
GRT	Gross Register Tonnage
HSE	Health, Safety and Environment
Hz	Hertz
IAGC	International Association of Geotechnical Contractors
IAPP Certificate	International Air Pollution Prevention Certificate
IFAW	International Fund for Animal Welfare
ILUA	Indigenous Land Use Agreement
IMO	International Maritime Organization
IMOS	Integrated Marine Observing System
IMS	Invasive Marine Species
IOPP	International Oil Pollution Prevention
ISO	International Standards Organization
ISPP	International Sewage Pollution Prevention
ITF	Indonesian Throughflow

Acronym/abbreviation	Description
IUCN	International Union for Conservation of Nature
JA	Jurisdictional Authority
JAMBA	Japan–Australia Migratory Birds Agreement
JHA	Job Hazard Analysis
KEF	Key Ecological Feature
km	Kilometre
Lpk	the maximum instantaneous sound pressure level (SPL) or zero-to-peak SPL
LAT	Lowest Astronomical Tide
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MC	Measurement Criteria
MDO	Marine Diesel Oil
MEP	Marine Environment Protection
MEPC	Marine Environment Protection Committee
MERCOM	Maritime Emergency Response Commander
MFO	Marine Fauna Observer
MGO	Marine Gas Oil
MNES	Matters of National Environmental Significance
MOSES	Marine Oil Spill Equipment System
MSDS	Material Safety Data Sheet
MSS	Marine Seismic Survey
NATPLAN	National Plan for Maritime Environmental Emergencies
NCVA	National Conservation Values Atlas
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NOPTA	National Offshore Petroleum Titles Administrator
NOx	Nitrogen Oxides
NRMMC	Natural Resources Management Ministerial Council
NTM	Notice to Mariners
OGP	Oil and Gas Producers
OGUK	Oil and Gas UK
OHS	Occupational Health and Safety
OIW	Oil in Water
OPEP	Oil Pollution Emergency Plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPRC	Oil Pollution Preparedness, Response and Cooperation
OSMP	Operational and Scientific Monitoring Program
OSRA	Oil Spill Response Atlas
OSTM	Oil Spill Trajectory Modelling
Pa	Pascal
PERR	Post-survey Environmental Review Report
PIRSA	Department of Primary Industries and Regions South Australia (South Australian)
PMS	Planned Maintenance System

Acronym/abbreviation	Description
PMST	Protected Matters Search Tool
POLREP	Oil Pollution Report
POMF	Pearl Oyster Managed Fishery
POWBONS	Pollution of Waters by Oil and Noxious Substances Act (Victoria)
PPE	Personal Protection Equipment
ppm	Parts per Million
PTS	Permanent Threshold Shift
RCC	Rescue Coordination Centre (AMSA)
RMS	Root-Mean-Square
ROKAMBA	Republic of Korea and Australia Migratory Birds Agreement
RPS	RPS Australia West Pty Ltd
RR	Residual Risk
SA	South Australia
SAMSCAP	South Australian Marine Spill Contingency Plan
SAP	Sampling and Analysis Plan
SAR	(satellite-mounted) Synthetic Aperture Radar
SBTF	Southern Bluefin Tuna Fishery
SEA	Survey Environmental Advisor
SEL	Sound Exposure Level
SIMA	Spill Impact Mitigation Assessment
SITREP(S)	Situation Report(s)
SMP	Scientific Monitoring Plan
SOLAS	Safety of Life at Sea
SOP	Standard Operating Procedure
SOPEP	Shipboard Oil Pollution Emergency Plan
SOx	Sulphur Oxides
SPA	Special Prospecting Authority
SPL	Sound Pressure Level
SPRAT	Species Profile and Threats Database
SRD	Streamer Recovery Device
STP	Sewage Treatment Plant
TAS	Tasmania
TASPLAN	Tasmanian Marine Oil Spill Contingency plan
TEC	Threatened Ecological Community
TMPC	Tasmanian Marine Pollution Controller
TSSC	Threatened Species Scientific Committee
TTS	Temporary Threshold Shift
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
VIC	Victoria
VMS	Vessel Management System
VOCs	Non-methane Volatile Organic Compounds
WGS84	World Geodetic System 1984

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1 Introduction

CGG Services (Australia) Pty Ltd (CGG) proposes to acquire a multi-client three-dimensional (MC3D) marine seismic survey (MSS) in the Gippsland Basin offshore of Victoria (Figure 1.1). The Gippsland MC3D MSS (the “activity”) will comprise acquisition of approximately 10,896 km^2 of seismic data within a larger operational area of approximately 16,180 km^2.

The area in which the activity is planned to occur lies entirely within Commonwealth waters, approximately 13 km from the Victorian mainland at its closest point. Exploration activities within Commonwealth waters are subject to the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)).

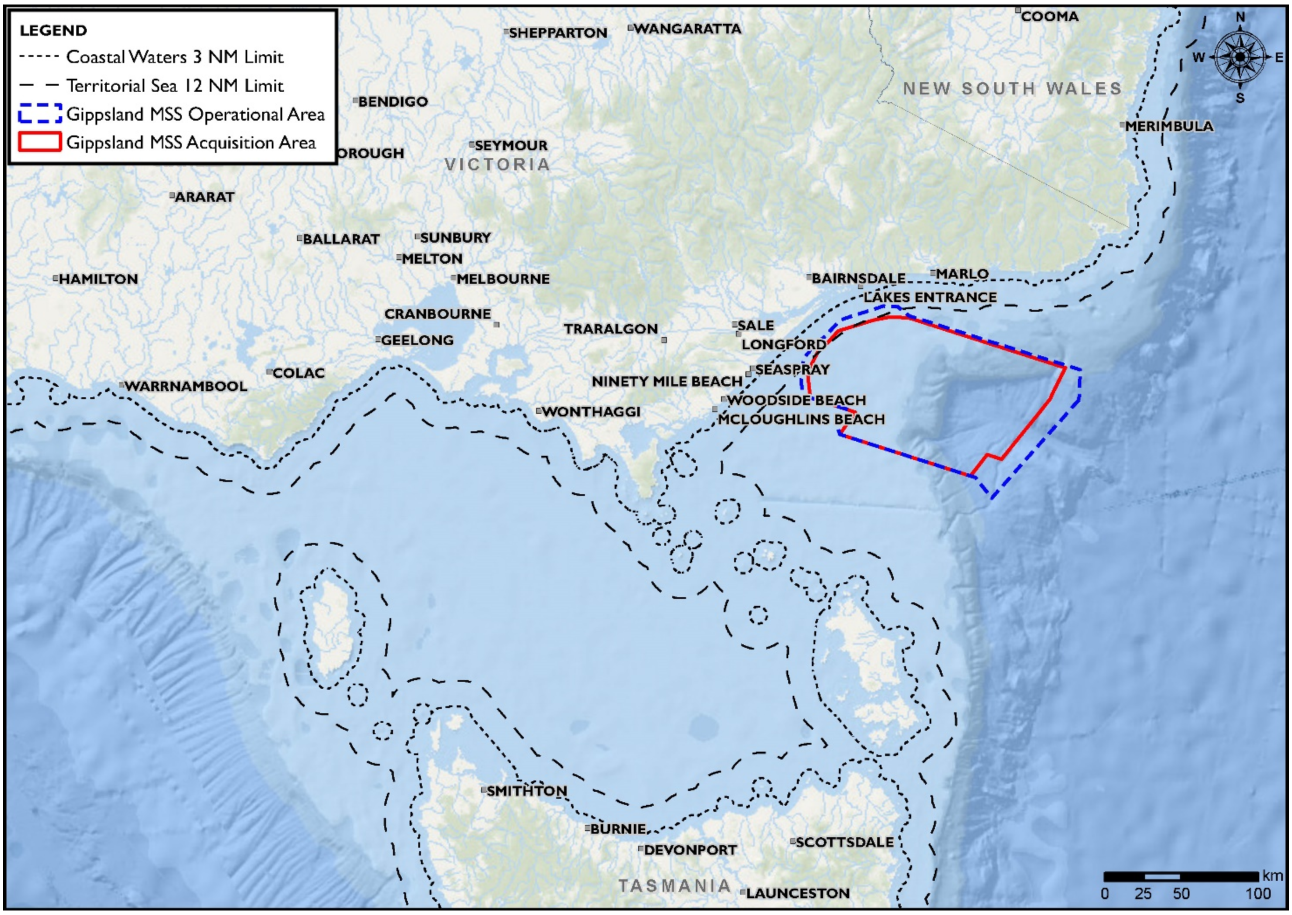

Figure 1.1 Proposed Gippsland marine seismic survey (MSS) area

1.1 Purpose and scope

This Environment Plan (EP) for the Gippsland MSS has been prepared as part of CGG’s requirements under the OPGGS(E) Regulations, which are administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). The Petroleum Activity is defined by seismic data acquisition, associated vessel movements and preparation and maintenance of seismic survey equipment, within the Operational Area.

In accordance with objectives set out under Regulation 3 of the OPGGS(E), this EP has been developed to demonstrate that the activity will be carried out in a manner:

- consistent with the principles of ecologically sustainable development set out in section 3A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- by which the environmental impacts and risks (of both routine/planned operations and non-routine/unplanned events) of the activity will be reduced to as low as reasonably practicable (ALARP)
- by which the environmental impacts and risk of the activity will be of an acceptable level.

This EP describes the "Operational Area" within which seismic data acquisition and normal movements and operations of the survey and support vessels such as streamer deployment and retrieval, maintenance and vessel manoeuvring, line run-ins/outs, soft-start procedures and line turns will occur. The EP also describes the "Acquisition Area" within which seismic data will be acquired (recorded). There will be no discharge of the airguns outside the Acquisition Area, apart from during "soft-starts" within the Operational Area.

This EP also describes the area within which emergency response actions, related to unplanned events as a result of the activities, may occur. It does not include transit routes to and from the operational area. The streamers may be deployed or retrieved during transit, but airguns will not be discharged at full power.

The EP, when accepted, will become a legally binding document between NOPSEMA, as the Regulator under the OPGGS(E), and CGG, setting out the performance outcomes, standards and criteria against which conformance and environmental performance will be monitored.

1.2 EP content (Reg 13(4))

Division 2.3 of the OPGGS(E) details specific requirements for the content of an EP. These have been met in developing this EP, as described below

- environmental assessment (Regulation 13) including
  - description of the activity – Regulation 13(1) (Section 2)
  - description of the environment – Regulation 13(2) and 13(3) (Section 4)
  - relevant requirements – Regulation 13(4) (Section 2)
  - evaluation of environmental impacts and risks – Regulation 13(5) and 13(6) (Sections 6 and 7)
  - environmental performance outcomes and standards – Regulation 13(7) (Sections 6 and 7)
- implementation strategy for the EP (Regulation 14) (Section 8)
- details of titleholder and liaison person (Regulation 15) (Section 1.2)
- other information in the environment plan (Regulation 16), including
  - a statement of the titleholder's corporate environmental policy (Appendix A)
  - a report on all consultations between the titleholder and any relevant person (Regulation 11a) (Section 9 and Appendix H)
  - details of all reportable incidents in relation to the proposed activity (Section 8.8).

1.3 Titleholder details (Reg 15)

CGG will be the Titleholder of the Special Prospecting Authority (SPA) and Access Authorities (AA) under the OPGGS Act for the Gippsland MSS planned under this EP. Access Authorities (AA) will be applied for with the relevant permit area titleholders when the final Acquisition Area and timing are confirmed. An application for a SPA has been submitted to the National Offshore Petroleum Titles Administrator (NOPTA) and is currently under assessment (NEATS application reference number: CLH6QH).

CGG is a fully integrated geoscience company providing leading geological, geophysical and reservoir capabilities to its broad base of customers, primarily from the global oil and gas industry. CGG offers a range of products to assist oil companies to find oil and gas reserves offshore worldwide, including seismic and electromagnetic services, data acquisition, processing, reservoir analysis/interpretation and multi-client library data. CGG was founded in 1931 and has a workforce of over 6,000 staff in 70 locations worldwide.

CGG has extensive experience of conducting seismic surveys internationally and in Australia. The company has a well-developed and systematic approach to environmental management, including an Environment Policy (Appendix A) that is applied successfully to operations around the world. CGG is a specialised seismic operator with a proven record of environmentally responsible operations in Australian waters.

The details of the titleholder are

Titleholder:	CGG Services (Australia) Pty Ltd
Business Address:	Level 1, 1 Ord Street, West Perth WA 6005
Telephone:	+61 8 9214 6200
Fax:	+61 8 9214 6222
ACN:	081 777 755

The titleholder's nominated liaison person is

Titleholder Liaison Person:	Mark Stanley
Business Address:	Level 1, 1 Ord Street, West Perth WA 6005
Direct Telephone:	+61 457 977 770
Email Address:	mark.stanley@CGG.com

NOPSEMA will be notified according to the requirements of Regulation 15(3) of the OPGGS(E) Regulations of changes to the titleholder, the nominated liaison person, and/or contact details for either the titleholder or liaison. CGG will submit written notice of changes to NOPSEMA within 30 days of the change.

1.4 CGG corporate environmental policy (Reg 16)

CGG recognises that concern and responsibility for the environment is an integral part of the way in which the company conducts its business. The company's public commitment is defined within their Health, Safety and Environment Policy (Appendix A). CGG is committed to caring for the environment and continually improving environmental performance through:

- conformance (compliance)
- stakeholder engagement
- risk assessment and management
- environmental practices
- training
- management review.

1.5 End of the EP (Reg 25a)

In accordance with Regulation 25A of the OPGGS(E) Regulations, the operation of this EP ends when

- CGG notifies NOPSEMA that
  - the activity to which the EP relates has ended
  - all the obligations under the EP have been completed
- NOPSEMA accepts the notification.

1.6 Demonstration of financial assurance (Reg 5G)

Under Regulation 5G of the OPGGS(E), NOPSEMA must be reasonably satisfied that CGG is compliant with Section 571(2) of the OPGGS Act and that the compliance is in a form acceptable to NOPSEMA. CGG will submit a financial assurance declaration (as described in the financial assurance for petroleum titles guideline N-04750-GL1381 Rev 6) to NOPSEMA.

CGG will be applying for Access Authorities for all relevant permit area titleholders for the survey once the timing and Acquisition Area have been confirmed. CGG will notify NOPSEMA as soon as practicable upon the authorities being granted and provide documentation demonstrating that the appropriate level of financial assurance is in place for these titles. The forms of financial assurance will be kept on record by CGG throughout the duration of the activity and will be available to NOPSEMA should this be requested. CGG will review the level of financial assurance in the event of changes in the survey plan or circumstances that affect the insurance risk profile.

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2 Relevant requirements (Reg 13(4))

2.1 Regulatory assessment

The Gippsland MSS Petroleum Activity is located wholly within Commonwealth waters. The regulatory framework for offshore petroleum activities in Commonwealth waters is governed by the OPGGS Act and the OPGGS(E) Regulations. The EPBC Act specifically governs the assessment of potential risks and impacts on matters of national environmental significance (MNES). The OPGGS Act and the EPBC Act are administered by NOPSEMA in relation to offshore Petroleum Activities.

2.1.1 Offshore Petroleum and Greenhouse Gas Storage Act (2006)

The objective of the OPGGS Act is to ensure that offshore petroleum operations are performed in a way that is consistent with the principles of ecologically sustainable development (ESD), through an accepted EP with agreed environmental outcomes and performance standards.

Approvals required of a titleholder under the OPGGS Act relevant to the activity include the following:

- Environment Plan (EP) assessment and acceptance
- Oil Pollution Emergency Plan (OPEP) (Section 8.7) assessment and acceptance.

NOPSEMA has responsibility for the assessment and acceptance of this EP in accordance with the provisions of the OPGGS(E).

Prior to accepting an EP, NOPSEMA must be reasonably satisfied that the titleholder has demonstrated compliance with the financial assurance requirements of subsection 571(2) of the OPGGS Act in a form acceptable to NOPSEMA.

2.1.2 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009)

The OPGGS(E) regulations are intended to ensure that petroleum activities are consistent with the principles of ecologically sustainable development (ESD), and in accordance with an accepted EP that has appropriate environmental performance outcomes and standards, as well as measurement criteria for determining whether the objectives and standards are met.

The OPGGS(E) define the following core elements as critical components of the EP

- identifying the applicable environmental regulatory requirements
- identifying and assessing the potential environmental effects and risks associated with normal (routine), as well as unforeseen (non-routine) events
- documenting the environmental outcomes, performance standards and measurement criteria to be implemented to reduce potential environmental effects of the activity to ALARP
- documenting the environmental management strategies that are to be implemented to manage potential environmental effects associated with the activity
- demonstration of appropriate levels of consultation with defined stakeholders.

CGG has prepared and submitted this EP to NOPSEMA for acceptance before commencement of the activities.

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2.1.3 Environment Protection and Biodiversity Conservation Act 1999

NOPSEMA's environmental management authorisation process has been endorsed by the Federal Minister for the Environment as a program that meets the requirements of Part 10 (Section 146) of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Since February 2014, NOPSEMA has responsibility for assessing oil and gas activities under the EPBC Act as part of its EP assessment process.

The EPBC Act protects matters of national environmental significance (MNES) in relation to Commonwealth actions and actions on (or impacting upon) Commonwealth land or waters. Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the MNES without approval from the Australian Government Environment Minister or the Minister's delegate.

CGG has considered relevant values and sensitivities of matters protected under the EPBC Act (as outlined in Regulation 13(3)). CGG will apply the requirements of EPBC Policy Statement 2.1 for the proposed activity (Section 6) through implementation of Part A Standard Management Procedures. In addition, certain requirements of the Part B Additional Management Procedures (for example, including utilising marine fauna observers (MFOs)) will be implemented as described in Section 6.2.

2.1.3.1 Ecologically sustainable development (ESD)

The National Strategy for Ecologically Sustainable Development (ESDSC 1992) defines the goal of ESD as "development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". The five principles of ESD are defined in Part 1, Section 3A of the EPBC Act as follows:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- The principle of inter-generational equity, in that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.
- Improved valuation, pricing and incentive mechanisms should be promoted.

CGG's commitment to sustainability in their operations and activities is reflected in their corporate Environmental Policy (Appendix A). In recognising their objective to continually improving environmental performance, CGG has made commitments under the areas of conformance, stakeholder engagement, impact and risk management, environmental practices, education and management review (Appendix A). CGG's commitments demonstrate consistency with the ESDSC (1992) definition and the principles of ESD as defined under the EPBC Act.

The OPGGS Act requires all activities to be consistent with the principles of ecological sustainable development (ESD), as defined by the EPBC Act (Part 3A). CGG has incorporated the principles of ESD into the assessment methodology described in Section 5, in the development of control measures, the criteria for risk acceptance and in the definition of environmental performance outcomes and standards for each impact or risk in Section 6 and Section 7, respectively. CGG believes that the commitments made within this EP demonstrate that the environmental management of the activity will be conducted in accordance with the principles of ESD.

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2.2 Other legislation, conventions and guidelines

2.2.1 Key Commonwealth and state legislation

Table 2.1 and Table 2.2 provide summaries of Commonwealth and state legislation relevant to the environmental management of the activity.

Table 2.1 Summary of key Commonwealth legislation

Legislation	Applicability	International convention enacted	Administering authority
Australian Heritage Council Act 2003	This Act identifies areas of heritage value listed on the Register of the National Estate and sets up the Australian Heritage Council and its functions.		Australian Heritage Council
Australian Maritime Safety Authority Act 1990 (AMSA Act)	Facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are given effect through AMSA. AMSA is the lead agency for responding to oil spills in the marine environment and is responsible for the Australian National Plan for Maritime Environmental Emergencies (NATPLAN) (AMSA 2016). The implementation of the NATPLAN is a component of the OPEP (Section 8.7). Authority is included into necessary OPEP/Shipboard Oil Pollution Emergency Plan (SOPEP) response documents for reporting purposes.	International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) 1990. Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000. Relates to non-routine operations (oil spills) and sets up a system of oil pollution contingency plans and cooperation in fighting oil spills.	Australian Maritime Safety Authority (AMSA)
Environment Protection (Sea Dumping) Act 1981	This Act protects Australian waters and regulates activities such as waste incineration, effluent discharges and sea dumping related to the activities of the vessels employed.	Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1996 (previously known as the London Dumping Convention)	Department of the Environment and Energy (DoEE)
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and Regulations 2000 (EPBC Regulations)	This Act protects matters of national environmental significance (MNES), streamlines the Commonwealth environmental assessment and approval process, and provides an integrated system for biodiversity conservation and management of protected areas. MNES include world heritage properties, RAMSAR wetlands, listed threatened species and communities, migratory species under international agreements, nuclear actions, the Commonwealth marine environment and the Great Barrier Reef Marine Park. MNES within (and in the vicinity of) the Activity and Oil EMBAs have been identified within this EP (Section 4).	1992 Convention on Biological Diversity and Agenda 21 Convention on International Trade in Endangered Species of Wildlife and Flora 1973 (CITES) Japan–Australia Migratory Bird Agreement 1981 (JAMBA) China–Australia Migratory Bird Agreement 1988 (CAMBA)	DoEE

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Legislation	Applicability	International convention enacted	Administering authority
	Part 8 of the EPBC Regulations provides guidance on interacting with cetaceans.	Republic of Korea–Australia Migratory Bird Agreement 2006 (ROKAMBA) Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (RAMSAR) International Convention on Whaling 1946 Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979	
Historic Shipwrecks Act 1976 and Regulations 1978	Protects the heritage values of shipwrecks and relics for shipwrecks more than 75 years old below the low water mark. It is an offence to interfere with a shipwreck covered by this Act. Available historic shipwreck locations covered by international conventions enacted by this legislation have been identified and assessed (as applicable) within this EP (Section 4.6.4).	Convention on Conservation of Nature in the South Pacific (APIA Convention) 1976 Australian–Netherlands Agreement concerning old Dutch Shipwrecks 1972 Convention on Protection of Underwater Cultural Heritage 2001	DoEE
National Environment Protection Council Act 1994	The Council develops (in conjunction with other State authorities through the Intergovernmental Agreement on the Environment) consistent environmental standards to be adopted between states. These requirements take the form of a National Environmental Protection Measure (NEPM) and include the National Pollutant Inventory.		Natural Resources Management Ministerial Council (NRMMC)/ Environment Protection and Heritage Council
National Greenhouse and Energy Reporting Act 2007	Introduces a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects and energy use and the production of corporations.		DoEE, Climate Change Authority
Navigation Act 2012	This Act regulates ship-related activities in Australian waters, including elements of a number of international agreements such as the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) relating to equipment and construction of ships. As the activity is a vessel-based survey in Australian waters, it is subject to the Act.	United Nations Convention on the Law of the Sea 1982 (UNCLOS) International Convention for the Safety of Life at Sea (SOLAS) Convention on the International Regulations for Preventing Collisions at Sea (COLREGS) International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL 73/78)	AMSA (operational) Department of Infrastructure and Regional Development Minister for Infrastructure and Regional Development

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Legislation	Applicability	International convention enacted	Administering authority
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 as amended (OPGGS(E))	The OPGGS Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum and greenhouse gas (GHG) exploration and development operations in Commonwealth waters. The OPGGS(E) ensure that offshore petroleum and GHG activities are undertaken in an ecologically sustainable manner, and in accordance with an EP that has appropriate environmental performance outcomes, standards and criteria.		NOPSEMA National Offshore Petroleum Titles Administrator (NOPTA) Department of Industry, Innovation and Science
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	Regulates the manufacture, importation and use of ozone depleting substances (typically used in fire-fighting equipment and refrigerants). Applicable to the handling of any ozone depleting substances.	Montreal Protocol on Substances that Deplete the Ozone Layer 1987 (Concerns the phase-out of ozone depleting substances) UN Framework Convention on Climate Change 1992	DoEE
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. This Act prohibits discharges of sewage, oil and various noxious substances into the sea and sets the requirements for a shipboard waste management plan. The following Marine Orders relating to marine pollution prevention have been put in place to give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78: • Marine Orders, Part 91 (Marine Pollution Prevention – Oil) • Marine Orders, Part 93 (Marine Pollution Prevention – Noxious Liquid Substances) • Marine Orders, Part 94 (Marine Pollution Prevention – Packaged Harmful Substances) • Marine Orders, Part 95 (Marine Pollution Prevention – Garbage) • Marine Orders, Part 96 (Marine Pollution Prevention – Sewage) • Marine Orders, Part 97 (Marine Pollution Prevention – Air Pollution) • Marine Orders, Part 98 (Marine Pollution – Anti-fouling Systems. The survey vessels will adhere to the relevant MOs by having a Shipboard Oil Pollution Emergency Plan (SOPEP), Oil Record Book and Waste Management Plan in place and implemented.	International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) provisions and unified interpretations of the articles, protocols and Annexes of MARPOL 73/78, including the incorporation of all of the amendments that have been adopted by the Marine Environment Protection Committee (MEPC) and have entered into force, up to and including the 2000 amendments (as adopted by resolution MEPC.89(45))	AMSA

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Legislation	Applicability	International convention enacted	Administering authority
Protection of the Sea (Powers of Intervention Act) 1981 Protection of the Sea (Powers of Intervention) Regulations 1983	This Act gives AMSA appropriate powers to intervene in shipping operations to protect the sea from pollution by oil and other noxious substances discharged from ships.	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969	AMSA
Protection of the Sea (Civil Liability for Bunker Oil Pollution Damage) Act 2008	Sets up a compensation scheme for those who suffer damage caused by spills of oil that is carried as fuel in ships' bunkers. There is an obligation on ships over 1,000 gross tonnage to carry insurance certificates when leaving/entering Australian ports or leaving/entering an offshore facility within Australian coastal waters. The survey vessels undertaking the Gippsland MSS will hold the necessary insurance certificates.	International Convention on Civil Liability for Bunker Oil Pollution Damage 2001	AMSA
Protection of the Sea (Harmful Antifouling Systems) Act 2006	This Act regulates the use of antifouling compounds and systems in Australian waters. Vessels will be required to have a hull antifouling system in place and will be subject to this Act, in particular Part 2 Application or use of a harmful antifouling system and Part 3 Antifouling certificates and antifouling declarations.	International Convention on the Control of Harmful Antifouling Systems on Ships 2001	AMSA/ Department of Infrastructure and Regional Development
Protection of the Sea (Shipping Levy) Act 1981	Provides that where, at any time during a quarter when a ship with tonnage length of no less than 24 m was in an Australia port, there was on board the ship a quantity of oil in bulk weighing more than 10 t, a levy is imposed in respect of the ship for the quarter. The survey and support vessels will adhere to the shipping levy.	Not applicable	AMSA
Biosecurity Act 2015 (& Regulation 2016)	From 16 June 2016, the *Biosecurity Act 2015* (Biosecurity Act) replaces the *Quarantine Act 1908* as Australia's primary piece of legislation used to manage the biosecurity risks posed by ballast water and sediments. For the petroleum industry, it regulates the condition of vessels and drill rigs entering Australian waters with regard to ballast water and hull fouling. The regulation stipulates that all information regarding the voyage of the vessel and the ballast water is declared correctly to the biosecurity officers. The survey and support vessels will adhere to biosecurity guidelines regarding biosecurity clearance to enter Australian ports and Territorial waters.	International Convention for the Control and Management of Ships Ballast Water and Sediments 2004	Department of Agriculture and Water Resources (DAWR)

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Table 2.2 Key state legislation

Legislation	Applicability
Victoria	
Coastal Management Act 1995	The objectives of this Act include the planning and management of the use of Victorian coastal resources on a sustainable basis for recreation, conservation, tourism, commerce and similar uses; protecting and maintaining areas of environmental significance on the coast; and maintaining and improving coastal water quality. This is achieved via the implementation of Coastal Management plans to guide planning and management at a regional level. Under this legislation a person must not use or develop coastal Crown land unless the written consent of the Minister has first been obtained. Coastal crown land also includes marine environments from shore to 3 NM including the seabed. Key management documents include the Victorian Coastal Strategy 2014, the Western Regional Coastal Plan 2015 and the Southwest Regional Coastal Action Plan 2002. Suggested guidelines for petroleum development (as they relate to this marine activity include) • early consultation with government agencies during the planning phase of the project • consider impacts to fishing operations for marine-based activities • identify environmental risks and produce a plan that addresses how these risks will be eliminated or reduced. The plan will consider shallow marine waters, threatened terrestrial and marine species habitats and locations, cetacean migratory routes, migratory bird flight paths, nesting areas and foraging/resting/aggregation areas • comply with State and Commonwealth cultural heritage legislation and avoid impacting any cultural heritage sites by consulting with Heritage Victoria, Aboriginal Affairs Victoria and local Aboriginal groups about any proposals • comply with all relevant water quality and wastewater requirements of the Victorian *Environment Protection Act 1970*. Administered by the Department of Environment, Land, Water & Planning (DELWP).
Environment Protection Act 1970 (& various regulations)	This is the key Victorian legislation that controls discharges and emissions (air, water) to the environment within Victoria (including State and Territorial waters). It gives the Environment Protection Authority (EPA) powers to licence premises discharges to the marine environment, control marine discharges and to undertake prosecutions. Provides for the maintenance and, where necessary, restoration of appropriate environmental quality (including spill response). To protect Victorian State waters from marine pests introduced via domestic ballast water, ballast water management arrangements applying to all ships in State and Territorial waters must be observed as per the Environment Protection (Ships' Ballast Water) Regulations 2006, Waste Management Policy (Ships' Ballast Water) and the Protocol for Environmental Management. High-risk domestic ballast water (ballast water that originates from an Australian port or within the territorial sea of Australia (to 12 NM)), regardless of the source, must not be discharged into Victorian State waters. Ship masters must undertake a ballast water risk assessment on a voyage by voyage basis to assess risk level, provide accurate and comprehensive information to the EPA on the status and risk of origin of ballast water contained on their ships (i.e. domestic/international), and to manage domestic ballast water discharges with EPA written approval. Administered by the Environment Protection Authority (EPA).
Emergency Management Act 2013 (& Regulations 2003)	Provides for the establishment of governance arrangements for emergency management in Victoria, including the Office of the Emergency Management Commissioner and an Inspector-General for Emergency Management. Provides for integrated and comprehensive prevention, response and recovery planning, involving preparedness, operational co-ordination and community participation, in relation to all hazards. These arrangements are outlined in the Emergency Management Manual Victoria. Administered by the Department of Justice and Regulation (Inspector General for Emergency Management).
Flora and Fauna Guarantee Act 1988 (FFG Act) (& Regulations 2011)	The purpose of this Act is to protect rare and threatened species, to enable and promote the conservation of Victoria's native flora and fauna, and to provide for a choice of procedures that can be used for the conservation, management or control of flora and fauna and the management of potentially threatening processes. Where a specie has been listed as threatened, an action statement is prepared that sets out the actions that have or need to be taken to conserve and manage the specie and community. Administered by the DELWP.

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Legislation	Applicability
Heritage Act 1995	The purpose of the Act is to provide for the protection and conservation of historic places, objects, shipwrecks and archaeological sites in State areas and waters (complementary legislation to Commonwealth legislation). Part 5 of the Act is focused on historic shipwrecks, which are defined as the remains of all ships that have been situated in Victorian State waters for 75 years or more. The Act addresses, among other things, the registration of wrecks, establishment of protected zones, and the prohibition of certain activities in relation to historic shipwrecks. Administered by the DELWP.
Marine (Drug, Alcohol and Pollution Control) Act 1988 (& Regulations 2012)	This Act provides for the prohibition of masters and other persons involved in vessel operations from being under the influence of prescribed drugs or alcohol, defines prohibited discharges (refer to *Pollution of Waters by Oil and Noxious Substances Act 1986*), and allocates roles, responsibilities and liabilities to ensure there is a capacity and obligation (i.e. Director – Transport Safety, public statutory body) to respond to marine incidents that have the potential, or do, result in pollution. Administered by the Department of Economic Development, Jobs, Transport and Resources (DEDJTR).
Marine Safety Act 2010 (& Regulations 2012)	This Act provides for safe marine operations in Victoria, including imposing safety duties on owners, managers and designers of vessels, marine infrastructure and marine safety equipment; marine safety workers, masters and passengers on vessels; regulation and management of vessel use and navigation in Victorian State waters; and enforcement provisions of Police Officers and the Victorian Director of Transport Safety. This Act reflects the requirements of international conventions – Convention on the International Regulations for Preventing Collisions at Sea and the International Convention for the Safety of Life at Sea. The Act also defines marine incidents and the reporting of such incidents to the Victorian Director of Transport Safety. Administered by Maritime Safety Victoria.
National Parks Act 1975	Established a number of different types of reserve areas onshore and offshore, including Marine National Parks and Marine Sanctuaries. A lease, licence or permit under the OPGGS Act that is either wholly or partly over land in a marine national park or marine sanctuary is subject to the *National Parks Act 1975* and activities within these areas require Ministerial consent before activities are carried out. Administered by the DELWP.
Pollution of Waters by Oil and Noxious Substances Act 1986 (POWBONS) (& Regulations 2002)	The purpose of the *Pollution of Waters by Oils and Noxious Substances Act 1986* (POWBONS) is to protect the sea and other waters from pollution by oil and noxious substances. This Act also implements the MARPOL Convention (the International Convention for the Prevention of Pollution from Ships 1973) in Victorian State waters. Requires mandatory reporting of marine pollution incidents. The Act restricts within Victorian State waters the discharge of treated oily bilge water according to vessel classification (>400 t); discharge of cargo substances or mixtures; prohibition of garbage disposal and packaged harmful substances; restrictions on the discharge of sewage; regulator reporting requirements for incidents; ship construction certificates and survey requirements. Jointly administered by DEDJTR and EPA.
Wildlife Act 1975 (& Regulations 2013)	The purpose of this Act is to promote the protection and conservation of wildlife. It seeks to prevent wildlife from becoming extinct and prohibits and regulates persons authorised to engage in activities relating to wildlife (including incidents). The Wildlife (Marine Mammal) Regulations 2009 prescribe minimum distances to whales and seals/seal colonies, restrictions on feeding/touching and restriction of noise within a caution zone of a marine mammal (dolphins (150 m), whales (300 m) and seals (50 m)). Administered by the DELWP.
South Australia	
Coast Protection Act 1972 (and associated regulations)	The Act seeks to provide for the conservation and protection of the beaches (the area between the low and high water marks at spring tides and within 100 m of the mean high water mark) and coast (within 3 NM of the mean low water mark and within any estuary, inlet, river, creek, bay or lake subject to the ebb and flow of tides) of South Australia. A Coast Protection Board is appointed under the Act, and is charged with, among other things, protecting the coast from erosion, damage, deterioration, pollution and misuse, and to restore any part of the coast that has been damaged by erosion, damage, deterioration, pollution and misuse. Administered by the Department of Environment, Water and Natural Resources (DEWNR).

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Legislation	Applicability
Environment Protection Act 1993 Environment Protection Regulations 2009	The Act aims to provide for the protection of the environment and establish the Environment Protection Agency (EPA), to promote the principle of ecologically sustainable development (ESD) and to ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment. This involves preventing, reducing, minimising and where possible, eliminating harm to the environment through community and industry programs, regulation and monitoring. Part 4 of the Act states that a person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm. Onshore Works Approvals and Licenses are granted by the EPA for persons wishing to conduct activities of environmental significance. A number of Environmental Protection Policies are in place, with those of most relevance to this project being the Environment Protection (Water Quality) Policy 2003. Administered by the Environment Protection Agency (EPA).
Fisheries Management Act 2007	This Act provides for the conservation and management of the aquatic resources of the State (within 3 NM of the mean low water mark and within any estuary, inlet, river, creek, bay or lake subject to the ebb and flow of tides), the management of fisheries and aquatic reserves, the regulation of fishing and the processing of aquatic resources, the protection of aquatic habitats, aquatic mammals and aquatic resources and the control of exotic aquatic organisms and disease in aquatic resources. Administered by the Department of Primary Industries and Regions (PIRSA) – Fisheries.
Emergency Management Act 2004	This Act establishes strategies and systems for the management of emergencies in the State. Administered by the Emergency Management Council (chaired by the Department of Premier and Cabinet).
Harbors and Navigation Act 1993	This Act provides for the administration, development and management of harbors, to provide for safe navigation in SA waters, to promote the safe and efficient movement of shipping within harbors and SA waters, and provide for the safe use of SA waters for recreational and other aquatic activities. Administered by the Department of Planning, Transport and Infrastructure (DPTI).
Marine Parks Act 2007 (& Marine Parks (Zoning) Regulations 2012)	This Act provides for the establishment and management of marine parks in SA waters, and establishes the Marine Parks Council of SA. The aim of the Act is to protect and conserve marine biodiversity and habitats. Four zones (general managed use, habitat protection, sanctuary and restricted access) are applied to marine parks. The Marine Parks (Zoning) Regulations 2012 (the regulations) prohibit certain activities in the respective marine park zones. The regulations prohibit certain activities that may be relevant to hydrocarbon spills in habitat protection and sanctuary zones, such as the removal of soil, dredging, and the removal of water. The regulations also prohibit entering or engaging in any activity in a restricted access zone. The regulations allow for a number of exemptions from prohibitions and restrictions, including for persons acting in the course of emergency. The definition of emergency provided in the regulations includes an event that causes, or threatens to cause harm to the environment, so it is possible that a permit would not be necessary for activities associated with hydrocarbon spill management or remediation in marine parks. Administered by the DEWNR.
National Parks and Wildlife Act 1972	This Act provides for the establishment and management of reserves (national parks, conservation parks, game reserves, recreation parks and regional reserves) for public benefit and enjoyment and for the conservation of wildlife in a natural environment. The Act establishes the SA National Parks and Wildlife Council and the Wildlife Conservation Fund. There are no reserves in the operational area but the Lower South East State Marine Park is partly located within the environment that might be affected (EMBA) by a Level 3 oil spill as a result of vessel collision (refer to Section 7.7). Administered by the National Parks South Australia.
Protection of Marine Waters (Prevention of Pollution by Ships) Act 1987	This Act provides for the protection of the sea and certain waters (i.e. State waters) from pollution by oil and other substances from ships. As outlined in Part 2 of the Act, it does not apply to ships discharging oil or an oily mixture if it is not within a special area, is proceeding en route, and does not exceed 15 ppm oil-in-water. Any trading ship or vessel with a gross tonnage greater than 400 t must carry an up-to-date oil record book. Administered by the DPTI.

Legislation	Applicability
Animal Welfare Act 1985 Animal Welfare Regulations 2012	This Act was established to promote animal welfare. Under the Act, fish are excluded under the definition of animals. The Act is focused on preventing the ill treatment of an animal that causes serious harm or death to that animal. Administered by the DEWNR.
Tasmania	
Pollution of Waters by Oil and Noxious Substances Act 1987	This Act is designed to protect State waters from pollution by oil and other substances and to give effect to certain parts of the MARPOL convention. Administered by the Environment Protection Authority (EPA).
Environmental Management and Pollution Control Act 1984	This Act provides for the management of the environment and the control of pollution. Administered by the EPA.
Emergency Management Act 2006	This Act provides for the protection of life, property and the environment in a declared State emergency by outlining prevention, preparedness, response and recovery procedures. Administered by the Tasmania State Emergency Service.

2.2.2 International conventions

The principal international agreements governing petroleum operations in Commonwealth waters are the United Nations Convention on the Law of the Sea 1982 (UNCLOS) and the International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 (MARPOL 73/78). Australia is also a signatory to the following international conventions that are of potential relevance to the activity

- International Convention on Oil Pollution Preparedness, Response and Co-operation 1990
- Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1996 (previously known as the London Dumping Convention)
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969
- International Convention on Civil Liability for Oil Pollution Damage 1992
- Framework Convention on Climate Change 1992
- Vienna Convention on the Protection of the Ozone Layer 1985
- Montreal Protocol on Substances that Deplete the Ozone Layer 1987
- Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)
- Japan–Australia Migratory Bird Agreement (JAMBA) 1981
- China–Australia Migratory Bird Agreement (CAMBA) 1988
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) 2006.

2.2.3 Applicable guidelines and standards

2.2.3.1 NATPLAN

The National Plan for Maritime Environmental Emergencies (NATPLAN) (AMSA 2016) is managed by AMSA and sets out national arrangements, policies and principles for the management of maritime environmental emergencies. It gives administrative effect to Australia's emergency response obligations relating to the

- International Convention on Oil Pollution Preparedness, Response and Co-operation 1990

- Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969
- Articles 198 and 221 of the UNCLOS.

Further details on NATPLAN and oil spill response are described in detail within the OPEP in Section 8.7.

2.2.3.2 Protected area management plans

All Australian Marine Parks (AMPs) within the South-east Marine Region are managed under the South-east Commonwealth Marine Reserve Network (SECMRN) Management Plan 2013-23 (Director of National Parks (DNP) 2013). The nearest are the East Gippsland AMP which is approximately 30 km to the east, Beagle Marine Park (approximately 44 km south west) and Flinders Marine Park about 150 km south. Control measures described within this EP have been identified in accordance with the management strategies of the SECMRN Management Plan and the relevant IUCN Category Management Principles for Marine Parks where receptors are within the environment that may be affected by the Gippsland MSS activities (refer to Sections 6 and 7).

2.2.3.3 EPBC Act management plans

The adopted control measures in the assessments in Sections 6 and 7 of this EP are in accordance with the relevant EPBC Act species-specific plans (refer to Table 2.3).

Table 2.3 Summary of EPBC conservation management plans, recovery plans and conservation advices relevant to the proposed acquisition area

Species	Recovery plan/ conservation advice	Key threats relevant to this EP	Plan management actions relevant to this EP	EP impact/ risk assessment section
Cetaceans				
Blue whale	Conservation Management Plan for the Blue Whale (DoE 2015) Conservation Advice (DoE 2015)	Noise interference – seismic surveys (Threat – Very High Risk)	Assessing the effect of anthropogenic noise on blue whale behaviour. Anthropogenic noise in biologically important areas (BIAs) will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area. EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales is applied to all seismic surveys.	Section 6.1 Section 6.2
		Vessel collisions (Threat – High Risk)	Ensure all vessel strike incidents are reported in the National Ship Strike Database. Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.	Section 7.2
		Marine debris Shipping noise Acute chemical discharge (Threat – Moderate)	No management actions as these are only relevant for threats rank high or very high risk.	Section 7.4 Section 6.3 Section 7.5-7.7

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Species	Recovery plan/ conservation advice	Key threats relevant to this EP	Plan management actions relevant to this EP	EP impact/ risk assessment section
Humpback whale	Humpback Whale Conservation Advice – (DoE 2015)	Noise interference	Assessing and addressing anthropogenic noise; shipping, industrial and seismic surveys All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B. Additional Management Procedures must also be applied. For actions involving acoustic impacts (e.g. pile driving, explosives) on humpback whale calving, resting, feeding areas, or confined migratory pathways site-specific acoustic modelling should be undertaken (including cumulative noise impacts). Should acoustic impacts on humpback calving, resting, foraging areas, or confined migratory pathways be identified a noise management plan should be developed. This can include the use of shutdown and caution zones pre and post activity observations the use of marine mammal observers and/ or Passive Acoustic Monitoring (PAMS) implementation of an adaptive management program following verification of the noise levels produced from the action (i.e. if the noise levels created exceed original expectations).	Section 6.1 Section 6.2 Section 6.3
		Vessel disturbance and strike	Ensure all vessel strike incidents are reported in the National Ship Strike Database (https://data.marinemammals.gov.au/report/shipstrike) Ensure the risk of vessel strikes on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required, appropriate mitigation measures are implemented.	Section 7.2
Sei whale Fin whale	Sei Whale Conservation Advice (DoE 2015) Fin Whale Conservation Advice (DoE 2015)	Anthropogenic noise and acoustic disturbance	Consequence rating – minor. Once the spatial and temporal distribution (including BIAs) of sei whales is further defined an assessment of the impacts of increasing anthropogenic noise (including from seismic surveys, port expansion, and coastal development) should be undertaken on this species. If required, additional management measures should be developed and implemented to ensure the ongoing recovery of sei whales.	Section 6.1 Section 6.2 Section 6.3
		Pollution (persistent toxic pollutants)	Consequence rating – minor. No management actions.	Section 6.7 Sections 7.5-7.7

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Species	Recovery plan/ conservation advice	Key threats relevant to this EP	Plan management actions relevant to this EP	EP impact/ risk assessment section
		Vessel strike	Consequence rating – minor. Ensure all vessel strike incidents are reported in the National Ship Strike Database.	Section 7.2
Southern right whale	Conservation Management Plan for the Southern Right Whale 2011-2021 (DSEWPAC 2012)	Noise interference – seismic surveys (Threat – Very High Risk)	Improve the understanding of what impact anthropogenic noise may have on southern right whale populations by assessing anthropogenic noise in key calving areas assessing responses of southern right whales to anthropogenic noise if necessary, developing further mitigation measures for noise impacts assessing the overlap between southern right whale distribution and potential sources of significant anthropogenic sound.	Section 6.1 Section 6.2
		Vessel collisions (Threat – High)	No specific management actions relevant to the activity but Plan advises reducing vessel speed or by separating vessels and whales.	Section 7.2
		Marine debris Shipping noise (Threat – Moderate)	No management actions as these are only relevant for threats rank high or very high risk.	Section 7.4 Section 6.2
		Acute chemical discharge (Threat – Low)	No specific management actions as these are only relevant for threats rank high or very high risk.	Section 7.5-7.7
Marine reptiles				
Turtles	Recovery Plan for Marine Turtles in Australia (DoEE 2017) Conservation advice (December 2008)	Marine debris Chemical and terrestrial discharge Light pollution Vessel disturbance Noise interference	No genetic stocks requiring management actions have been identified in the eastern Bass Straits	Section 7.5-7.7 Section 6.4 Section 7.1 Section 6.1
Pinnipeds				
Australian sea lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (DSEWPaC 2013d)	Noise interference Oil spill Pollution Marine Debris	These threats are identified as ‘secondary threats’, with noise interference identified as of ‘potential concern’ in the bioregional management plan. Assess the impacts of marine debris on Australian sea lion populations. Develop and implement measures to mitigate the impacts of marine debris on Australian sea lion populations. Management actions developed to mitigate impact of vessel strike, pollution and oil spills on Australian sea lion populations.	Section 6.1 (noise from seismic operations) May be encountered in Oil Spill EMBA (see Section 7.7) Section 7.5

Species	Recovery plan/ conservation advice	Key threats relevant to this EP	Plan management actions relevant to this EP	EP impact/ risk assessment section
Sharks and fish				
Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC 2013e)	Ecosystem effects – habitat modification and climate change (including changes in sea temperature and acidification)	No specific management actions relevant to the activity	Section 6.1
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DSE 2014)	Introduced species Pollutants	No specific management actions relevant to the activity	Section 6
Australian grayling	National Recovery Plan for the Australian Grayling *Prototroctes maraena* (DSE 2008)	N/A	No specific management actions relevant to the activity.	N/A

2.2.3.4 Guidelines, standards and codes of practice

The following guidelines, standards and codes of practices are relevant to the preparation of this EP.

Table 2.4 Guidelines, standards and codes of practice

Organisation	Document
AMSA (2013)	Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities, March 2013
AMSA (2016)	National Plan for Maritime Environmental Emergencies
Standards Australia/Standards New Zealand (2006)	Handbook on Environmental Risk Management – Principles and Process. Third edition. Standards Australia/Standards New Zealand (HB 203:2006)
Australian Petroleum Production and Exploration Association (APPEA) (2008)	Code of Environmental Practice (CoEP) – In Australia, the petroleum exploration and production industry operate via an industry code of practice developed by the APPEA; the CoEP. This code provides guidelines for activities that are not formally regulated and have evolved from the collective knowledge and experience of the oil and gas industry, both nationally and internationally. The APPEA CoEP covers general environmental objectives for the industry, including planning and design, assessment of environmental risks, emergency response planning, training and inductions, auditing and consultation and communication. For the offshore sector specifically, it covers issues relating to geophysical surveys, drilling and development and production. CGG applies the APPEA CoEP when planning and managing offshore petroleum exploration activities.
APPEA (2014)	Method to Assist Titleholders in Estimating Appropriate Levels of Financial Assurance for Pollution Incidents Arising from Petroleum Activities, December 2014
APPEA (2017)	APPEA Stakeholder Consultation and Engagement Principles and Methodology – Working Draft

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Organisation	Document
Commonwealth of Australia (2009)	National Biofouling Management Guidance for the Petroleum Production and Exploration Industry
Commonwealth of Australia (2013)	EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance
DEWHA (2005)	Australian National Guidelines for Whale and Dolphin Watching
DAWR (2017)	Australian Ballast Water Management Requirements, version 6
ESDSC (1992)	National Strategy for Ecologically Sustainable Development
International Association of Geophysical Contractors (IAGC) (2001)	Environmental Manual for Worldwide Geophysical Operations
IAGC (2011)	Recommended Mitigation Measures for Cetaceans during Geophysical Operations
International Association of Oil and Gas Producers (OGP) (1997)	Environmental Management in Oil and Gas Exploration and Production
International Standards Organization (ISO)	3100:2009 Risk Management – Principles and Guidelines
NOPSEMA (2014a)	Guidance Note: Notification and Reporting of Environmental Incidents (N03000-GN0926, Revision 4, 28 February 2014)
NOPSEMA (2014b)	Information Paper: Consultation Requirements under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (N04750-IP1411, Revision 2, December 2014)
NOPSEMA (2015)	Guidance Note: Activities within Commonwealth Marine Reserves (N-04750-GN1565, Revision 0, November 2015)
NOPSEMA (2016)	Guidance Note: Environment Plan Content Requirements (N04750-GN1344, Revision 3, April 2016)
NOPSEMA (2016b)	Guideline, GL1566, Rev 1, 13 July 2016: Environment Plan Summaries
NOPSEMA (2016c)	Information Paper, IP1349, Rev 2, March 2016: Operational and Scientific Monitoring Programs
NOPSEMA (2016d)	Guidance Note: Financial Assurance for Petroleum Titles (N-04750-GL1381, Revision No. 5, June 2016)
NOPSEMA (2016e)	Guidance Note: Petroleum Activity (N04750-GN1343, Revision 2, April 2016)
NOPSEMA (2017a)	Information Paper: Oil Pollution Risk Management (N04750-IP1488, Revision 1, February 2017)
NOPSEMA (2017b)	Guideline, GL1721, Rev 3, May 2017: Environment Plan Decision Making

3 Description of the activity (Reg 13(1))

3.1 Location of the activity

The CGG Gippsland MSS will acquire seismic data over a maximum area of 11,161 km^2 (Figure 3.1). The ‘Acquisition Area‘ is the area within which the seismic source (airguns) will be operational and seismic data will be acquired, including soft start procedures and run-outs (required to obtain full fold coverage). The water depths within the Acquisition Area range from a minimum of approximately 43 m along Ninety Mile Beach to 3,345 m in the Bass Canyon. Line turns conducted towards the nearshore waters will be conducted on full power to acquire full-fold coverage.

There will be no discharge of the airguns outside the Acquisition Area, including within the ‘Operational Area’, which comprises a maximum area of 13,421 km^2 and covers both the Acquisition Area and additional buffer. This area is where seismic related activities including streamer deployment and retrieval, maintenance and recovery, and vessel manoeuvring (line turns) will occur.

As shown in Figure 3.1 the Acquisition Area has been sectioned into five zones, primarily to assist in management of long-term displacement of fishers (Section 6.3). The precise border of each zone may alter slightly due to changes in survey sail lines (Section 3.4.2), however each zone will take a maximum of one month to complete. The order in which zones are completed will be determined following advice from the CGG Gippsland MSS Scientific Advisory Committee (SAC; Section 9) and consideration of impacts to sensitive receptors (as described in Section 6). The orientation of each zone is aligned with survey sail lines in an ESE – WNW direction (~108°) (described in Section 3.4). Boundary coordinates for these areas are provided in Table 3.1.

Transit of vessels to and from the Operational Area is excluded from the scope of this EP.

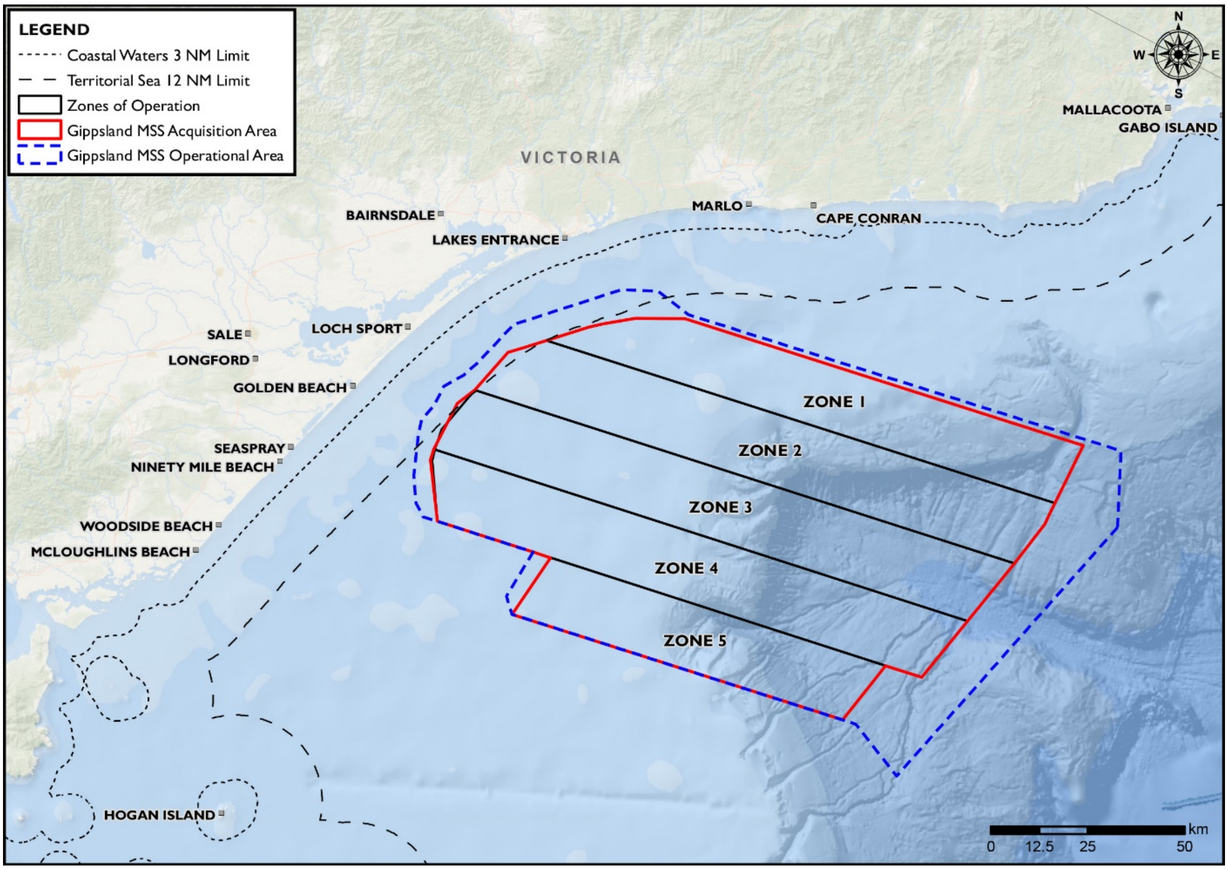

Figure 3.1 Proposed Gippsland marine seismic survey (MSS) area

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Table 3.1 Boundary coordinates for the Gippsland MSS area (WGS 1984 UTM zone 55S)

Description	Latitude (DMS)	Longitude (DMS)
Acquisition area		
	38° 45' 10.828" S	149° 12' 4.539" E
	38° 53' 9.591" S	149° 4' 10.352" E
	38° 51' 39.755" S	148° 57' 39.818" E
	38° 59' 17.845" S	148° 50' 13.229" E
	38° 45' 16.737" S	147° 51' 0.381" E
	38° 37' 20.876" S	147° 57' 43.917" E
	38° 36' 34.962" S	147° 54' 35.685" E
	38° 32' 24.044" S	147° 37' 34.215" E
	38° 23' 52.274" S	147° 36' 14.641" E
	38° 22' 21.881" S	147° 36' 50.340" E
	38° 15' 57.585" S	147° 40' 56.570" E
	38° 14' 3.595" S	147° 43' 59.581" E
	38° 8' 47.616" S	147° 49' 50.743" E
	38° 8' 3.866" S	147° 52' 43.117" E
	38° 8' 3.856" S	147° 52' 43.159" E
	38° 5' 10.563" S	148° 3' 59.403" E
	38° 4' 40.561" S	148° 6' 34.419" E
	38° 3' 48.839" S	148° 12' 17.887" E
	38° 3' 47.279" S	148° 20' 59.012" E
	38° 20' 16.990" S	149° 31' 50.723" E
	38° 24' 33.744" S	149° 29' 21.616" E
	38° 29' 50.692" S	149° 26' 17.126" E
	38° 31' 24.663" S	149° 25' 22.335" E
	38° 36' 57.369" S	149° 20' 10.954" E
Operational area		
	38° 31' 32.451" S	149° 38' 19.658" E
	39° 6' 59.217" S	149° 0' 4.954" E
	38° 59' 51.603" S	148° 52' 34.953" E
	38° 45' 16.891" S	147° 50' 59.030" E
	38° 42' 47.754" S	147° 49' 56.514" E
	38° 36' 34.962" S	147° 54' 35.685" E
	38° 32' 24.044" S	147° 37' 34.215" E
	38° 31' 46.651" S	147° 35' 3.019" E
	38° 31' 43.065" S	147° 35' 0.579" E
	38° 29' 54.502" S	147° 33' 46.755" E
	38° 26' 5.732" S	147° 33' 19.558" E

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Description	Latitude (DMS)	Longitude (DMS)
	38° 20' 23.901" S	147° 34' 5.870" E
	38° 18' 12.102" S	147° 34' 41.192" E
	38° 16' 11.705" S	147° 36' 53.817" E
	38° 13' 36.566" S	147° 38' 30.726" E
	38° 13' 32.899" S	147° 38' 38.718" E
	38° 12' 0.139" S	147° 42' 0.683" E
	38° 10' 24.977" S	147° 44' 17.852" E
	38° 4' 52.631" S	147° 50' 50.186" E
	37° 59' 51.371" S	148° 9' 48.558" E
	38° 0' 1.892" S	148° 16' 13.713" E
	38° 3' 12.575" S	148° 21' 33.527" E
	38° 20' 54.013" S	149° 38' 33.263" E

3.2 Timing of the activity

The survey is currently planned to commence early March 2019 with acquisition taking approximately 6.5 months including downtime. Downtime allows for inclement weather, avoiding conflicts with other users and marine megafauna, and maintenance. Depending on the actual start date, it is planned for the survey to be completed by the end of July 2019. Should for any reason the survey is not completed by July 2019 it may be continued in 2020. If this were the case the survey would be undertaken within an early January to end of July time period. Survey activities would not continue beyond July 2020. The timing of the activity is subject to the availability of the survey vessels for conducting the survey, client data requirements, sea state conditions suitable for marine seismic acquisition, and granting of the required regulatory approvals and access authorities. Seismic data will be acquired over a 24-hour period, with shut downs for routine and reactive maintenance, repairs, transit and line turns and fauna and stakeholder avoidance.

Each of the five survey zones (Figure 3.1) will take approximately one month to complete. Undershooting (Section 3.4.3) is anticipated to take approximately two to four weeks depending on the number of platforms being undershot (up to ten platforms depending on client requirements). Start dates of individual zones have not been determined at this time, with the exception of Zone 4 which will be surveyed sometime between March and April to minimise impacts to spawning fish (Section 6.1).

3.3 Survey justification

CGG has reprocessed existing seismic data in the basin and has noted a number of issues with the surveys that prevent a more accurate and high-resolution set of maps being produced. These include:

1. Survey orientation: Most of the existing surveys have a NNE-SSW orientation. This was judged to be the optimal survey orientation at the time. However, CGG has found that an orthogonal orientation better addresses the coherent noise problems seen in the data. In addition, by having two surveys in different directions increases the amount of information that can be extracted.
2. Cable length: Most of the existing surveys used recording cable lengths of 4000 – 5000 m. Modelling has demonstrated that a 7,000 m cable length will allow significantly improved data quality using a recently developed seismic processing technique (Full Waveform Inversion).
3. Sensor depth: Existing surveys have been acquired at 6-8 m cable depth. This was optimised for recording higher frequencies but is not optimal for low frequencies. By towing at 18 m, CGG will record better low frequencies and also have cleaner data as the sensors will be well below the effect of wave action. This is very important for imaging beneath the extensive coals and volcanic rocks in the basin.

4. Multi-component Sensor: CGG will be using the latest generation of multi-component sensor which will overcome the traditional problem of interference with reflections from the sea surface. This will result in higher resolution images.
5. Consistent survey: There are more than 16 different 3D surveys in the basin, of varying quality and sampling. By having a single high-resolution survey, CGG will be able to map more subtle geological structures and identify new oil and gas targets.
6. Gaps in coverage: There are gaps in coverage between the existing surveys that need to be filled in to understand the geology. The Kingfish field does not have a proper 3D acquired over it.
7. Gazettal blocks: In 2018, the Australian Government has gazetted 4 new blocks in the Gippsland Basin, and these do not have complete 3D seismic coverage.
8. Outer East: There is little to no 3D seismic and limited 2D at the eastern end of basin. By extending the seismic coverage into this prospective area, CGG can limit the necessity for future surveys, thereby keeping disruption to existing activities to a minimum.

The activity is a typical 3D survey similar to the majority of seismic surveys conducted in Australian marine waters in terms of technical methods and procedures. No unique or unusual equipment or operations are proposed. CGG is committed to minimising potential for interactions with other marine users and had engaged in early and continued consultation. The specific survey vessel(s) that will be used for the survey is yet to be determined but will be conducted using purpose-built seismic vessel(s) similar in specifications to the M/V Geo Coral (section 3.5.1)

3.4 Seismic program

3.4.1 Survey parameters

A summary of the seismic survey parameters is provided in Table 3.3.

Table 3.2 Gippsland MSS survey parameters

	Survey parameter	Description
General parameters	Acquisition Area	11,161 km^2
	Range of survey water depths in Acquisition Area	43–3,345 m below lowest astronomical tide (LAT)
	Planned survey commencement date[1]	Mid-January 2019
	Survey duration	6.5 months
Seismic airgun array parameters	Airgun array volume (maximum)	3,000 in^3
	Operating pressure	2,000 psi
	Source amplitude	261 dB re 1 µPa (SPL peak to peak, L_{pk-pk})
	Peak frequency range	up to 2,000 Hz
	Source depth	6 m (±1 m)
	Source (shot point) interval	12.5 m (37.5 m over SE Reef)
	Line spacing	400–600 m
	Number of streamers	8-12
	Streamer length	7,050 m max
	Streamer spacing	50–100 m
	Streamer depth	6–18 m
	Streamer type	Solid

Note 1: Survey commencement date and survey window timing is subject to survey vessel availability, operational constraints and prevailing weather conditions.

RPS

3.4.2 Primary data acquisition

During the proposed activity, the seismic survey vessel will traverse a series of pre-determined sail lines within the Acquisition Area at a speed of approximately 4.5 to 5 knots (8 to 9.3 km/hr). As the vessel travels along the survey lines, a series of noise pulses (every 4.5-5.5 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranged along a number of hydrophone cables (streamers) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in order to identify potential hydrocarbon reservoirs.

The receiver array will comprise 8 to 12 solid streamers spaced between 50 and 100 m apart, with an approximate length of 7050 m. Sail line spacing will be between 400 and 600 m but the vessel will traverse subsequent survey lines in a “race-course” fashion by skipping a number of lines; this is to maintain control of the streamer array while turning. The acoustic source (airgun array) will be towed at 5 to 9 m (+/-1 m) below the sea surface, and the streamer tow depth will be 6 to 18 m.

The prime vessel uses three source arrays, but only one will be discharged at each shotpoint which are spaced 12.5 m apart (‘flip/flop/flap’ firing sequence). Each of the three sources repeats every 37.5 m. Each source array has a maximum volume of 3000 cubic inch (in3), operated at a pressure of 2000 psi.

The Acquisition Area has been divided into five zones, based on the manner in which groups (swathes) of sail lines are completed, so as to provide other marine users with greater detail on where the vessel will be operating during the survey (Figure 3.2). Each zone will take approximately one month to complete (allowing for 10% downtime due to weather and other contingencies).

3.4.3 Undershooting

Undershooting is intended to be undertaken in the vicinity of up to ten platforms within the Acquisition Area (Figure 3.2). During undershooting, a secondary vessel with a similar seismic source will be positioned parallel to the main survey vessel and for each platform, two passes will be made on each side of the platform, once with the secondary source vessel on the same side as the main vessel and a second pass where the secondary source will be on the opposite side of the platform. The two source vessels will be approximately 500 to 800 m apart. The primary vessel with streamers has two sources and the second vessel (which has no streamers) also has two sources. Each source will fire every 50 m, alternating between the two source vessels, so there is still 12.5 m between shot points. Hence the amount of sound being produced in a given amount of time is the same as for conventional data acquisition. The vessels will be passing over the same ground twice either side of the platform, so four extra passes in total are required. Each undershoot will take between 18 and 54 hours; the likely average duration is 36 hours. The source firing for each undershoot will take place in a 75 km^2 area (25 km x 3 km) and will be 10 hours of acquisition in an 18 to 54 hour period. Undershooting will only occur during daylight hours.

RPS

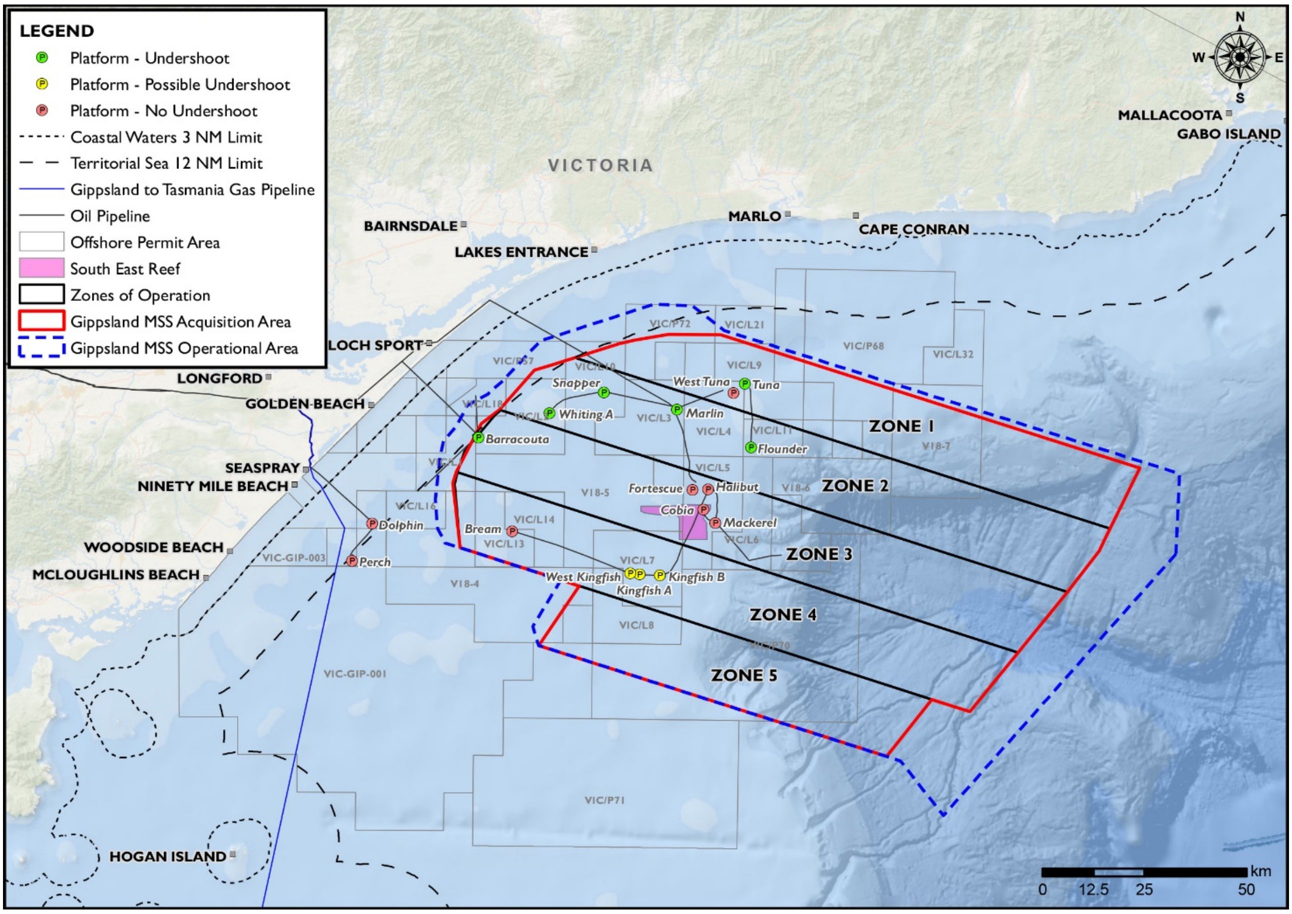

Figure 3.2 Location of undershooting platforms and survey zones

3.5 Survey vessels

3.5.1 Seismic vessels

The specific seismic survey vessels that will be used for the Gippsland MSS are yet to be determined but will be purpose-built seismic vessels similar in specifications to the MV Geo Coral (Figure 3.3) operated by CGG. The vessel will be required to operate in accordance with CGG's Environmental Policy and this EP and will have an approved and tested Shipboard Oil Pollution Emergency Plan (SOPEP). The vessel will also be required to have all necessary certification/registration and be fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose. CGG will conduct an audit prior to contracting the vessel to ensure it meets with CGG's commitments and requirements described within this EP. Seismic survey vessel speeds will not vary across different vessels, and the expected average speed within the Acquisition Area will be 8–9 km/hr (approximately 4.5 knots).

The second vessel used in undershooting will be similar in size and functionality and likewise compliant with regulatory requirements. Typically, the seismic vessels have a crew of 70 people on board (POB).

Figure 3.3 Typical seismic survey vessel – MV *Geo Coral*

3.5.2 Support and escort / chase vessels

The seismic survey vessels will be supported by two types of vessels. These types are in accordance with IAGC guidelines and CGG Escort & Support Vessel Operation Manual (doc. MAR MSS MNL 001E).

Support vessel – Equipped and competent to perform at sea supply, crane operations, bunkering, towing, equipment recovery and personnel transport as well as scouting and guard duties. Support vessels are required to have passed an IMCA CMID (Common Marine Inspection Document) or OCIMF OVID (Offshore Vessel Inspection Database) audit prior to engagement.

Escort/chase vessel – Additional support role in scouting and guard duties. Not normally equipped for other roles performed by the support vessel.

One support vessel and at least one escort vessel will be deployed full-time for the duration of the seismic survey. Escort vessel(s) will be procured locally in Australia. CGG will undertake an IAGC inspection of escort vessels prior to engagement.

All vessels over 400 GRT will have an approved and tested SOPEP. All operations undertaken by support and escort/chase vessels will be carried out in accordance with CGG's Escort & Support Vessel Operations Manual (and procedures described within) as well as CGG procedures specific to interactions with ships and seismic operations (QA Policies, Processes and Procedures_Document_2018-8-4_Seismic).

Typically, each support or escort vessel has a crew of 15 POB.

RPS

4 Description of the existing environment

This section provides a regional overview of environmental values and sensitivities in the area and describes the environment that may be affected by the activity (EMBA), as required by Regulation 4 of the OPGGS(E)R and including Regulations 13(2) and 13(3). This description has been summarised into the following categories

- defining the EMBA for the activity
- regional overview, including particular values and sensitivities
- physical environment
- biological environment
- socio-economic environment.

The extent of the existing environment described herein was determined by considering the nature, timing and scale of the proposed activity, along with the potential environmental impacts and risks associated with the survey given its proximity to popular Victorian beaches. A vessel collision resulting in a hydrocarbon spill was identified as having the largest spatial extent of all credible environmental hazards.

The Gippsland MSS is planned to commence mid-January 2019 for completion by the end July of the same year, although there is potential for the survey to be continued during the same period in 2020 if data acquisition is not completed during 2019. As such, the existing environment description considers environmental sensitivities predominantly present during this period.

4.1 Defining the EMBA

OPGGS(E) regulation 13(2) requires an EP to include a description of the environment that may be affected (EMBA) by the Gippsland MSS activity and to detail relevant values and sensitivities in the affected area.

The Oil (Spill) EMBA encompasses the maximum areal extent of effects from any planned activities (impacts) and unplanned events (risks) and sets the spatial boundaries for spill response actions addressed in the OPEP and associated OSMP. The risk assessment and spill response planning are based on this area. The detailed description of the receiving environment in this chapter is based on the greater area of the Oil EMBA. Other impacts and risks may extend outside the operational area such as those from underwater noise, but are unlikely to extend as far as the worst credible oil spill,

The environmental and socio-economic features and values within, or bordering the Oil EMBA include:

- Commonwealth and state marine and national parks and sanctuaries
- key ecological features and threatened communities
- biologically important areas (BIA) for species protected under the EPBC Act 1999
- Ramsar sites
- various Commonwealth-managed and state-managed fisheries.

The impact assessment and identification of relevant affected receptors and stakeholders were limited to the maximum areal extent of effects from the activity specific to their activities. For example, impacts to whales were assessed over the area of ensonification to the low frequency whale threshold, whereas impacts to fishers were assessed over the area ensonified to the relevant fish thresholds.

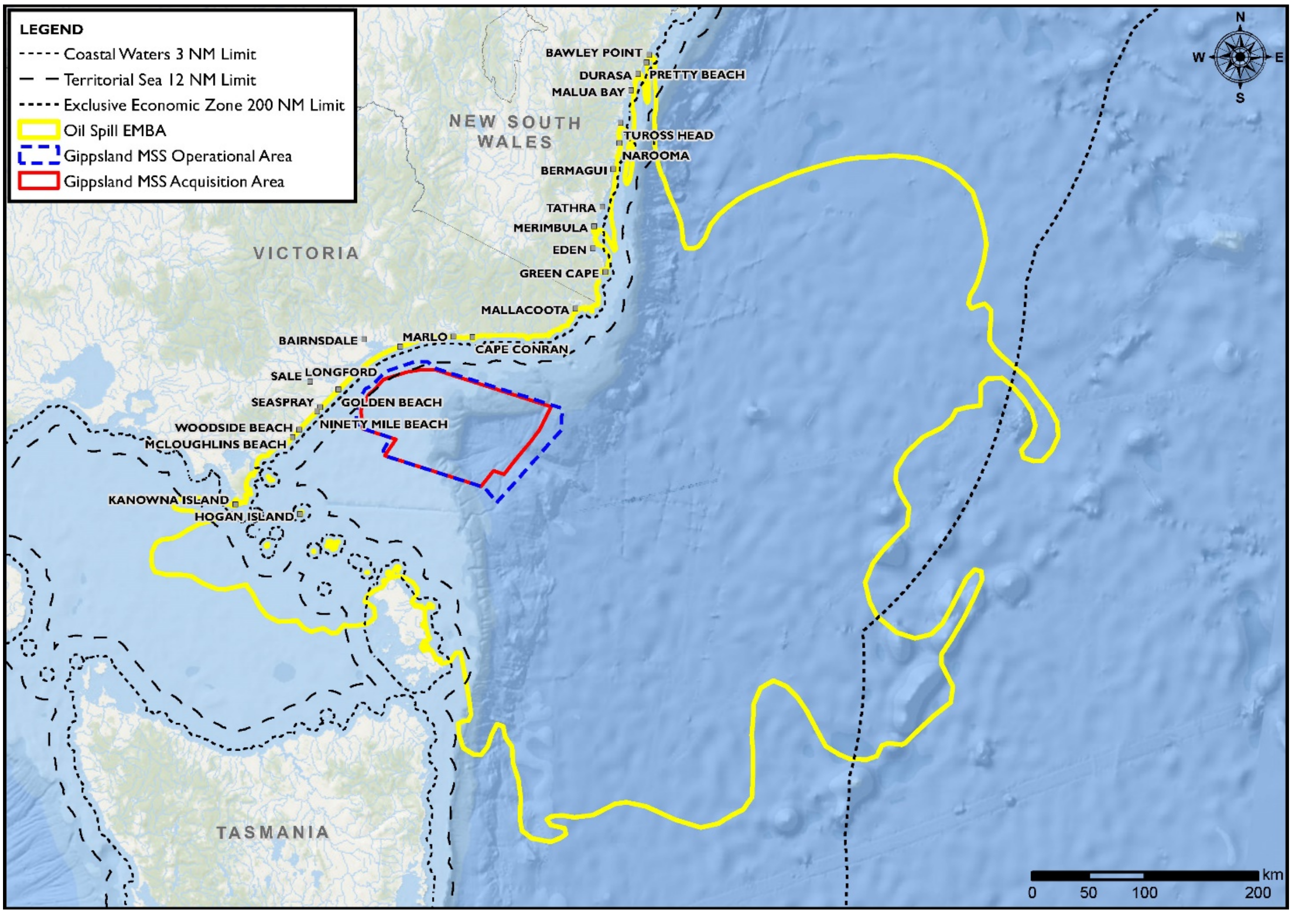

Figure 4.1 Oil EMBA for the Gippsland MSS

4.1.1 Oil EMBA

The Oil EMBA (Figure 4.1) is based on the predicted extent of an oil spill as a result of vessel collision or grounding and the loss of the contents of the largest fuel tank in the survey fleet from anywhere within the Operational Area. This is considered appropriate because

- Assuming the total loss of the largest fuel cell is conservative, given mitigation of a spill through valve closure, transferring cell contents to undamaged cells etc. is likely to some extent.
- Fuel tanks are unlikely to be carrying a full fuel inventory at any given time after steaming from port or having been refuelled.
- Over 300 locations and conditions were modelled (100 in each of the nearshore, central and offshore sections of the Operational Area). Their extents were combined to determine the ‘probability’ of where a single spill may travel. A single event would have a considerably smaller footprint than the Oil EMBA.

The potential extent of 300 spills resulting from SIMAP stochastic modelling (Section 7.6) has been used to generate the Oil EMBA boundary which encloses the limits of the areas that have the potential for exposure at defined threshold concentrations. The thresholds are defined for shoreline oil loadings and concentrations of dissolved and entrained hydrocarbons and sea surface floating oil. This is considered appropriate, though conservative, to define the Oil EMBA as:

- By randomly selecting 300 unique spill start-times (including initial months of the survey, November to March) and using any of the 5 years of metocean data from 2008-2012 with a randomly allocated sequence of wind and current data, a likely envelope of possible locations was generated for a spill anywhere in the Operational Area under typical summer metocean conditions.

- The EMBA includes deeper benthic and pelagic systems which would not be affected by a surface slick and shallower zones of entrained hydrocarbons. The areas bound by the different thresholds are used additively, not exclusively.
- Results are conservative as period of exposure is not used in determining the Oil EMBA. If an area is exposed to hydrocarbons above a threshold for an hour, it is considered impacted. In reality, the open ocean currents/tides and rapid weathering will ensure few areas are repeatedly or constantly exposed to the extent that a moderate impact occurs.
- Modelling considered the loss of the contents of a fuel tank larger than any of the fuel tanks on the analogue vessel, the MV Geo Coral, because the vessel specifications were not known at the time of modelling and conservative assumptions were made (Section 7.7).
- The EMBA boundary was drawn around all waters that may be exposed to sea surface oil >10 g/m^2 and/or dissolved aromatics >6 ppb and/or entrained hydrocarbon >100 ppb. These thresholds are discussed further in Section Error! Reference source not found. and in the detailed model report (Appendix C). Coastlines are included where oiling is forecast above 10 g/m^2.

4.1.2 EPBC protected matters search

A search using the EPBC Act Protected Matters Search Tool (PMST) (Appendix B) was conducted for the total extent of the Oil EMBA, which fully encompasses the Operational Area. The PMST report was used to identify matters of national environmental significance (MNES) and other matters protected under the EPBC Act that may occur within the two EMBAs. The PMST report was reviewed and 'threatened' and 'migratory' terrestrial species that do not occur along the shores of the Oil EMBA were identified and excluded from the fuel spill risk assessment.

Species-specific information was gathered using data portals such as the National Conservation Values Atlas (DoEE), Victorian Biodiversity Atlas (Victoria State Government), National Marine Mammal Data Portal (Australian Marine Mammal Centre), DoEE Species Profile and Threats (SPRAT) database, recovery plans, conservation advice, peer-reviewed scientific publications and available grey literature. Results of these searches are provided in Appendix B.

4.2 Regional overview

The Operational Area is located in the South-west Shelf Transition bioregion of the South-east Marine Region (Director of National Parks 2013). The continental shelf is relatively broad and shallow in the southern area of the Gippsland Basin. The waters are strongly influenced by a number of different currents that run through and nearby the shelf, bringing both warm and cool currents. Nutrients from cooler upwellings such as the Eden Upwelling (section 4.5.1) supply rich biota that thrives in the warmer, shallower shelf region. Fauna is characterized by assemblages of fish, echinoderms, gastropods and bivalves (Director of National Parks 2013).

The coastline consists of long sandy beaches broken by rocky headlands and numerous coastal lagoons. Estuary systems occur along the coastline within the region, with the larger estuaries located at Lakes Entrance (Gippsland Lakes); Sydenham Inlet and Mallacoota Inlet. Most of these estuary systems are normally closed to the marine environment (Director of National Parks 2013).

4.3 Conservation values and sensitivities

No EP planned activities will occur in any Commonwealth Marine Reserves, or State Marine Parks or sanctuaries.

4.3.1 Australian marine parks

Australian Marine Parks (previously Commonwealth Marine Reserves) within the South-east Marine Region are managed under the South-east Commonwealth Marine Reserve Network Management Plan 2013-23 (Director of National Parks 2013). Following proclamation of the South-east Commonwealth Marine Reserve Network, approval was given under Section 359B of the EPBC Act to undertake oil and gas seismic surveys in Special Purpose zones (IUCN VI) and Multiple Use zones (IUCN VI), and the transit of vessels through the network in connection with mining operations undertaken elsewhere (Director of National Parks 2013).

South-east Marine Region Marine Parks are listed as Type A under NOPSEMA's (2015) guidance note for 'Activities within Commonwealth Marine Reserves' (now termed Marine Parks). Proponents of projects that involve activities within or with potential to impact on this type of Marine Park should have regard to the management plan that is in effect and ensure that their EP is not inconsistent with the management plan (NOPSEMA 2015)

Australia's South-east Commonwealth Marine Reserves Network stretches from the far south coast of New South Wales, around Tasmania and Victoria and west to Kangaroo Island off South Australia. The reserves include striking features such as underwater canyons and mountains, and the diverse marine life associated with them. The South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DotE 2013) lists the Marine Parks that overlap or border the Oil EMBA as shown in Figure 4.2 below and describes how activities in the region are required to be carried out in a manner consistent with the Australian IUCN reserve management principles.

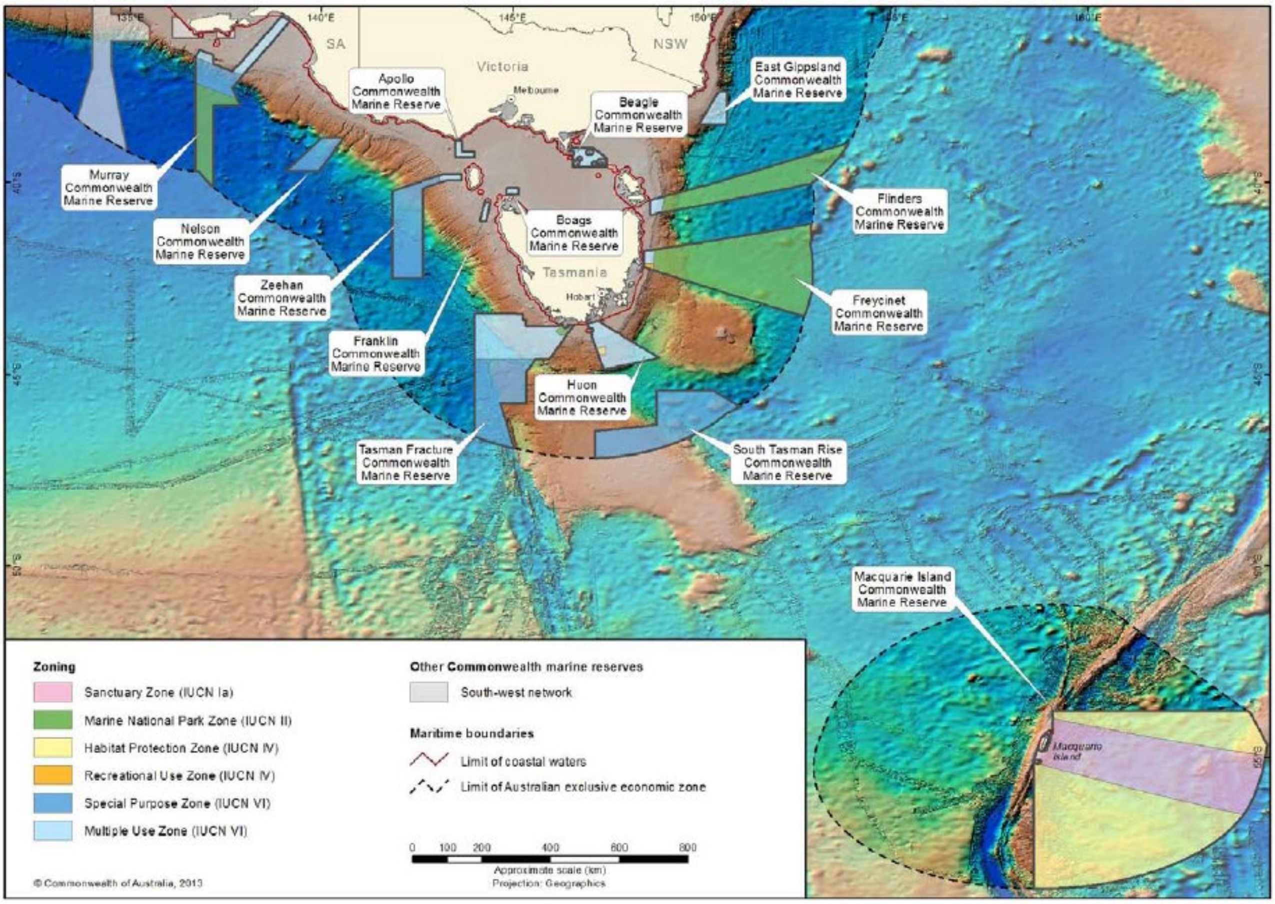

Figure 4.2 Commonwealth marine park network in the south-east marine region

The *South-east Commonwealth Marine Reserve Network Management Plan* describes the key values and threats for the three Commonwealth Marine Reserves that border on or across the Oil EMBA.

- Beagle Commonwealth Marine Reserve (approximately 72 km to the south-west of the Operational Area) represents an area of shallow continental shelf ecosystems in depths of about 50–70 m that extends around south-eastern Australia to the east of Tasmania. The sea floor that it covers formed a land bridge between Tasmania and Victoria during the last ice age 10 000 years ago. Its boundary encloses Tasmania’s Kent Group Marine Reserve and the Hogan and Curtis Island groups. Nearby to the north-east is Victoria’s Wilsons Promontory Marine National Park. The reserve encompasses the fauna of central Bass Strait, which is expected to be especially rich based on studies of several sea floor–dwelling animal groups. Its ecosystems are similar to those documented for the deeper sections of the Kent Group Marine Reserve, especially those based around habitats of rocky reefs supporting beds of encrusting, erect and branching sponges, and sediment composed of shell grit with patches of large sponges and sparse sponge habitats. Islands encompassed by the reserve and nearby islands support important breeding colonies for many seabirds and for the Australian fur seal. The waters of the reserve provide an important foraging area for those species breeding nearby. The rich marine life also attracts top predators, such as the great white shark and killer whales
- East Gippsland Commonwealth Marine Reserve (approximately 18.5 km to the east of the Operational Area) The geomorphic features of this reserve include rocky-substrate habitat, submarine canyons, escarpments and a knoll, which juts out from the base of the continental slope. The reserve includes both warm and temperate waters, which create habitat for free-floating aquatic plants or microscopic plants (i.e. phytoplankton) communities, complex seasonality in oceanographic patterns influences the biodiversity and local productivity. The East Australian Current brings subtropical water from the north, and around Cape Howe the current forms large eddies, with a central core of warm water. Around the outside of the eddies, cooler, nutrient-rich waters mix with the warm water creating conditions for highly productive phytoplankton growth, which supports a rich abundance of marine life. During winter an eastward moving current called the Bass Cascade (Godfrey et al. 1980) sees cold, dense and more saline water from the Bass Strait sink below the warmer fresher water of the Tasman Sea just a few kilometres landward of the 200 m isobath. Upwellings of cold water may occur and bring nutrient-rich waters to the surface, boosting productivity. Many oceanic seabirds forage in these waters and humpback whales pass by during their migrations north and south along the eastern seaboard (DotE 2013). See section 4.5.1(Key Ecological Features)
- Flinders Commonwealth Marine Reserve (approximately 130 km to the south of the Operational Area). covers a depth range from about 40 m on the shallow continental shelf to abyssal depths of 3,000 m or more near the edge of Australia’s exclusive economic zone. Key features of this area are the continental shelf, and a long section of steep continental slope, incised by a series of deep submarine canyons. Sea bottom habitats include sheer rocky walls and large rocky outcrops that support a rich diversity of small seabed animals, such as lace corals and sponges. These and the large expanses of sandy and muddy sediments are habitats to a wide variety of fishes and to populations of the giant crab. The biodiversity of the reserve is influenced by summer incursions of the warm East Australian Current and associated large-scale eddies (DotE 2013).

The values of the three reserves are summarised in Table 4.1 below.

Table 4.1 Australian marine parks within or bordering on the Oil EMBA

Marine park	Major conservation values	Relevant IUCN category	IUCN management reserve principles
East Gippsland – 600 m to more than 4000 m	• Examples of ecosystems, habitats and communities associated with the Southeast Transition and associated with the sea floor features, abyssal plain/deep ocean floor, canyon, escarpment and knoll/abyssal hillslope • Features with high biodiversity and productivity: Bass Cascade; upwelling east of Eden • Important foraging area for: wandering, black-browed, yellow-nosed and shy albatrosses; great-winged petrel; wedge-tailed shearwater; and cape petrel • Important migration area for: humpback whale	Multiple Use Zone – IUCN Category VI	The reserve or zone should be managed mainly for the ecologically sustainable use of natural ecosystems based on the following principles • the biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term • management practices should be applied to ensure ecologically sustainable use of the reserve or zone • management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles
Beagle – 50–70 m that extends around south-eastern Australia to the east of Tasmania	• Ecosystems, habitats and communities associated with the Southeast Shelf Transition and associated with the sea-floor features: basin, plateau, shelf and sill • Important migration and resting on migration area for: southern right whale • Important foraging area for: Australian fur seal, killer whale, white shark, shy albatross, Australasian gannet, short-tailed shearwater, pacific and silver gulls, crested tern, common diving petrel, fairy prion, black-faced cormorant and little penguin • Cultural and heritage sites: the wreck of the steamship *SS Cambridge* and the wreck of the ketch *Eliza Davies*.	Multiple Use Zone – IUCN Category VI	
Flinders – 40 m to 3000 m	• Examples of ecosystems, habitats and communities associated with the Tasmania Province, the Tasmanian Shelf Province, the Southeast Transition and the Southeast Shelf Transition and associated with the sea-floor features: abyssal plain/deep ocean floor, canyon, plateau, seamount/ guyot, shelf and slope • Features with high biodiversity and productivity: east Tasmania subtropical convergence zone • Important foraging area for: wandering, black-browed, yellow-nosed and shy albatrosses, northern giant petrel, Gould's petrel and cape petrel, killer whale and white shark • Important migration area for: humpback whale.	Marine National Park Zone – IUCN II (25,812 km^2) Multiple Use Zone – IUCN VI (1,231 km^2)	

These Commonwealth Marine Parks are shown in Figure 4.3 along with the state protected sanctuaries, and reserves and internationally important sites.

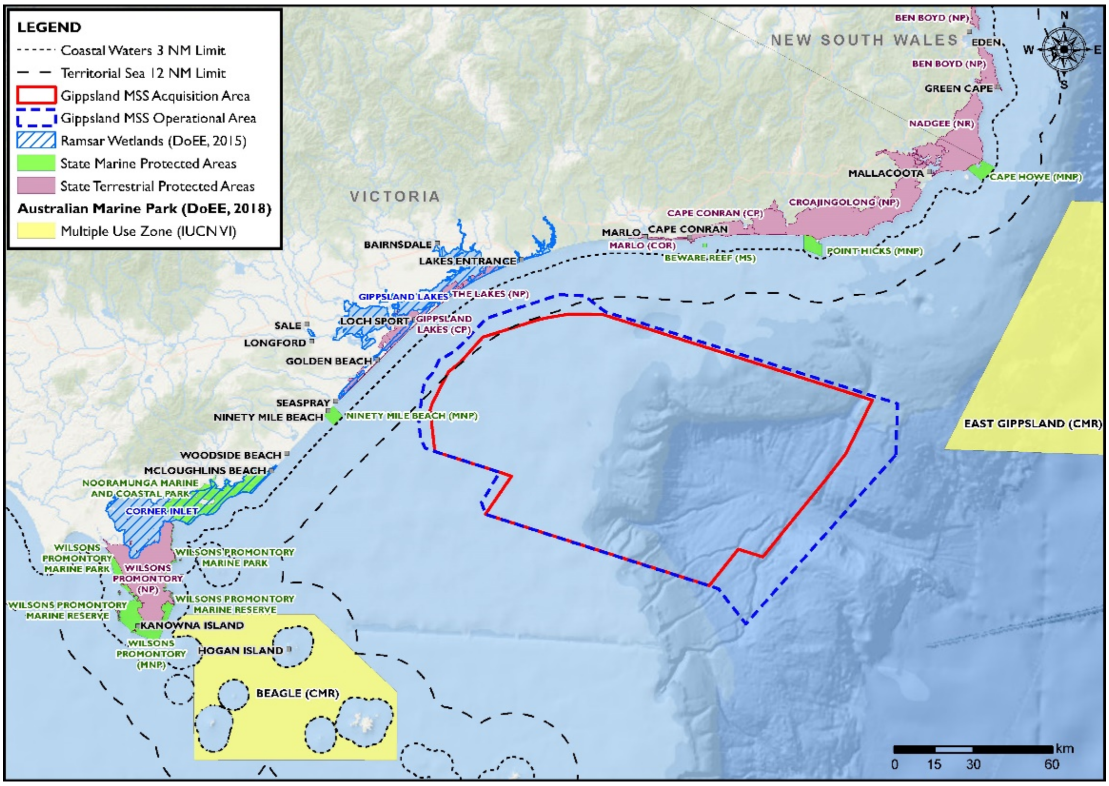

Figure 4.3 State, Commonwealth and international protected areas in the vicinity of the Gippsland MSS

4.3.2 Victorian protected areas

In 2002, the Victorian Government enacted the National Parks (Marine National Parks and Marine Sanctuaries) Act 2002, establishing 13 protected marine national parks and 11 smaller protected marine sanctuaries. These are “no take” areas that form the major component of the marine protected areas system. There are also special management areas, where different levels of use are permitted. Parks Victoria is responsible for managing the State’s marine parks and sanctuaries under the Parks Victoria Act 1998.

Marine parks and sanctuaries along the Gippsland coast relevant to the proposed activity include (Figure 4.3):

- Gippsland Lakes Coastal Park – approximately 16 km north west of the Operational Area
- Wilsons Promontory Marine National Park approximately 101 km south west of the Operational Area
- Corner Inlet Marine National Park – approximately 103 km south west of the Operational Area
- Ninety Mile Beach Marine National Park approximately 30 km north west of the Operational Area
- Cape Howe Marine National Park approximately 90 km north east of the Operational Area
- Cape Conran Coastal Park approximately 34 km north of the Operational Area
- Nooramunga Marine and Coastal Park approximately 60 km west of the Operational Area
- Beware Reef (Cape Conran) Marine Sanctuary approximately 36 km north of the Operational Area
- Point Hicks Marine National Park approximately 47 north of the Operational Area.

In addition to recognised marine reserves, national parks and sanctuaries described below, the Skerries (approximately 62 km to east-north-east of the Operational Area, Section 4.4.3.4) and Gabo Island harbour (approximately 93 km to east-north-east, Section 4.4.3.4) are recognised as Marine Special Management Areas.

4.3.2.1 Gippsland Lake Coastal Park

This narrow coastal reserve (7584 ha) along the Ninety Mile Beach runs from Seaspray to Lakes Entrance. The Park's key natural values are listed as (use of the term 'parks' in this section references the adjacent Lakes National Park):

- Valuable remnants of vegetation communities including Coast Banksia Woodland, Heath Tea-tree Heathland and Hairy Spinifex Grassland.
- Lake Reeve and Bunga Arm – international significance as a Ramsar site (Section 4.3.5.2). This long, shallow lagoon is fringed by salt marsh. Important breeding habitat for a number of waterfowl species and is one of Victoria's five most important areas for waders and contain important breeding, feeding and roosting sites for many significant species, including the hooded plover. These water bodies are protected from ocean processes via the 5 -8m dune barrier system
- Six significant flora and over 20 significant fauna species have been recorded within the Parks.
- The wetlands are important nursery areas for many fish species.
- The Parks contain sites of National, State and regional geological and geomorphological significance mainly associated with the evolution of the barrier system that formed the Gippsland Lakes.
- The Gippsland Lakes area, which includes the Parks, is recorded as a significant regional landscape by the National Trust of Australia.
- The coastal vegetation strip is identified as containing Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Twenty-six species of native mammals (including the endangered New Holland mouse (*Pseudomys novaehollandiae*), 17 of reptiles and 11 of amphibians.

4.3.2.2 Wilsons Promontory National Park

Wilsons Promontory Marine National Park covers 15,580 ha and surrounds the southernmost tip of Wilsons Promontory National Park. The main habitats protected by the park include intertidal and subtidal soft sediment, intertidal and subtidal reefs. A number of invertebrates are found in the rocky intertidal zone. The subtidal soft sediments are predominantly inhabited by infauna and bottom-dwelling skates and rays. Seagrass beds of Halophila australis and *Heterozostera nigricaulis* are restricted to sheltered waters, in particular Waterloo and Oberon Bays. A variety of fish have been recorded on seagrass and associated soft substrates (Parks Victoria 2013a). The Wilsons Promontory Marine National Park and Wilsons Promontory Marine Park Management Plan May 2006 (Parks Victoria 2006a) identifies important values for the park, including:

- natural values
  - Victoria's southernmost and largest Marine National Park and the only marine protected area within the Flinders bioregion
  - granite habitats, which are unusual in Victorian marine waters, including extensive heavy reefs with smooth surfaces, boulders and rubble and low profile reefs
  - biological communities with distinct biogeographic patterns, including shallow subtidal reefs, deep subtidal reefs, intertidal rocky shores, sandy beaches, seagrass and subtidal soft substrates
  - abundant and diverse marine flora and fauna, including hundreds of fish species and invertebrates such as sponges, ascidians, sea whips and bryozoans
  - 68 species of marine flora and fauna recorded, or presumed to be, at their eastern or western distributional limits
  - important breeding sites for a significant colony of Australian fur seals

- important habitat for several threatened shorebird species, including species listed under international migratory bird agreements
- cultural values
  - seascape of high traditional and cultural significance to Indigenous people
  - cultural places and objects of significance to Indigenous people
  - part of a past land link to Tasmania occupied and used by Indigenous people
  - Indigenous cultural lore and interest maintained by the Gunai / Kurnai and Boonwurrung people
  - historic shipwrecks, many of which are listed on the Victorian Heritage Register
  - opportunities for cultural values investigation and learning in an area with minimal human disturbance
- recreational and tourism values.

4.3.2.3 Corner Inlet Marine National Park

Corner Inlet Marine National Park adjoins the Corner Inlet Ramsar Site (see Section 4.3.5.1).

Corner Inlet Marine National Park (1333 ha) adjoins the Corner Inlet Marine and Coastal Park (28,500 ha). The park protects a wide variety of marine habitats including deep channels to extensive shallow seagrass beds, tidal sand and mud flats, sandy beaches, rocky reefs, mangroves and saltmarsh. Another important natural value of the park is the extensive beds of the seagrass Posidonia australis, the only large beds in Victoria (Parks Victoria 2013b).

The Corner Inlet Marine National Park Management Plan (Parks Victoria 2005a) notes that spills of oil or other chemicals could have devastating effects on park values, particularly on seabirds, seagrass and intertidal areas. It identifies the environmental values as:

- natural values
  - internationally significant wetland listed as part of the Corner Inlet Ramsar site
  - many open bay habitat types, such as seagrass, mangrove, intertidal sandy beaches and subtidal soft sediments
  - extensive seagrass communities with a particularly high faunal diversity
  - extensive broad-leaf seagrass meadows
  - very high diversity of invertebrates in soft sediments
  - important habitat for threatened shorebird species, including species listed under international migratory bird agreements. It supports 50% of Victoria’s migratory waders and 20% of Victoria’s total wader population
- cultural values
  - seascape of high cultural significance to Indigenous people
  - cultural places and objects of significance to Traditional Owners
  - an important area for maritime and other cultural history
- recreation and tourism values.

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4.3.2.4 Ninety Mile Beach National Park

Ninety Mile Beach Marine National Park (2650 ha) located south-west of Seaspray, extends offshore for approximately 3 nautical miles (NM) to the limit of Victorian waters from the high water mark along 5 km of coastline. The park is adjacent to Ninety Mile Beach, which extends from Corner Inlet to Red Bluff, crossing the artificial entrance at Lakes Entrance, providing a barrier between the ocean and the Gippsland Lakes. The main protected habitats include intertidal and extensive subtidal soft sediments. The intertidal soft sediment contains a low biodiversity of invertebrate fauna including isopods, bivalves, polychaetes, amphipods and insect larvae. Flora is restricted to macroalgae drift and macroalgal epiphytes. The intertidal zone is an important roosting and feeding area for several threatened shorebirds. The subtidal soft sediments are home to a highly diverse invertebrate assemblage, with crustaceans, ascidians, seastars, as well as an unusual soft coral *Pseudogorgia godeffroyi* (Parks Victoria 2013c).

The Ninety Mile Beach Marine National Park Management Plan (Parks Victoria 2006b) identifies important values for the park, including:

- natural values
  - very high diversity of invertebrates in soft sediments
  - scattered low calcarenite reefs providing habitat for a distinctive marine invertebrate fauna, especially sponges
  - important habitat for threatened shorebird species, including species listed under international migratory bird agreements
- cultural values
- seascape and places of high cultural significance to the Traditional Owners
- recreation and tourism values.

4.3.2.5 Cape Howe Marine National Park

Cape Howe National Park (4,050 ha) lies on the Victoria/NSW border. It protects habitats that support a mixture of cool water southern marine species and warmer waters species more common further north. The reefs range from intertidal to subtidal to depths of approximately 50 m. On shallow reefs there is a dense canopy created by the brown seaweed Phyllospora, with sea squirts, coralline algae, sea tulips, sponges, seastars, brittlestars, crustaceans, polychaetes and many large shells. Within the deeper waters, there are dense sponge gardens composed of sponges, hydroids, gorgonian corals and sea whips. These habitats support many fish including wrasse, herring cale and sunfish (Parks Victoria 2013e).

The Cape Howe Marine National Park Management Plan July 2006 (Parks Victoria 2006c) identifies the following values:

- natural values
  - diversity of habitats including subtidal and intertidal reefs, subtidal soft sediment and sandy beaches
  - co-occurrence of eastern temperate, southern cosmopolitan and temperate species, as a result of the mixing of warm eastern and cool southern waters
  - marine mammals such as whales, dolphins, Australian fur seals and New Zealand fur seals
  - transient reptiles such as green turtles from northern waters
  - threatened fauna including whales and birds
  - foraging area for a significant breeding colony of little penguins from neighbouring Gabo Island
  - active coastal landforms within and adjoining the park, such as granite and sandstone reefs

  - outstanding landscapes, seascapes and spectacular underwater scenery
- cultural values
  - seascape of high cultural significance to Indigenous people
  - places and objects of significance to Indigenous people
  - a diverse and rich maritime and post-settlement history, including a shipwreck
- recreational and tourism values.

4.3.2.6 Cape Conran Coastal Park

Cape Conran Coastal Park (11,700 ha) includes extensive heathlands, wetlands, riparian and forest vegetation communities, and is home to several significant species of threatened flora. Numerous species of threatened fauna find refuge in the park, including the Little Tern, Smoky Mouse, Ground Parrot, White-bellied Sea-Eagle and Australian Grayling. The Cape Conran Coastal Park Management Plan October 2005 (Parks Victoria 2005b) identifies the following values

- natural values
  - rich and diverse vegetation, including damp and lowland forest, woodlands, various types of heathland, swamp, coastal and riparian communities
  - the Dock Inlet catchment, a pristine example of a coastal stream system with associated wetlands terminating in a freshwater coastal lagoon
  - the undisturbed Yeerung River supporting predominantly native fish is one of only two entirely lowland rivers in the region draining directly to the sea
  - almost 50 species of threatened fauna including six endangered nationally, and 14 bird species listed under international migratory bird agreements
  - at least 40 species of threatened flora, including the bonnet orchid and leafless tongue-orchid which are both vulnerable nationally
  - extensive heathland areas in excellent condition harbouring populations of threatened fauna, including the ground parrot and smoky mouse
  - Sydenham Inlet, part of the Bemm Heritage River corridor, supporting expansive seagrass meadows that provide important habitat for fish and waterbirds
  - high scenic values associated with the diverse geological formations of the park’s headlands, its coastal estuaries and heathy plains
  - excellent examples of coastal dynamics such as sand movement, wave action and river outflows
- cultural values
  - an extensive pre- and post-settlement history of Indigenous occupation with more than 50 recorded important Aboriginal archaeological sites, including numerous middens
  - Cape Conran and Pearl Point are two of the most significant Indigenous places on the Victorian coast for archaeological research, and culturally important to the Traditional Owners
  - seascapes of high traditional cultural significance to Indigenous peoples
  - legendary burial sites of shipwrecked sailors at Sailors Grave, shipwrecks in waters adjacent to the park
- tourism and recreational values
  - sightseeing, picnicking, viewing wildlife, walking and camping in natural coastal settings

- a range of easily accessed beaches- surfing, swimming and fishing activities
- cabins and lodge accommodation near Cape Conran,
- West Cape boat ramp, with excellent opportunities for ocean fishing and diving
- tour operations (e.g. horse riding, canoeing, four-wheel-drive tours)

- outstanding opportunities for cultural and environmental education.

4.3.2.7 Nooramunga Marine and Coastal Park

The Nooramunga Marine and Coastal Park (IUCN Category VI) includes the coastal area from the north-east side of Corner Inlet through to McLoughlins Beach (30,170 ha). It includes the largest stands of white mangrove and saltmarshes in Victoria. Seagrass meadows also occur in the park providing habitat to over 300 marine invertebrates, including a range of large crabs, seastars, sea snails, iridescent squid and many fish including pipefish, stingarees, flathead, whiting and flounder. Finfish such as snapper, King George whiting, flathead, garfish and salmon are caught by recreational fishers. Thirty two migratory wader species have been recorded in the park, including the largest concentrations of bar tailed godwit and great knot in south eastern Australia which feed over the mudflats at low tide.In summer the beaches provide nesting habitats for pied oystercatchers, crested terns , Caspian terns, fairy terns and hooded plover.. There is no management plan available for the park however as it is located within the Corner Inlet Ramsar Site and has similar features to both the Corner Inlet and Ninety Mile Beach Marine National Parks, the values identified for those could be applied.

4.3.2.8 Beware Reef Marine Park

Beware Reef Marine Sanctuary, located approximately 5 km south-east of Cape Conran, comprises a granite outcrop covering an area of 220 ha and extending for a distance of approximately 500 m from the edge of the exposed reef. It rises from a depth of approximately 30 m and is exposed at low tide, providing a resting area for Australian fur seals. The reef is covered by outcrops of bull kelp (Durvillaea sp.) and supports a diverse range of marine life, including seahorses and leafy seadragons (Parks Victoria 2009b). Beware Reef is a popular location for recreational divers and the remains of numerous shipwrecks can be encountered in the sanctuary.

The Beware Reef Marine Sanctuary Management Plan July 2006 (Parks Victoria 2006d) identifies important values for the Sanctuary, including:

- natural values
- a diversity of habitats, including subtidal and intertidal reefs, exposed reefs and subtidal soft sediment
- a haul-out area for Australian fur seals and New Zealand fur seals
- a diversity of invertebrates and fish species
- a reef environment, including shipwrecks, rich in marine biota
- threatened fauna, including several bird species and marine mammals
- outstanding landscapes, seascapes and spectacular underwater scenery
- excellent opportunities for scientific investigation and learning
- opportunities to build knowledge of marine protected areas and their management and to further understand marine ecological function and changes over time.
- cultural values
  - a seascape of high cultural significance to Indigenous people
  - a place of significance to Indigenous people

- a diverse and rich maritime and post-settlement history, three historic shipwrecks.
- recreational and tourism values – boat-based recreational activities including diving and snorkelling

4.3.2.9 Point Hicks Marine National Park

Point Hicks Marine National Park (3810 ha) adjoins Point Hicks Lighthouse Reserve and the Croajingolong National Park. It extends offshore to state limits (3 NM) from the high water mark along 10 km of coastline from 2 km east of Clinton Rocks to Stable Bay. The main habitats protected by the park include subtidal and intertidal soft sediments, and subtidal and intertidal reefs. Over 80% of the subtidal area of the park is deeper than 20 m. East coast species contributing to these differences have lower densities at Point Hicks than in New South Wales (NSW). The subtidal reef consists of highly exposed granite slopes, boulders, rock gullies and outcrops and includes shallow reefs, as well as deep reefs that extend below 80 m depth (Parks Victoria 2013d).

The Point Hicks Marine National Park Management Plan July 2006 (Parks Victoria 2006e) identifies important values, including:

- natural values
  - a diversity of habitats, including subtidal and intertidal reefs, subtidal soft sediment and sandy beaches
  - a very high diversity of fauna, including intertidal and subtidal invertebrates
  - co-occurrence of eastern temperate, southern cosmopolitan and temperate species, as a result of the mixing of warm eastern and cool southern waters
  - a range of rocky habitats, from large boulders to smaller rocks and stones
  - marine mammals such as dolphins, whales, Australian fur seals and New Zealand fur seals.
  - transient reptiles from northern waters, including turtles and sea snakes
  - threatened fauna, including whales and several bird species
  - outstanding landscapes, seascapes and spectacular underwater scenery
  - outstanding active coastal landforms within and adjoining the park, such as granite reefs and mobile sand dunes
  - outstanding opportunities to build knowledge of marine protected areas and their management and to further understand marine ecological function and changes over time
- cultural values
  - seascape of high cultural significance to Indigenous people
  - places of significance to Indigenous people
  - a diverse and rich maritime and post-settlement history, including shipwrecks
- recreational and tourism values

4.3.3 Tasmanian protected areas

Many of the Bass Straits islands that border on the Oil EMBA lie within the Kent Group. The Kent Group Marine Reserve is located approximately 74 km to the south-west of the Operational Area, wholly within the Beagle CMR. It is managed by the Parks and Wildlife Service of Tasmania. The Kent Group National Park (Terrestrial Portion) Management Plan 2005 (Parks and Wildlife Service 2005) specifically excludes the marine portion of the park declared in September 2004. As such, the values identified for the Beagle CMR are considered relevant.

The Small Bass Strait Island Reserves Draft Management Plan October 2000 (TPAWS 2000) identifies a number of environmental values for the islands of the Furneaux Group relevant to this activity, including:

- Low Islets, Foster Islands and Penguin Island Nature Reserves are significant as Tasmania's only Australian pelican breeding colonies and apart from one New Zealand breeding site, are the most southerly in the world.
- Moriarty Rocks, Tenth Island, Judgement Rocks, West Moncoeur and Reid Rocks Nature Reserves are significant as Tasmania's only Australian fur seal breeding colonies, which provide approximately half the global habitat for the species.
- Cat Island Conservation Area is significant as once being the world's largest gannet colony with an estimated 20,000 birds in 1908 before the population was systematically destroyed by fishers and then fire. It is also important as a site for the potential recolonisation of the Australasian gannet.
- Rodondo Island Nature Reserve is significant, because due to the absence of fire, it supports climax *Eucalyptus globulus* and *Melaleuca armillaris* communities, which are considered extremely rare.

4.3.4 NSW protected areas

The Oil EMBA extends into the southern coast of New South Wales (NSW), and is predicted to make isolated contact with the shoreline of the Nadgee Nature Reserve and Ben Boyd National Park, the boundaries of which extend to the low water mark of the coastline. Nadgee Nature Reserve is in the southern most part near the Victorian border, with the coastline dominated by rocky cliffs and platforms with isolated sandy beaches. Green Cape lies further north and comprises largely rocky cliffs and rock platforms.

4.3.5 Ramsar sites

No Ramsar sites are overlapped by the Operational Area. There are three Wetlands of International Significance (Ramsar sites) that potentially border the Oil EMBA – Corner Inlet, Gippsland Lakes and the East Coast Cape Barren Ramsar Site. While the Logan Lagoon Ramsar site has been listed in the PMST report, on close examination of the oil spill modelling of shoreline contacts and the probability of exposure to elevated hydrocarbons, no impacts to the Lagoon are predicted from a potential spill and hence the site is not described here.

4.3.5.1 Corner Inlet Ramsar site

The Corner Inlet Ramsar Site is located about 54 km south west of the Operational Area on the south-east coast of Victoria (Figure 4.4). It is bounded to the west and north by the South Gippsland coastline, in the south-east by a series of barrier islands and sandy spits lying end to end and separated by narrow entrances, and to the south by the hills of Wilsons Promontory. Corner Inlet includes the chain of barrier islands, multiple beach ridges, lagoons and swamps, tidal creeks, tidal deltas, and tidal washovers (Australian Wetlands Database 2013).

The key environmental values of the Corner Inlet Ramsar Site as described in the Corner Inlet Ramsar Site Strategic Management Plan (Parks Victoria 2002) include:

- wetland representativeness: it includes three wetland types as defined under the Victorian classification scheme, including the state's most depleted wetlands
- flora and fauna: more than 160 species of native fauna and 390 species of native flora
- vegetation communities: fifteen communities ranging from woodland to fringing saltmarsh and intertidal mangroves, including rare and restricted distribution communities
- islands: supporting significant saltmarsh and mangrove communities
- seagrass meadows: extensive meadows with high faunal diversity
- soft sediment habitats: from fine mud and silt to sandy bottoms in both intertidal and subtidal areas

- birds: Internationally important feeding, resting and breeding habitat for 57 species of waterbirds. More than 25 species protected under international conventions
- natural function: provides a range of important functions supporting the maintenance of the wetland and surrounding ecosystems
- cultural heritage: many Aboriginal sites and existing connections to the land. Early European settlements and numerous shipwrecks
- socioeconomic: supports commercial (directly and indirectly) and recreational fisheries. Important coastal ports (Barry Beach, Port Welshpool, Port Franklin, Port Albert)
- recreation and tourism: Main activities include fishing, boating, swimming, kayaking, camping and horse riding. A number of commercial tourism operations
- condition: native vegetation communities are in relatively good condition and show little sign of disturbance. The broad leaf seagrass communities are in a “medium” condition. Nutrient input and catchment conditions are of concern.

The mainland coast and several sandy islands are covered with mangroves, saltmarshes, sandy beaches and very extensive intertidal mudflats. The area contains the only extensive bed of the broad-leafed seagrass (Posidonia australis) in Victoria. The islands of Corner Inlet, although not rich in plant diversity, are of high biogeographical significance as a result of their geological history and connectivity to the mainland during ice ages. The islands also contain significant areas of saltmarsh and mangroves, both of which are communities of very limited distribution within the region.

Corner Inlet was used traditionally by Indigenous people and many archaeological sites including scarred trees, burial sites, artefact scatters, shell middens and camps have been found. Currently, the Ramsar site is used for biological conservation, ports with servicing facilities for off-shore oil and natural gas exploration, commercial fishing, recreational fishing, and other recreational activities. Diving is popular around the numerous shipwreck sites in Corner Inlet and around the barrier islands (Australian Wetlands Database 2013).

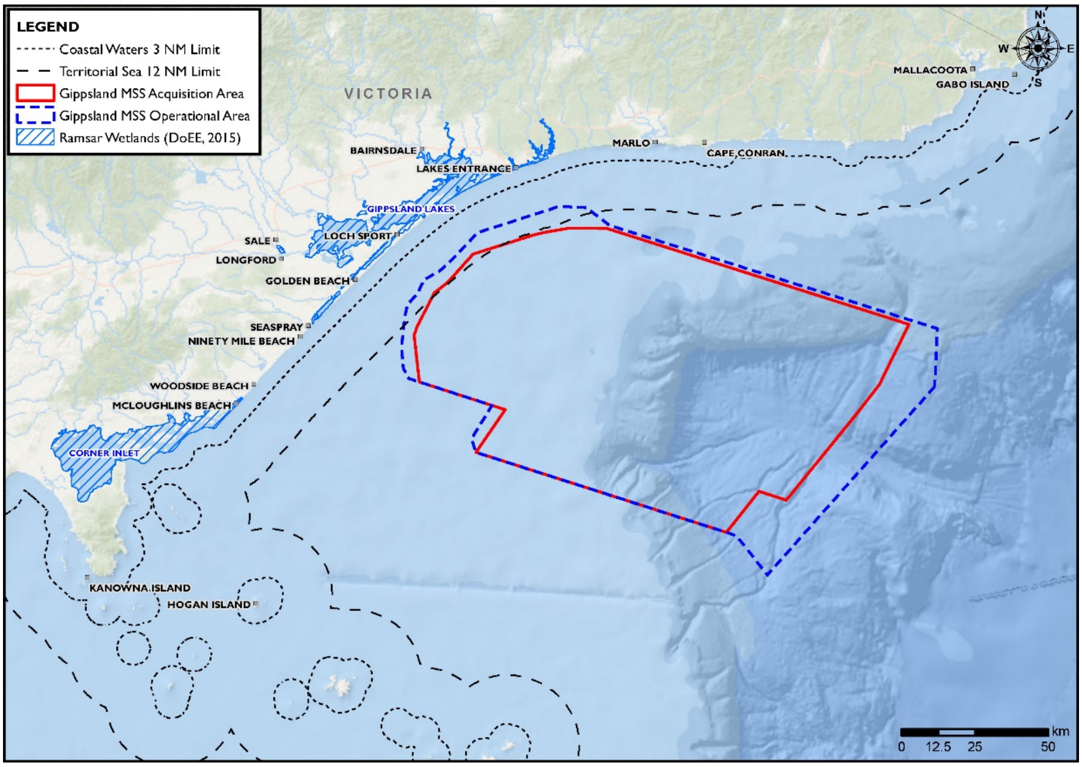

Figure 4.4 Corner Inlet Ramsar site

4.3.5.2 Gippsland Lakes Ramsar site

The Gippsland Lakes Ramsar site (Australian Wetlands Database 2018) is located on the low-lying South East Coastal Plain bioregion. Covering a vast area, the lakes are a series of large, shallow, coastal lagoons separated from the sea by sand dunes. The three main water bodies together form the largest navigable inland waterway in Australia and create a distinctive regional landscape of wetlands and flat coastal plains of considerable environmental significance.

The Ramsar site contains 11 Ramsar wetland habitat types including most notably, coastal lagoons, subtidal seagrass and algal beds, and a range of saline, brackish and freshwater marsh environments. The site supports a broad range of ecosystem services including nationally and internationally threatened wetland species, waterbird breeding and fish spawning sites. Cultural and socio-economic values are equally diverse, noting the particular importance of the site in a regional context in terms of recreational activities such as boating, recreational fishing and holiday tourism.

The Gippsland Lakes supports a number of nationally listed species. The bird diversity of the Ramsar wetland is high with 86 species of waterbirds being recorded including large numbers of the red-necked stint, black swan, sharp-tailed sandpiper, chestnut teal, musk duck, fairy tern and little tern.

Currently, parts of the Lakes system are heavily used for commercial and recreational fisheries and boating activities, while the immediate hinterland has been developed for agricultural use, and limited residential and tourism purposes (Australian Wetlands Database 2018). Management of the Gippsland Lakes are currently under the Victorian Government’s Gippsland Lakes Environmental Strategy (Gippsland Lakes Ministerial Advisory Committee 2013). The environmental strategy details broad strategic directions to manage the current and future health of the lakes and wetlands of the system. The strategy identifies further research that is required to fill knowledge gaps and inform future management actions.

The Gippsland Lakes open to the ocean near Lakes Entrance, which is about 15 km north of the Operational area. Approximately one-third of the Gippsland Lakes Ramsar site is located within the Lakes National Park (2,390 ha) and Gippsland Lakes Coastal Park (17,584 ha), which are proclaimed under the National Parks Act 1975 (Vic).

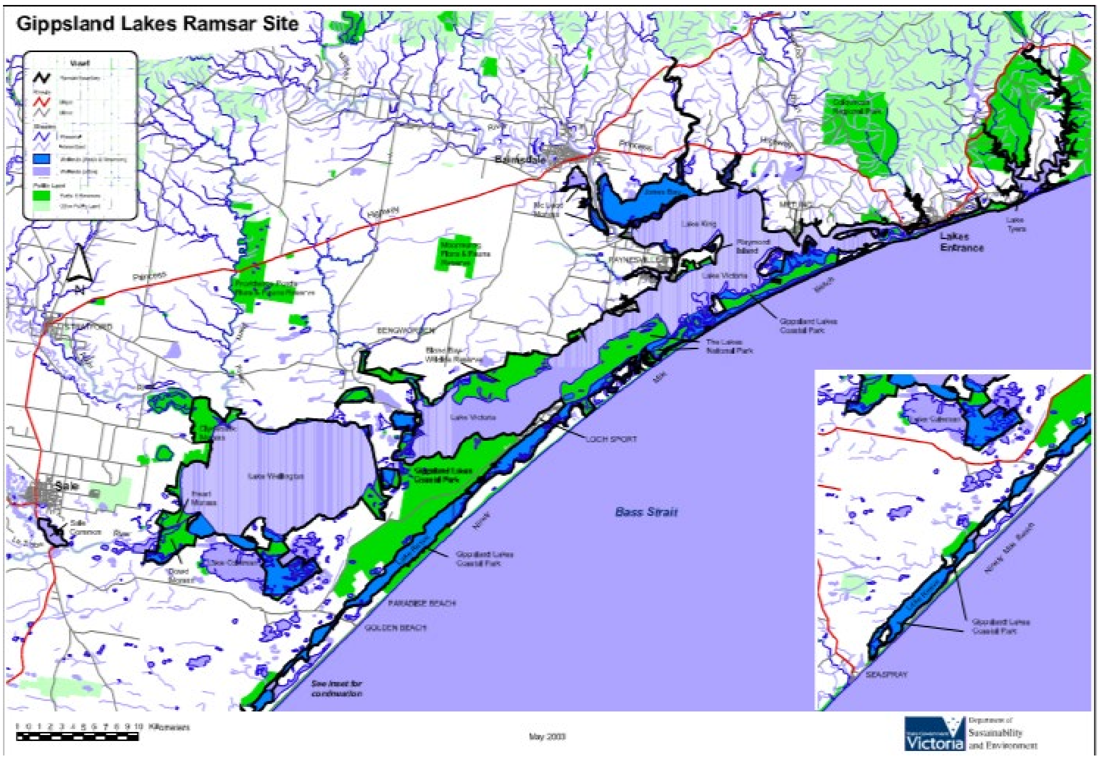

Figure 4.5 Gippsland Lakes Ramsar site

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4.3.5.3 Cape Barren Islands Lagoon

The East Coast Cape Barren Island Lagoons Ramsar site is located on the east coast of Cape Barren Island, one of the Furneaux Group of islands which lie in Bass Strait to the north-east of Tasmania. It comprises a complex of freshwater, brackish, saline and sometimes hypersaline lagoons, wetlands and estuaries that owe their existence to a dune system which has been slowly developing in an easterly direction, leaving shallow sandy soils, depressions and intermittently flowing water courses The vegetation of the site is characterised by a tussock grassland of the exotic species Marram Grass on the foredunes, with a closed-scrub of Coastal Wattle, Prickly Moses and Marram Grass stabilising the hind dunes. Coastal Wattle, Silver Banksia and Southern Grass Tree form an open scrub on the sand plains behind these dunes, with further inland areas dominated by Manna Gum, Swamp Gum and Smithton Peppermint.

This extensive system of shallow coastal lagoons contains a number of species that are considered to be of special botanical interest, including the Scarce Centrolepis which is rare at both a state and national level. Pointed Centrolepis, Sharpleaf Rush, Water Milfoil, Sago Pondweed, and Round-leaf Wilsonia are also found within the site.

Locally significant numbers of duck species for the Flinders bioregion utilise this area. In addition, the Ramsar site is of great importance for the Hooded Plover.

This area is of cultural importance to the local Indigenous community, who manage the freehold title to part of Cape Barren Island, including the Ramsar site. Access is currently restricted, keeping the site largely undisturbed, with a single bush track for 4WD vehicles providing access for duck hunters to Flyover Lagoon.

Figure 4.6 below shows the location of the wetlands with respect to Cape Barren island.

Figure 4.6 East Coast Cape Barren Ramsar site

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4.3.6 Nationally important wetlands

In Victoria, the Benedore River, Corner inlet, Ewings Marsh and Lake King wetlands are all regarded as nationally important wetlands.

Benedore River opens to the Bass Straits, often with a sandbar across the entrance, in the Croajingolong National Park. The dominant floral community of the corridor is lowland sclerophyll forest, with sixteen threatened flora specie and twenty-five threatened fauna species within the Benedore reaches.

Corner inlet is described in Section 4.4.1. The shores of Corner Inlet contain significant areas of saltmarsh and mangroves, both are communities of limited distribution. 61 waterbird species have been recorded. Fishing, swimming, boating (including yachting and kayaking), bird watching and duck hunting are popular activities.

Ewings Marsh was formerly an open lagoon supplied with seawater and fresh water floods. It is now virtually enclosed within a barrier. It provides habitats for 13 threatened bird species.

The Lake King Wetlands consist of two large coastal lagoons and associated channels with surrounding salt marshes and brackish to fresh marshes. The system opens to the Bass Straits at Lakes Entrance. "Moss balls", of a green alga *Cladophora echinis*, are a unique feature. 46 waterbird species have been recorded

In NSW the Nadgee Lake and tributary wetlands, Nargal lake, Nelson lagoon and Tuross River Estuary are listed in the PMST report as potentially bordering on the oil EMBA.

Lake Nadgee opens onto the Bass Strait through a broad unvegetated sand berm at the normal breakout entrance and is more than often tidal. Estuarine aquatic vegetation includes sea grass beds of Ruppia sp. (an aquatic food plant for waterbirds) which occur in shallower water near the southern and western foreshores.

Lake Nargal is a dune-swale freshwater lake that does not border on or are within the Oil EMBA

Nelsons Lagoon is an intermittently closed and open barrier lagoon with areas of saltmarsh of conservation significance.

Tuross River opens to the Bass Strait. It supports migratory waders and several species which are listed under JAMBA and / or CAMBA.

4.3.7 EPBC Act protected habitats – threatened communities

The Gippsland Red Gum Grassy Woodland has a 10 km section of coastline north of the Operational Area. Most of the listed flora and fauna protected under the EPBC Act 1999 are typically found in the woodland and native grasslands, i.e. inland of the shoreline.

Littoral Rainforest and Coastal Vine Thickets of Eastern Australia Ecological Communities are found along sections of coastline east of Lakes Entrance up the length of NSW and Queensland and are listed as Critically Endangered. Similarly, the habitats of Lowland Grassy Woodland in the SE Bioregion (comprising forests, grasslands and woodlands) lie well inland of the shoreline with occasional habitats closer to the coast.

The White Box-yellow Box – Blakely’s Red Gum Grassy Woodlands and derived native grasslands (http://www.environment.gov.au/biodiversity/threatened/communities/vic) are located inland of the shoreline, west of Lakes Entrance.

Whilst most of these threatened habitats do not lie directly on the beach, oil spill response onshore takes into account their values and sensitivities when assessing appropriate spill response strategies (Section 7.8).

Giant kelp beds and coastal salt marshes protected under the EPBC Act are shown in Figure 4.7.

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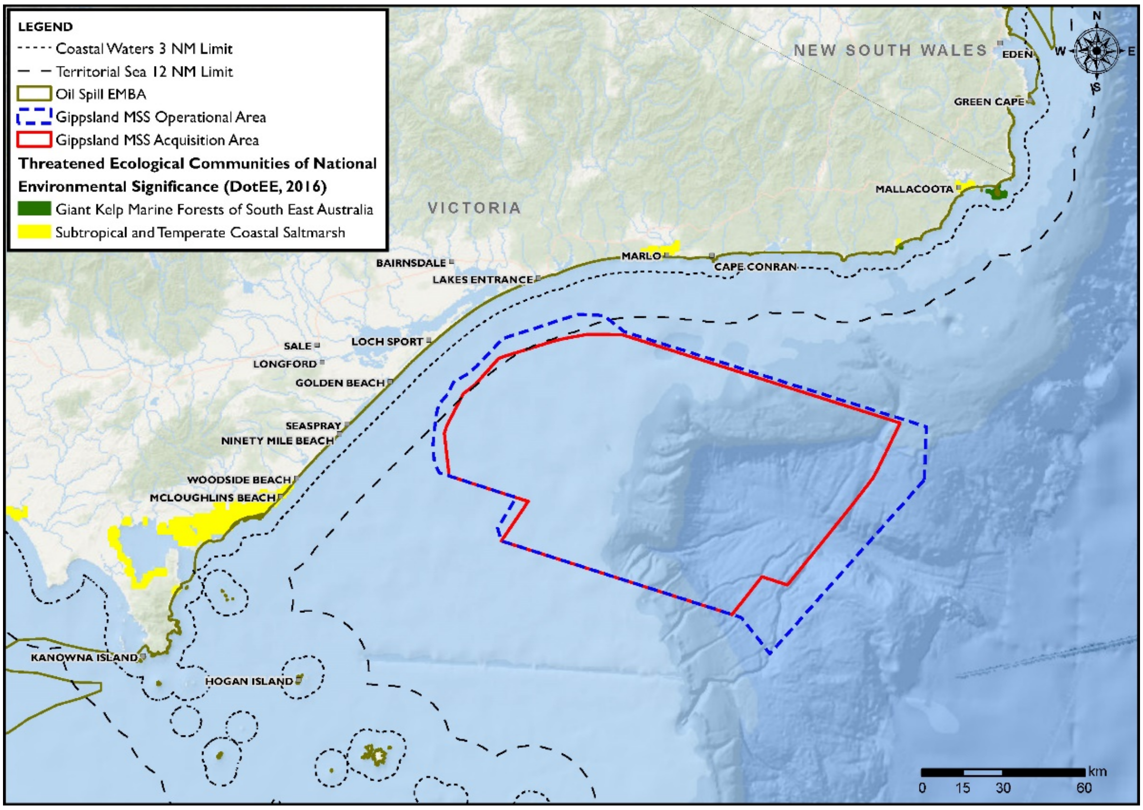

Figure 4.7 Threatened ecological communities bordering on or within the Oil EMBA

4.3.7.1 Giant kelp marine forests

Also known as string kelp, giant kelp (*Macrocystis pyrifera*) is protected as National Environmental Significance under the EPBC ACT. It is a large brown macroalgae that grows on rocky reefs from the sea floor 8 m below sea level and deeper. It requires clear, shallow water shallower than approximately 35 m below sea level as they are photoautotrophic organisms dependent on photosynthesis. Its fronds grow vertically toward the water surface, in cold temperate waters off south east Australia. Giant kelp is the largest and fastest growing marine plant. Its presence on a rocky reef adds vertical structure to the marine environment that creates significant habitat for marine fauna, increasing local marine biodiversity.

Stands may occur intermittently from Gabo Island (about 90 km from the Operational Area) west for approximately 100 km, with two known stands – one east of Cape Conran (about 35 km north of the Operational Area) and the second within Port Hicks Marine National Park also about 47 km from the Operational Area (Barton et al, 2012) (Figure 4.7). Other stands are found in shallower waters near Corner Inlet (approximately 93 km from the Operational Area), around islands in the Kent Group and near NW coasts of Flinders Island. Climate change is listed as a major threat. Other potential threats include increasing sedimentation into coastal waters and the removal of urchin predators through fishing operating across its range.

As the survey will be undertaken in water deeper than 43 m, much over sandy seabed, it is not predicted to be encountered in the Operational Area.

4.3.7.2 Subtropical and temperate coastal saltmarshes and natural damp grasslands

The Subtropical and Temperate Coastal Saltmarshes and the Natural Damp Grasslands overlap along the central southern Victorian coast. Two salt marsh regions – one near Orbost lies about 30 km north of the Operational Area and the second near Yarram (Corner Inlet, about 53 km from the Operational Area). Both lie within the Oil EMBA.

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The natural Damp Grasslands follow the coast from Lakes Entrance to Corner Inlet. No impacts from planned activities on these habitats. Should a coastal spill occur, impacts would primarily be in the form of isolated strandings of oil on the coastline with potentially elevated hydrocarbons (dissolved and entrained) in shallow water environments. Inland impacts are not forecast (discussed in Section 7.8) and as such inland habitats are not further described here but would be part of any onshore spill response assessment (Section 8.7).

4.3.8 Commonwealth heritage-listed places

Commonwealth Heritage-listed places are natural, indigenous and historic heritage places owned or controlled by the Commonwealth as protected under the EPBC Act (Chapter 5, Part 15).

No properties on the Commonwealth Heritage List occur within the Oil EMBA. The nearest places are the Wilsons Promontory Lighthouse (approximately 113 km southwest of the Operational area) and the Gabo Island Lighthouse (93 km northeast of the Operational area). Though Gabo Island is located within the Oil EMBA, as the lighthouse is located high above the waterline, the lighthouse itself is not considered part of the EMBA.

4.4 Physical environment

Bass Strait is the region of the continental shelf that separates mainland Australia from Tasmania. The Gippsland Basin is the broad shallow region on the eastern side of Bass Strait (Figure 4.8) that slopes to water depths greater than 1500 m in the south east.

Bass Strait has a history of variable exposure and immersion during sea level changes in the last few million years. Dramatic sea level fluctuations over the last 125,000 years (Pleistocene era) have occurred as ice caps formed and melted, changing sea levels. In the last period of glaciations, sea levels were over 100 m lower than they are at present and the Australian mainland and islands to the south, including Flinders Island, were connected by land.

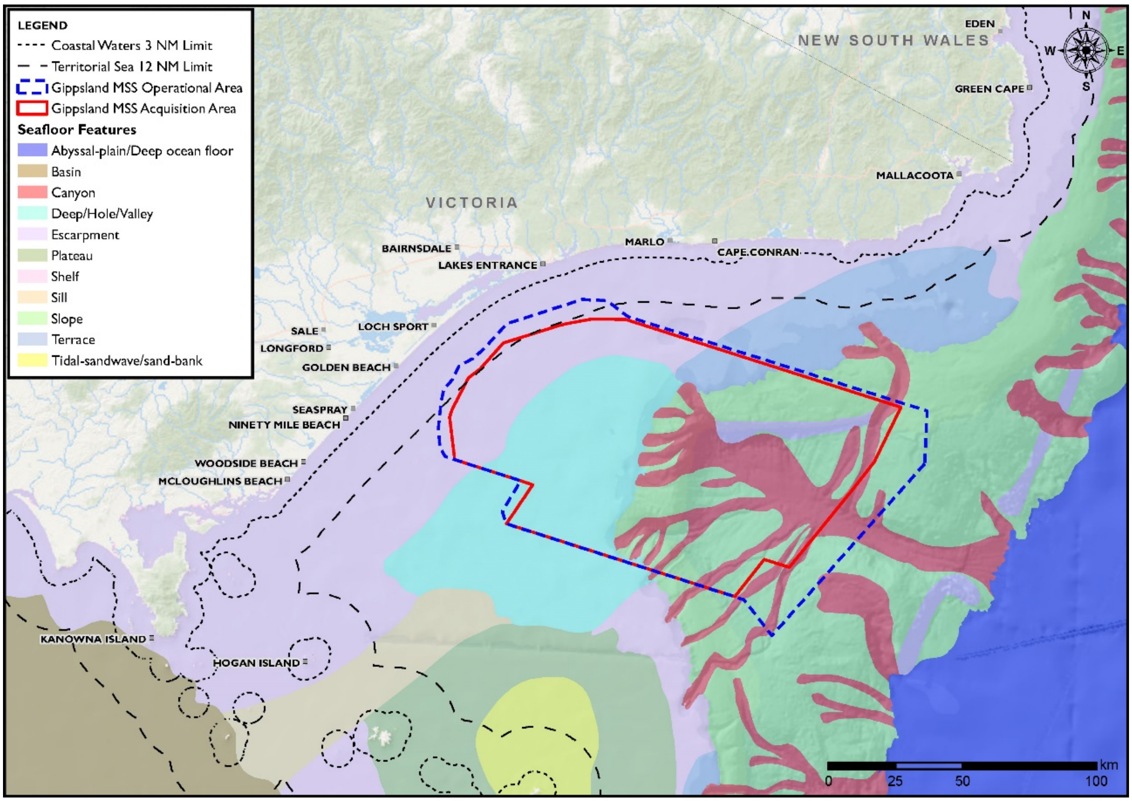

Figure 4.8 Sea floor features – south-east marine / Gippsland basin

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4.4.1 Climate and meteorology

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties. Wind direction and speed depend on the position and movement of synoptic systems. Wind speeds are typically in the range of 10 to 30 km per hour, with maximum gusts reaching 100 km per hour. The wind direction in central and eastern Bass Strait is predominately westerly during winter, westerly and easterly during spring and autumn (when wind speeds are highest) and easterly during summer. Strong south-easterly winds can be generated by low pressure systems known as “east coast lows”. Although these occur relatively infrequently (typically once or twice per year), the longer fetch of these winds increases their potential for generating extreme wave conditions (BOM 2018).

The monthly nearshore wind roses for the Operational Area are shown in Figure 4.9. The colour key shows the wind magnitude, the compass direction provides the direction FROM and the length of the wedge gives the percentage of the record for a particular speed and direction combination. The RPS Oil Spill Modelling report (2018) shows the wind data for 5 years for nearshore and centre of the Operational Area for the years 2008-2012 inclusive.

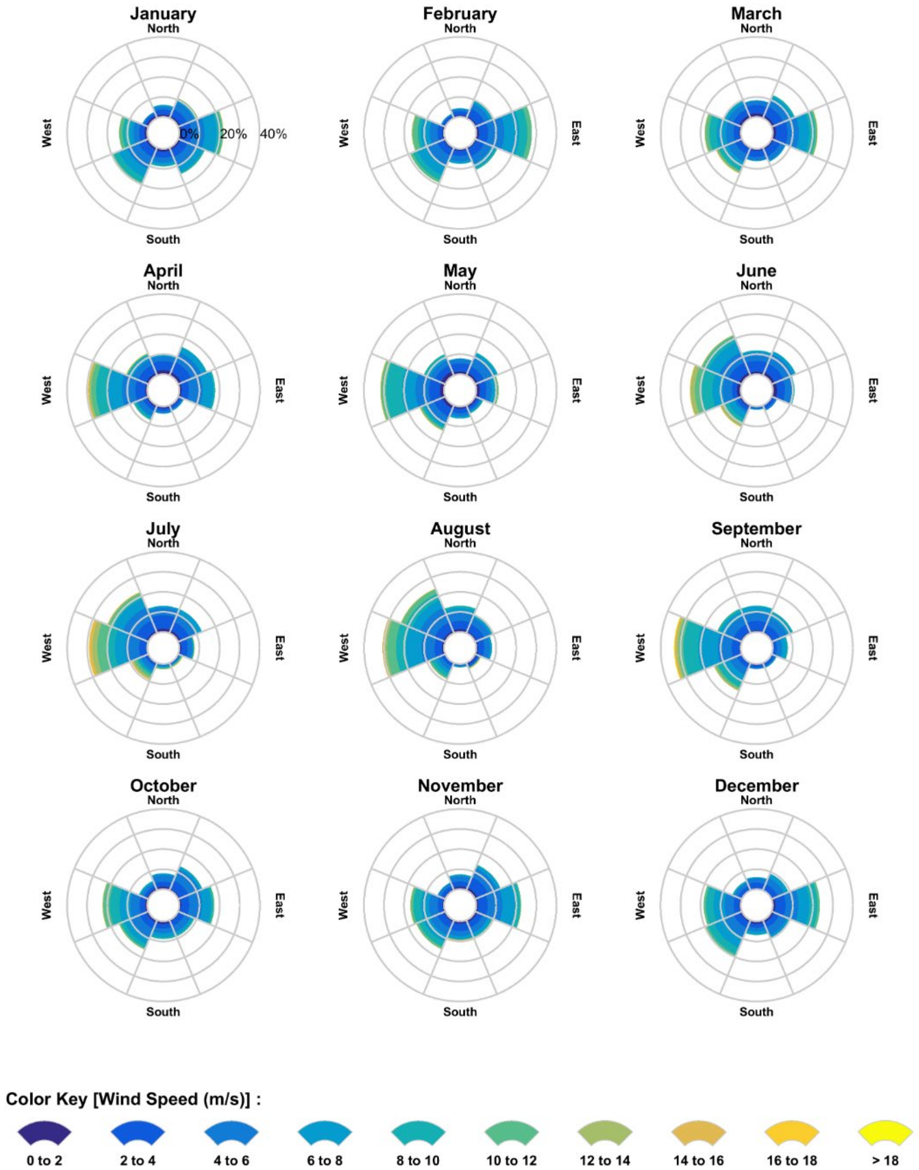

Figure 4.9 Monthly wind rose distributions for the wind node at the near-shore edge central to the activity area (2008–2012 inclusive)

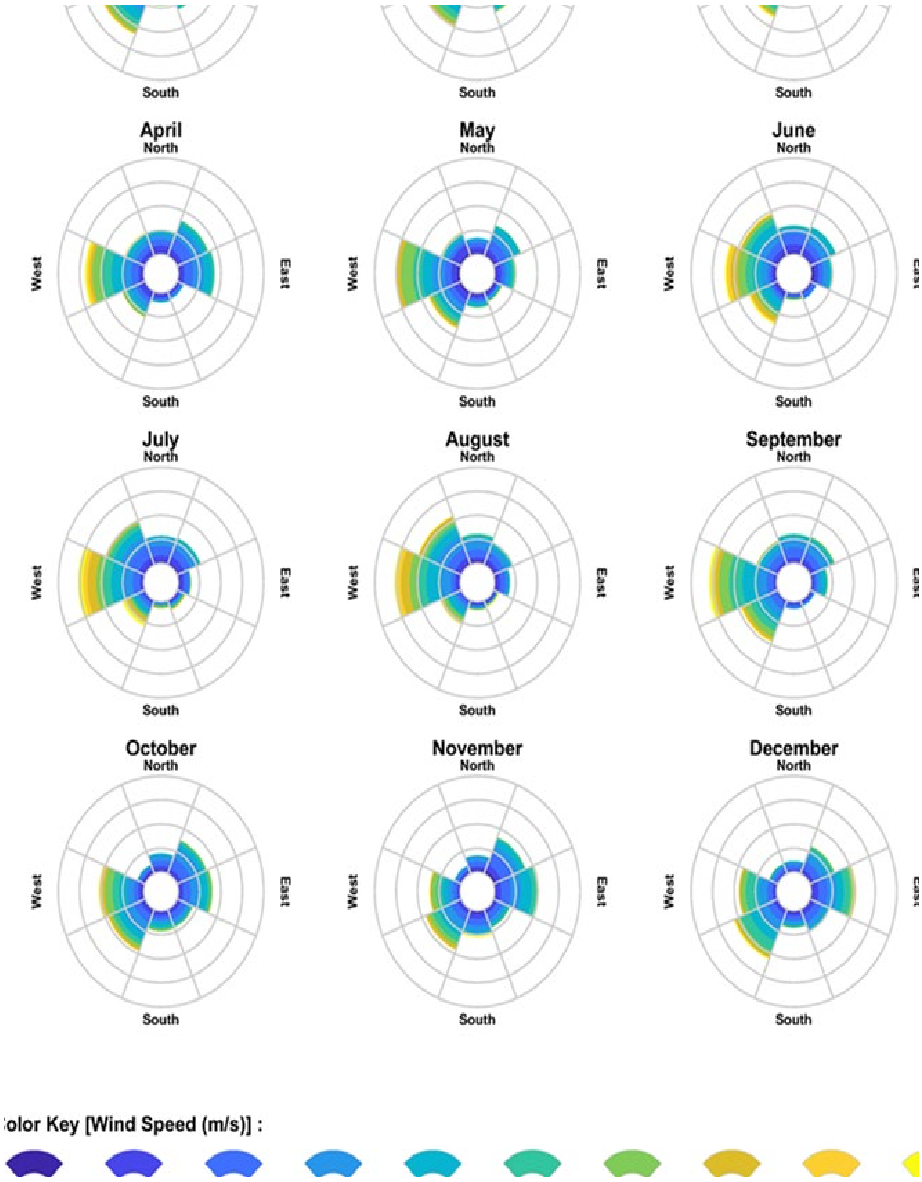

Figure 4.10 Monthly wind rose distributions for the wind node at the central activity area (2008–2012 inclusive)

Average summer air temperatures in coastal Victoria range from 12 to 26 °C (BOM 2018). Average coastal winter temperatures range from 5 to 16 °C. Deal Island in Kent Island Group, approximately 70 km to the SW of the Operational Area), has milder conditions occur with an average summer range of 12 to 21 °C and an average winter range of 8 to 14 °C (BOM 2018).

Average annual rainfall along the Gippsland coast ranges from approximately 600 mm to greater than 1,000 mm (Lakes Entrance 714 mm). Offshore (on Deal Island) annual rainfall is comparable (average 717 mm) and shows a similar pattern to the coastal region (Lakes Entrance) (BOM 2018).

4.4.2 Oceanography

4.4.2.1 Bathymetry

The seabed bathymetry across the region is highly variable. A steep inshore profile (0 to 20 m water depth) extends to a less steep inner (20 to 60 m water depth) and moderate profile (60 to 120 m water depth), concluding with a flat outer shelf plain (greater than 120 m water depth) in the western part of the Oil EMBA, and a steep slope into the Bass Canyon in the east (Black et al. 1991).

The Gippsland Basin is composed of a series of massive sediment flats, interspersed with small patches of reef, bedrock and consolidated sediment. Near shore sediments consist of coarse sands with isolated areas of gravels, shells and pebbles. Finer, muddy sands occur further offshore in the midshelf regions. Sedimentation is generally low due to the small supply from rivers and the relatively low productivity of carbonate. Submarine canyons include the edge of the Big Horseshoe Canyon (section 4.5.1) in the east of the Operational Area and within the Oil EMBA).

4.4.2.2 Currents and tides

Currents in eastern Bass Strait are tide and wind driven. Tidal movements in eastern Bass Strait predominantly have a north-east–south-west orientation. Tidal flows in Bass Strait come from the east and west during a rising (flood) tide and flows out to the east and west during a falling (ebb) tide. Tidal streams are dominated by the lunar tidal constituent, which has a period of 12.4 hours. The main tidal components in Bass Strait vary in phase by about three to four hours from east to west. Most of this phase change occurs between Lakes Entrance and Wilsons Promontory. Timing of the high tide, for example, can vary by up to three hours across this region. Tides within the Operational Area show seasonal variation with spring tides of approximately 0.9 m and neap tides of 0.6 m. Strong semi-diurnal tidal currents (2–2.5 knots) run parallel to the coast and are characteristic of this area (Barton et al. 2012). Tides in the Operational Area are however, relatively weak in comparison to some other areas of Bass Strait (GEMS 2005).

Wind driven currents in the Oil EMBA can be caused by the direct influence of weather systems passing over Bass Strait (wind and pressure driven currents) and the indirect effects of weather systems passing over the Great Australian Bight (GEMS 2005). On the east coast of Australia, seasonal upwellings of cooler waters can occur from northern NSW to south of Eden. An example is the East of Eden Upwelling (Section 4.5.1) which is not always predictable in timing and magnitude as the mechanisms driving it are various and sporadic such as the East Australian Current, coastal waters and local forcing winds (Shepherd et al, 2013).

4.4.2.3 Salinity, water temperature and density stratification

Salinity varies from 35.3 to 35.6 PSU (National Oceanographic Data Centre – World Ocean Atlas (www.metoc.gov.au). Temperatures in the subsurface waters of central and eastern Bass Strait range from about 13°C in August/September to 16°C in February–March. Surface temperatures in the Gippsland Basin can exceed 20°C at times in late summer due to the warmer waters of the East Australia Current entering the strait (Jones 1980). Water temperatures in the Oil EMBA are expected to follow this pattern.

Waters are generally well mixed, but surface warming sometimes causes weak stratification in calm summer conditions. During these times, mixing and interaction between varying water masses leads to variations in horizontal water temperature and a thermocline (temperature profile) develops. The thermocline acts as a low friction layer separating the wind driven motions of the upper well-mixed layer from the bottom well mixed layer. As a result, upwelling of cold water (Bass Cascade and Upwelling east of Eden) can occur (Jones 1980).

4.4.2.4 Waves

Bass Strait is a high-energy environment exposed to frequent storms and significant wave heights. High wave conditions are generally associated with strong west to south-west winds caused by the eastward passage of low-pressure systems across Bass Strait. Storms may occur several times a month resulting in wave heights of 3 to 4 m or more. In severe cases, south-west storms can result in significant wave heights of greater than 6 m (Jones 1980).

The Oil EMBA is protected from south-westerly swells by Tasmania but is strongly influenced by south-easterly and easterly swell heights of 1–1.5 m with maximum heights varying between 1.9 and 2.7 m (LCC 1993). Stalled low-pressure systems in the Tasman Sea during summer can generate higher wave energy at this time.

4.4.3 Coastal environment

The physical coastal environment described in this section is defined by the extent of the EMBA, stretching from Wilsons Promontory and Corner Inlet east to sections of coastline near the Victorian/NSW border. Bass Strait islands are described in 4.3.3.

The environmental features of the coast immediately adjacent to the proposed survey acquisition area is predominantly sandy sediment with sparse low-profile carbonate reef. The coastline is entirely sandy beach.

From Marlo to Mallacoota (about 125 km in length) the coast is fringed by dense forest and an absence of beachside towns (other than Bemm River on the banks of the Sydenham Inlet). It is remote with no sealed roads leading to the coast between Sydenham Inlet Road (Bemm River) and Genoa-Mallacoota Road (Mallacoota). From a rock fringed shoreline south of Mallacoota to the NSW/Victoria boundary the sandy beaches continue with Gabo island (Section 4.4.3.4) providing a rocky outcrop offshore and a rocky platform off Cape Howe. The NSW beaches are considerably narrower with rocky shores north of Nadgee Nature Reserve (Section 4.3.4).

4.4.3.1 Shoreline types

Ninety Mile Beach is an approximately 145 km long stretch of sandy beach fringed by a narrow, tall, vegetated sand dune system – an important area for hooded plover and other shorebirds. The coastline is intermittently interspersed with short sections of mixed sand/shore platforms around the Lake Tyers area. From here to Mallacotta the coastline comprises sandy shoreline, estuaries, and occasional rocky outcrops.

4.4.3.2 Estuaries

More than 20 estuaries lie along the coast, most intermittently open often during springtime flooding. Exceptions include Lake Entrance, Snowy River, Wingan Inlet and Mallacoota which are open all year. Estuaries provide foraging, nesting and roosting sites for colonies of several seabird and shorebird species, including the hooded plover and little tern.

4.4.3.3 Intertidal habitats

The EMBA is dominated by sand as the intertidal substrate. However, intertidal shore platforms are found near Cape Conran, Clinton Rocks, Point Hicks, Petrel Point, Rame Head, Wingan Point, Sandpatch Point and the coastline of Gabo Island.

Intertidal and subtidal rock reefs are likewise dispersed along the coastline, becoming intermittent subtidal features just east of the Snowy River estuary. Rocky reef substrates can be found at numerous locations such as Beware reef, Cape Conran, Point Hicks and Croajingalong Reefs.

4.4.3.4 Offshore islands

The Oil EMBA includes islands off the northeast as well as in the south west off Wilsons Promontory

Gabo Island (154ha) comprising pink granite lies about 500 m off the coast (ParksVic, 2012). The island is home to the largest breeding colony of little penguins in the world at 35,000 individuals (ParksVic, 2012; DEDJTRA, 2017a). Large seabird populations, including short-tailed shearwaters, provide a source of food for raptors such as white-bellied sea-eagles, whistling kites, marsh harriers and brown falcons (ParksVic, 2012). Marine mammals sighted include southern right whales, common dolphins, bottlenose dolphins, and at the rocky platforms – Australian fur seals (~30-50 individuals) and New Zealand fur seals (ParksVic, 2012; DEDJTR, 2017a).

Tullaberga Island comprises a 10-15 m high granitic outcrop about 7 km east of Mallacoota Inlet and 1 km offshore. It is surrounded by a rocky platform, with small areas covered thinly by beach and sand dunes (VRO, 2017). where about 900 breeding penguin nest from May to January. It also provides seabird breeding habitat (DEDJTR, 2017a).

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The Skerries comprise a granite outcrop opposite Wingan Inlet form and part of the Croajingolong National Park. The Skerries are an important breeding habitat for Australian fur seals (~11,500 individuals) and New Zealand fur seals (~300 individuals), with the breeding season being mid-October to late December. It also provides breeding habitat for crested terns (ECC, 2000; DEDJTR, 2017a).

Bass Strait islands are described in section 4.3.3.

4.4.4 Geology and seabed sediments

4.4.4.1 Geology

The Late Jurassic-Cainozoic Gippsland Basin is a large basin on the south-east margin of Australia's continental shelf offshore Victoria. About two thirds of the basin lies offshore in mainly shallow water (<200 m); although in the Bass Canyon in the east, water depths exceed 3,000 m. The basin overlies Palaeozoic metasediments and consists of a central depocentre (the Central Deep) with up to 10 km of section, flanked by the North and South Strzelecki Terraces, in turn flanked by the North and South Platforms. Initial rifting in the Early Cretaceous resulted in a complex system of graben and halfgraben, forming part of the southern rift system between Australia and Antarctica. Volcanogenic and non-marine sediments up to 3,000 m thick were deposited during this phase (Strzelecki Group).

Renewed extension in the Turonian-Campanian, associated with the opening of the Tasman Sea, established the Central Deep as the main depocentre. Coarse grained alluvial and fluvio-lacustrine facies were deposited during this phase (lower Latrobe Group), with minor marine incursions from the late Santonian. Post-rift subsidence was accompanied by alternating marine and non-marine fluviodeltaic/alluvial deposition in the Late Cretaceous-Palaeogene (upper Latrobe Group). Major canyon cutting and subsequent canyon-fill deposition occurred in the Eocene. Cool water marine carbonate sedimentation commenced in the Early Oligocene (Seaspray Group) and progradation of the carbonate shelf continues today. Middle Miocene compression formed a series of north-east to east-north-east trending anticlines that host many of the basin's large oil and gas accumulations.

4.4.4.2 Seabed and sediments

The Gippsland Basin is composed of a series of massive sediment flats, interspersed with small patches of reef, bedrock and consolidated sediment. Sandy plains are only occasionally broken by low ribbons of reef, which formed as shorelines or sand dunes during ice ages when the sea level was lower than today. These reefs do not support the large brown seaweeds characteristic of many Victorian reefs, but instead are covered by resilient red seaweeds and encrusting animals that can survive the sandy environment (Jones & Davies 1983).

The seabed is characterised by a variety of sediment types that are associated with tidal currents and wave energy. Sediments become progressively finer with distance from the shore. Near-shore sediments consist of coarse sands with isolated areas of gravels, shells and pebbles. Sediments can be grouped generally into three megafacies dominated either by quartzose sand (inner shelf and around islands in Bass Strait), relict carbonate particles (mid shelf and near shore islands in Bass Strait) or Holocene biogenic carbonate (inner to outer shelf) (Jones & Davies 1983). Near the 35 to 40 m depth contours, an irregular bed colonised by marine growth occurs.

Video observations of the Bass Strait inshore areas indicate that the seabed consists of symmetrical wave generated sandy ripples, becoming shelly in the troughs as the depth increases (Black et al. 1991). Further offshore, a change to an irregular bed colonised by marine growth occurs near the 35 to 40 m depth contour. This is the depth at which wave orbital velocities generated during storms no longer exceed the threshold velocity for sediment transport. Finer, muddy sands occur further offshore in the midshelf regions. The higher mud component is due to the seaward transport of finer grained sediment from the high energy inner to middle shelf. Unconsolidated sediments of quartzose sand cover the mostly flat seabed of the inner Gippsland Shelf (Jones & Davies 1983; Bax & Williams 2001).

Sedimentation is generally low due to the small supply from rivers and the relatively low productivity of carbonate. Sedimentation rates are estimated at 50 to 160 mm per 100 years. In the north of Bass Strait, material forming the upper slope appears to be terrigenous in origin, comprising sandy silt, clays and mudstone with occasional shelly layers. In the Gippsland Basin, seabed material is predominantly calcium carbonate comprised of calcarenite marls and marine shales. Seaward, the sediments are comprised primarily of sand (92%) and silt/clay (8%) (GEMS 2005).

4.4.4.3 Seabed features relevant to commercial fisheries

Based on a CSIRO and FRDC survey of habitat types and associated fish assemblages relevant to commercial fishing methods (Bax and Williams 2001), the following description of key fishing grounds overlapping the Operational Area is provided:

Danish Seine Grounds – extensive sediment flats in shallow nearshore regions near Lakes Entrance. Depths to 20 m. Low relief patches of harder bottom, typically with a rise of about one metre. The area fished by this sector is described in Section 4.6.5.

South East Reef – a relatively large, isolated reef that rises 10 – 15 m above the surrounding seabed. Its edges are mostly gently shelving. It is the site of three oil rigs (Fortescue A, Halibut and Cobia A) and in a restricted trawl area. South East Reef historically produced large catches of blue warehou but catches declined significantly in the 1990s. Information provided during consultation for the proposed CGG MSS indicates that blue warehou found on the reef are protected from fishing as part of a recovery plan for the species (refer to Section 4.5.6), and that the reef is important for certain commercial fishing operations including the shark gillnet fishery.

Outer-shelf Trawl Grounds – areas of the shelf-break region on the western side of the Bass Canyon, where flat, hard bottom drops sharply away to the continental slope, are or have been important fishing grounds for commercial trawlers. Trawling areas have reportedly been opened up in places off the shelf-edge, although waters deeper than 700 m are closed to this fishery. Although mentioned by Bax and Williams (2001), no concerns or issues have been raised over these outer-shelf trawl grounds during consultation by CGG for the proposed seismic survey (Section 9).

4.5 Biological environment

The Operational Area lies in central and eastern region of Bass Strait. Bass Strait contains high faunal diversity and species endemicity. Possible causes for this high endemism include the long period of isolation in geological time and climatic barriers, a history of variable exposure and immersion during sea level changes in the last few million years, the influence of water masses from the west, north-east and south, and the complexity and high biogenic component of the sediment.

Bass Strait supports a diverse benthic invertebrate fauna as well as a wide variety of vertebrate species such as fish, birds, seals and whales. Bass Strait also contains species of high commercial and conservation value. Species that are listed under the EPBC Act that may occur in the Activity and Oil EMBAs were identified using the online EPBC Act protected matters search tool. The full PMST report is included as Appendix B.

4.5.1 Key Ecological Features

Key Ecological Features (KEFs) in the Commonwealth marine environment are features that, based on current scientific understanding are considered to be of regional importance for either the region’s biodiversity or the ecosystem function and integrity. KEFs identified in the PMST report include:

- Big Horseshoe Canyon
- upwelling East of Eden
- canyons on the eastern continental slope
- shelf rocky reefs.

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Although not identified in the PMST report, the Bass Cascade KEF is listed in the South-East Commonwealth Marine Reserves Network Management Plan 2013-23 (Director of National Parks 2013) and SPRAT (DoEE) as a feature with high biodiversity and productivity that is of major conservation value. As this feature may occur within the Operational Area it is also described below.

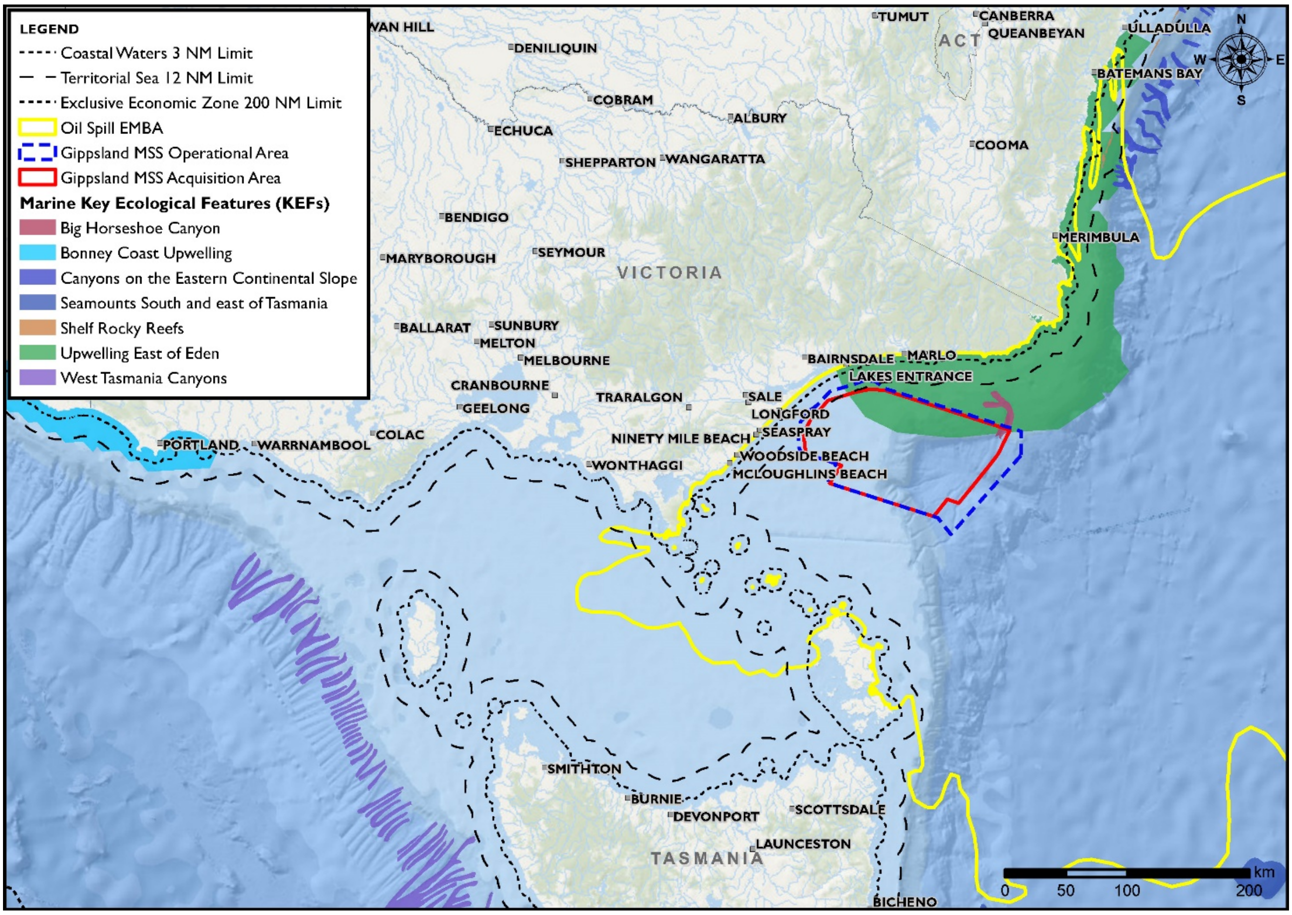

Figure 4.11 Key ecological features within or bordering the Oil EMBA

Big Horseshoe Canyon: The Big Horseshoe Canyon lies outside of the Operational Area but within the Oil EMBA (Figure 4.11). This canyon enters into the Bass Canyon system. It covers an area of approximately 319 km^2 at a depth of approximately 1500 m. Areas of rocky reef are exposed from muddy sediments on the steep slopes and harbour a diverse, abundant, sessile megafauna. Organisms include filter-feeding species, such as dense beds of large sponges and the stalked crinoid *Metacrinus cyaneus*, and numerous species of octocoral (especially gold corals). This site is the type locality for *M. cyaneus* and it is the only known location of the species off south-eastern Australia. Above 600 m, fisheries are important in this area (Hutchinson et al. 2010). The Big Horseshoe Canyon can alter currents creating upwellings and trap rich organic sediments, thereby enhancing local productivity (Kloser and Keith 2010) and supporting higher abundance and/or biomass of benthic organism (Conlan et al. 2015).

Upwelling East of Eden: this feature displays seasonal and annual variation because the mechanisms driving them are various and sporadic (Roughan and Middleton, 2002). It covers approximately one quarter of the north east of Operational Area (roughly 4500 km^2, Figure 4.11). Approximately 9000 km^2 of the Upwelling lies in the Oil EMBA. The boundaries are based on winter seasonal data (1998-2010).

The values of the Eden Upwelling KEF include oceanographic features, nutrients, plankton and predatory fishes. Dynamic eddies of the East Australian Current cause episodic productivity events when they interact with the continental shelf and headlands. The episodic mixing and nutrient enrichment events drive phytoplankton blooms that are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish. The upwelling supports regionally high primary productivity that supports fisheries and biodiversity, including top order predators, marine mammals and seabirds. This area is one of two feeding areas for blue whales and humpback whales, known to arrive when significant krill aggregations form. The area may also be important for seals, other cetaceans, sharks and seabirds (DEE, SPRAT 2018).

Canyons on the eastern continental slope: These canyons provide habitat that supports a diverse range of benthic, demersal and pelagic species. They are a widespread feature along the NSW coastline (DSEWPaC 2012). The canyons overlap with the extremities of the Oil EMBA but their nearest point is located approximately 200 km north of the Operational Area.

Shelf rocky reefs: these generally occur at a depth of 45 m and support a range of complex benthic habitats. These habitats support diverse benthic communities that include a range of temperate and tropical species. They are a widespread feature along the NSW coastline (DSEWPaC 2012). The Shelf rocky reefs overlap with the extremities of the Oil EMBA but their nearest point is located approximately 220 km north of the Operational Area.

Bass Cascade: this is a winter phenomenon resulting from the cascade of relatively warm, saline Bass Strait waters down the steep continental slope of the Bass Canyon. The cascading water has a displacing effect, causing nutrient rich waters to rise which leads to increased primary productivity in the area. As a result, fish and whales are known to aggregated along its leading edge (CoE 2015). Although the Bass Cascade is not spatially defined (CoE 2015), it may occur within the Operational Area. Also refer to Section 4.4.2.3.

4.5.2 Biologically important areas (BIAs)

Biologically Important Areas (BIAs) in the South-East Marine Region are mapped on the National Conservation Values Atlas (NCVA 2014) for protected species under the EPBC Act. BIAs spatially and temporally define areas where protected species display biologically important behaviours (including breeding, foraging, resting or migration). A search of the NCVA identified BIAs that overlapped the Oil EMBA for the following species

- white shark (breeding – nursery area, foraging)
- grey nurse shark (breeding and foraging)
- southern right whale (migration and resting on migration)
- pygmy blue whale (known foraging area)
- humpback whale (migration)
- albatrosses (foraging)
  - Antipodean albatross
  - black-browed albatross
  - Buller’s albatross
  - Indian yellow-nosed albatross
  - wandering albatross
  - Campbell albatross
- albatrosses, shearwaters and petrels (foraging, breeding)
  - shy albatross
  - wedge-tailed shearwater
  - short-tailed shearwater
  - white-faced storm petrel

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- common diving petrel
- little penguin (breeding, foraging).

4.5.3 Habitats

Marine habitats that occur within the Oil EMBA include:

- intertidal rocky shores on steep granite boulders
- subtidal and offshore rocky reefs covered in a range of kelp and other seaweeds
- seagrass meadows
- soft sediment areas.

Seaweeds found on Bass Strait's intertidal rocky shores include Neptune's necklace (*Hormosira banksii*) and the large bull kelp (*Durvillaea antarctica*), which grows on the lower fringe of more exposed rocky shores (O'Hara et al. 1999). Most animals on the intertidal rocky shores are herbivorous molluscs. Filter feeding organisms abound, including tube building worms, sea squirts (cunjevoi), mussels and barnacles. There are no rocky shores within the Operational Area. The closest rocky shores are at Cape Conran, approximately 17 km from the Operational Area. See too Giant Kelp – Section 4.5.1.

Subtidal reefs occur either as extensions of intertidal rocky shores or as isolated offshore reefs. They are scattered throughout Bass Strait waters from the low-water mark to a depth of 100 m. The rocky reefs of southern Australia support a highly endemic marine flora and fauna. Over 1,400 species of algae have been recorded from southern Australia, with 70% endemic to the area (DSE 2009). Typically, the shallow reefs (0 to 20 m) are dominated by kelps or other brown seaweeds. Bubble kelp (*Phyllospora* sp.) and leather kelp (*Ecklonia* sp.) combine to cover many of the exposed reefs. *Sargassum* spp. and *Cystophora* spp. are dominant in more sheltered areas. As described in Section 4.6.3.2 there are also areas of reef in other locations within the Operational Area, notably South East Reef in the central area of this EMBA and the Broken Reef Complex in the east of the EMBA. These areas of hard substrate are expected to hold significant epibenthic communities that have been modified to varying extent by trawling activities (Bax and Williams 2001).

Meadows of seagrasses cover the sea floor in many bays and inlets. Seven seagrass species occur in Victoria and support a diverse marine community (DSE 2009). Seagrass beds typically grow in sheltered waters on silt or sand. The beds bind together unstable sediments and provide substrate, habitat and food sources for many other organisms. Abundant smaller invertebrates, including marine worms (polychaetes), small crustaceans (amphipods, cumaceans and harpacticoids), snails and bivalves (molluscs) shelter in the leafy canopy or in the sediment among the roots. Large areas of seagrass are known to exist at Mallacoota Inlet, Gippsland Lakes and Corner Inlet. In 1965, it was estimated that there were 11,900 ha of Posidonia australis growing in Corner Inlet as well as Zostera and Heterozostera (Morgan 1986).

Beaches and soft substrates form a distinctive group of marine habitats with their own biological communities. The soft substrates in deeper, subtidal waters support some of the most diverse marine communities. A few square metres of sand can contain over 570 species of macroinvertebrates (Heislers & Parry 2007). Soft subtidal sediments commonly support seapens, ascidians, hydroids, bryozoans and large, diverse sponge gardens. The animals within the sediment are predominately marine worms and crustaceans. Subordinate groups include bivalves, brittle stars, holothurians, sea urchins, gastropods, nematodes and nemerteans. Ninety Mile Beach is the closest beach, located 13 km from the Operational Area at its nearest point.

4.5.4 Benthic communities

Benthic communities in Bass Strait within the Oil EMBA are varied and are principally determined by the sea floor habitat. Generalised benthic communities include:

- sessile fauna including sparse small bushy sponges and the occasional large finger sponge in regions of unconsolidated sediments of quartzose sand
- small bryozoans, solitary ascidians and anemones occurring on the flat sandy seabed. Mobile fauna observed in this habitat included hermit crabs and octopus
- infauna including amphipods, callianassid shrimps, bivalves, tubeworms, small crustaceans, nematodes, nemerteans, seapens and polychaetes occur in areas of finer-grained mud habitats. Many of these species are burrowing organisms that cause moderate bioturbation (Edgar 2001)
- large and small sponges, bryozoans, hydroids and ascidians, which prefer stable attachment surfaces, occur on granite outcrops (Underwood et al. 1991; Andrew & O'Neill 2000).

The Museum of Victoria conducted an extensive survey of benthic invertebrates in Bass Strait from 1979 to 1983 (Poore et al. 1985; Wilson & Poore 1987). In general, a highly diverse array of invertebrate groups was found, with several polychaete families, pycnogonids, pericarid crustaceans, opisthobranch molluscs, bryozoans and brachiopods being the most species rich. The main findings included

- high diversity of invertebrate groups in Bass Strait when compared to equivalent areas of the northern hemisphere
- many species are widely distributed across Bass Strait, suggesting heterogeneous sediments and many microhabitats
- crustaceans and polychaetes dominate the infaunal communities, many of which are unknown species.

A periodic upwelling between Lakes Entrance and Gabo Island (Parry et al. 1990) results in coastal waters being about 5 °C colder than adjacent surface waters and may contribute to the distinctiveness of fauna off east Gippsland (LCC 1993). For example, Parry et al. (1990) found high diversity and patchiness of benthos sampled off Lakes Entrance, where 353 species of infauna were recorded. Crustaceans (53%), polychaetes (32%) and molluscs (9%) dominated sample results.

The sea floor of the Gippsland Basin is predominately sandy. Macroalgal communities are not common on subtidal reefs in east Gippsland, possibly due to exposure, poor light levels and abrasion by moving sand.

4.5.5 Marine pests

Introduced marine pests are plants or animals that are not native to Australia and can have a significant impact on human health, fisheries and aquaculture, shipping and ports, tourism, environmental values, biodiversity and ecosystem health. Marine pest incursions also have a large financial impact. Marine pests have been introduced and moved around Australia (translocated) by a variety of human and natural means. Potential modes of transport (vectors) for marine pests include:

- ballast water (water carried by commercial ships to enhance stability, trim and structural integrity)
- biofouling (marine organisms that attach to objects immersed in salt water such as vessels" hulls, ropes, anchors and other equipment)
- aquaculture operations
- aquarium imports
- marine debris
- ocean current movements.

Exotic marine species introduced to Bass Strait and within the oil EMBA include the New Zealand screw shell (*Maoricolpus roseus*), known to form extensive and dense beds on the sandy sea floor in eastern Bass Strait. The screw shell can tolerate depths from 1 to 130 m and has extended its distribution to the continental shelf, including Bass Strait. An unusually high abundance (more than 90% of the total biomass of infauna) of the invasive New Zealand screw shell was recorded by Heislers and Parry (2007) at Point Hicks. In addition, it was found that where this invasive species was most abundant, the diversity of infauna was reduced, suggesting that this exotic species poses a serious threat to much of Bass Strait (Heislers & Parry 2007) and Eden port.

The northern pacific seastar (*Asterias amurensis*) also has the potential to impact Bass Strait. This species is believed to have arrived in Australia in ships' ballast water from Japan more than 20 years ago. The seastar feeds on a wide range of native animals and can have a major effect on the recruitment of native shellfish populations that form important components of the marine food chain. This species is already common in south-east Tasmanian waters and in Port Phillip Bay. However, this species is more likely to remain confined to coastal habitats rather than oceanic environments (intertidal to 200 m depth but usually <25 m depth).

Other known pests in Eden and Port Phillip Bay (include the European fan worm (*Sabella spallanzanii*) which generally prefers sheltered water to 30 m, and the green shore crab (*Carcinus maenas*) which is usually found in bays/estuaries but has been sighted on all types of shores up to 60m. Japanese kelp (*Undaria pinnatifida*) and Asian date mussels (*Musculista senhousia*) both prefers lower intertidal habitat to 20 m depth and are found in Port Philip Bay, as is the European clam (*Varicorbula gibba*) which burrows into soft bottomed habitat intertidal habitats up to 150 m water depth altering food availability of other species. Table 4.2 lists marine pests known to occur in the region of the proposed seismic survey.

Table 4.2 Summary of marine pests known to occur in the Gippsland area

Invasive marine pest	Habitat	Port Philip Bay	Northern Tasmania	Eden
Northern Pacific seastar	Soft sediment but also artificial structures and rocky reefs Estuaries, bays, rock pools Intertidal to 200 m depth (usually <25 m depth)	Yes		No
European fan worm	Tubes attached to hard surfaces, artificial structures, rocks, shells and seagrass on soft sediments Sheltered waters, to 30 m depth	Yes	Yes	Yes
European green shorecrab	Prefers bays/estuaries but found on all types of shores up to 60 m depth Tolerates temperatures up to 30 °C	Yes	Yes	Yes
Japanese kelp/ wakame	Cold temperate ocean waters Lower intertidal to 20 m depth Rock, reef and stones, artificial structures and aquaculture equipment	Yes		No
Asian date mussel/ bag mussel	Prefers soft sediments but also fouls artificial hard surfaces Up to 20 m depth	Yes	Yes	No
European or basket shell clam	Burrows into soft bottomed habitats, may attach to gravel and stones Intertidal to 150 m depth Temperate waters	Yes	Yes	No
New Zealand screw shell	Lying on or partially buried in sand, mud or gravel Also found in crevices Low intertidal and subtidal up to 130 m depth	Yes	Yes	Yes

4.5.6 Fish

Thirty-nine fish species (excluding sharks and rays) are listed under the EPBC Act that may occur in the Oil EMBA (Table 4.3; Appendix B). The majority are listed syngnathids (pipefishes, seahorses, pipehorses and seadragons; described in 4.5.6.3). A number of species may be found inland in freshwater or brackish rivers where the river mouths open up to the coastlines adjacent to the Oil EMBA. The recovery plans (where available) and threats to species have been assessed and where impacts on the species are unlikely, they are omitted from further discussion (such as the Murray cod and galaxias).

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Table 4.3 EPBC Act listed fish (excluding sharks) that may occur in the Oil EMBA

Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Threatened	Migratory		
Prototroctes maraena	Australian grayling	Vulnerable	N/A	No	National Recovery Plan for the Australian Grayling *Prototroctes maraena* (DSE 2008)
Epinephelus daemelii	Black rockcod, black cod, saddled rockcod	Vulnerable	N/A	No	None – Species or species habitat may occur within area
Galaxiella pusilla	Eastern dwarf galaxias, dwarf galaxias	Vulnerable	N/A	No	National Recovery Plan for the Dwarf Galaxias *Galaxiella pusilla* (DoE 2010)
Maccullochella peelii	Murray cod	Vulnerable	N/A	No	National Recovery Plan for the Murray Cod *Maccullochella peelii peelii* (DSE, 2010)
Thymichthys politus	Red handfish	Critically Endangered	N/A	Yes	Recovery Plan for Three Handfish Species (DoE 2015)
Acentronura tentaculata	Shortpouch pygmy pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Cosmocampus howensis	Lord Howe pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Heraldia nocturna	Eastern upside-down pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Hippocampus abdominalis	Big-belly seahorse, eastern potbelly seahorse, New Zealand potbelly seahorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Hippocampus breviceps	Short-head seahorse, short-snouted seahorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Hippocampus minotaur	Bullneck seahorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Hippocampus whitei	White's seahorse, crowned seahorse, Sydney seahorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Histiogamphelus briggsii	Crested pipefish, Briggs' crested pipefish, Briggs' pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Histiogamphelus cristatus	Rhino pipefish, Macleay's crested pipefish, ring-back pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Hypselognathus rostratus	Knifesnout pipefish, knife-snouted pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Kaupus costatus	Deepbody pipefish, deep-bodied pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Kimblaeus bassensis	Trawl pipefish, Bass Strait pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Leptoichthys fistularius	Brushtail pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area

Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Threatened	Migratory		
Lissocampus caudalis	Australian smooth pipefish, smooth pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Lissocampus runa	Javelin pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Maroubra perserrata	Sawtooth pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Mitotichthys mollisoni	Mollison's pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Mitotichthys semistriatus	Halfbanded pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Mitotichthys tuckeri	Tucker's pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Notiocampus ruber	Red pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Phycodurus eques	Leafy seadragon	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Phyllopteryx taeniolatus	Common seadragon, weedy seadragon	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Pugnaso curtirostris	Pugnose pipefish, pug-nosed pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Solegnathus robustus	Robust pipehorse, robust spiny pipehorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Solegnathus spinosissimus	Australian spiny pipehorse	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Solegnathus cyanopterus	Robust ghostpipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Stigmatopora argus	Spotted pipefish, gulf pipefish, peacock pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Stigmatopora nigra	Widebody pipefish, wide-bodied pipefish, black pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Stipecampus cristatus	Ringback pipefish, ring-backed pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Syngnathoides biaculeatus	Double-end pipehorse, double-ended pipehorse, alligator pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Urocampus carinirostris	Hairy pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Vanacampus margaritifer	Mother-of-pearl pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Vanacampus phillipi	Port Phillip pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area
Vanacampus poecilolaemus	Longsnout pipefish, Australian long-snout pipefish	N/A	N/A	Yes	N/A – Species or species habitat may occur within area

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4.5.6.1 Sharks and rays

There are five shark and one ray species that may occur in the Oil EMBA that were identified in the PMST (Table 4.4; Appendix B). All are listed as Migratory except the grey nurse. The great white shark and the whale shark are also listed as Vulnerable. The grey nurse is listed as Critically Endangered. Although not reported in the PMST, the school shark (*Galeorhinus galeus*) is listed under the EPBC Act as Conservation Dependent.

Table 4.4 EPBC Act listed sharks that may occur in the Oil EMBA

Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Threatened	Migratory		
Carcharodon carcharias	Great white shark	Vulnerable	Yes	Yes	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC 2013)
Isurus oxyrinchus	Shortfin mako shark	N/A	Yes	No	N/A
Carcharias taurus	Grey nurse shark	Critically Endangered	No	Yes	Recovery Plan for the Grey Nurse Shark (*Carcharias Taurus*) (DSE 2014)
Rhincodon typus	Whale shark	Vulnerable	Yes	No	[Whale Shark (*Rhincodon typus*) Recovery Plan 2005-2010]
Lamna nasus	Porbeagle	N/A	Yes	No	N/A
Manta birostris	Giant manta ray	N/A	Yes	No	N/A

The great white shark *Carcharodon carcharias* is normally found in inshore waters around areas of rocky reefs and seal colonies. Juveniles are found in coastal regions in the Corner Inlet to Ninety Mile Beach area, which is considered a “shark nursery area” (Bruce & Bradford 2012) and is likely to be frequented between the months of December and June (Holliday 2003). White sharks are highly vulnerable to overexploitation and increases in natural mortality, particularly given their low fecundity and rates of population increase (Holliday 2003). The key threats are from fishing (including as bycatch) and shark control activities (Bruce & Bradford 2012). The National Conservation Values Atlas (NCVA) search for Biologically Important Areas (BIAs) for white sharks is shown in Figure 4.12. The nursery area is considered critical habitat under the Recovery Plan for the White Shark (DSEWPaC 2013). The key threats to white sharks listed by DSEWPaC (2013) include:

- mortality related to being caught accidentally (bycatch) or illegally (targeted) by commercial and recreational fisheries, including issues of post-release mortality
- mortality related to shark control activities such as beach meshing or drum lining (east coast population).

Other potential threats to the species include the impacts of illegal trade in white shark products; ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents and acidification); and ecotourism, including cage diving. Note that underwater noise is not listed as a threatening process for white sharks (DSEWPaC 2013). It is likely that the white shark would occur in the Operational Area during the Gippsland MSS.

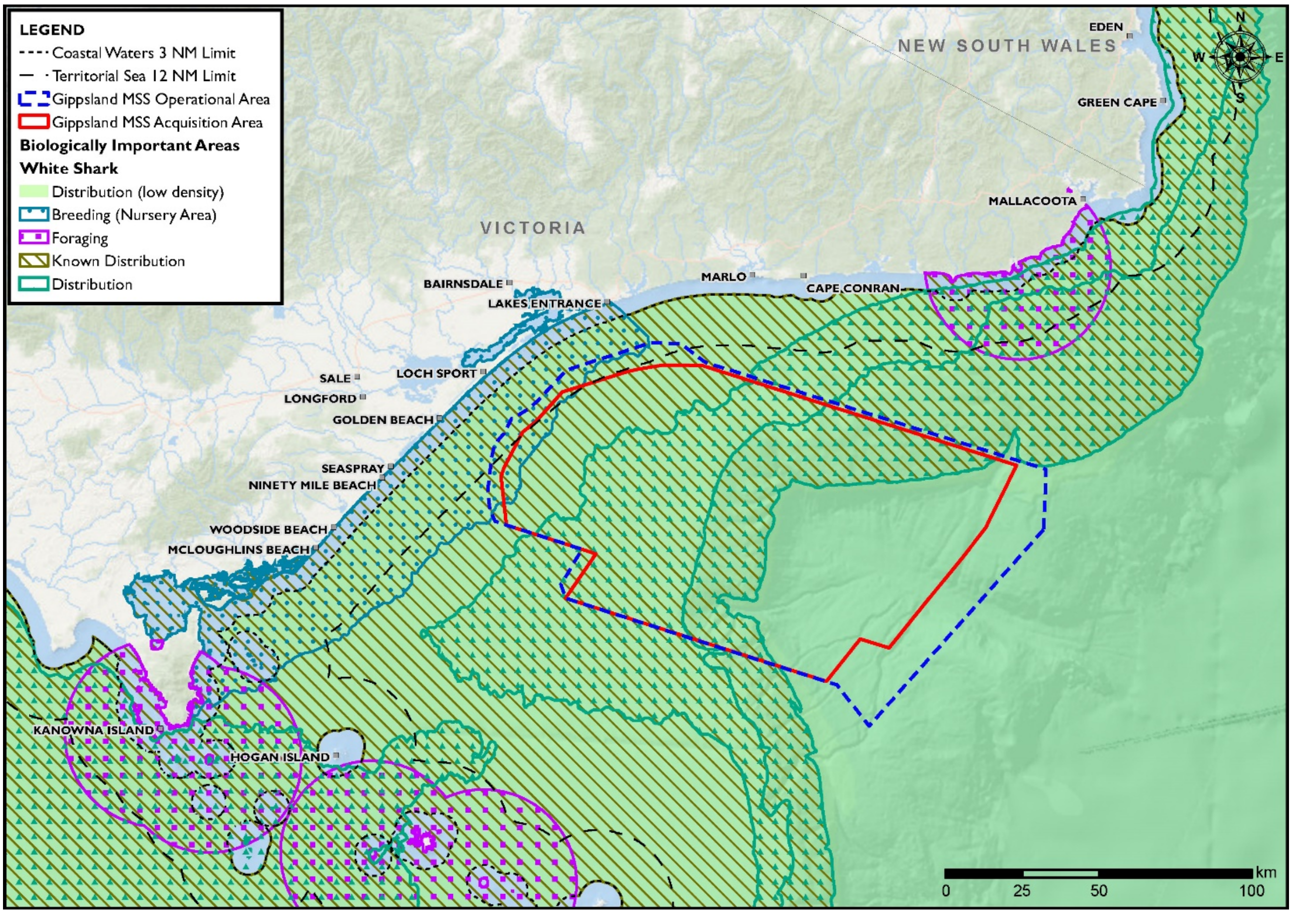

Figure 4.12 Great white sharks biologically important area – foraging, distribution and breeding

Whale sharks (Rhincodon typus) are generally found in warmer oceanic waters where temperatures range from 21 to 25 °C. They therefore mainly occur in waters off the Northern Territory, Queensland and northern Western Australia. However, there have been a few isolated reports of immature male whale sharks from the south-eastern coast of New South Wales through to South Australia and the western fringe of the Great Australian Bight (Last & Stevens 1994). Critical habitats identified in the Whale Shark Recovery Plan 2005-2010 (DEH 2005a) are the known seasonal aggregation sites, which are believed to be linked to local seasonal food availability. In Australia, whale sharks are known to aggregate at Ningaloo Reef and in the Coral Sea. No known seasonal whale shark aggregation sites are located within or adjacent to the Oil EMBA. It is considered unlikely that whale sharks would occur other than occasional individuals in the Oil EMBA.

The shortfin mako (*Isurus oxyrinchus*) is an oceanic species and is known to occur in both tropical and temperate waters. It is normally oceanic and cosmopolitan in its distribution and is widespread in Australian waters, occurring from the surface to water depths of at least 500 m. It is occasionally found close inshore where the continental shelf is narrow. It is not normally found in waters below 16 °C (Cailliet et al. 2009). The Southern Shark Ecology Group from SARDI Aquatic Sciences in South Australia tagged several shortfin makos offshore from Lakes Entrance. It is possible that they may occur within the Oil EMBA.

The porbeagle shark occurs primarily in temperate waters, mostly occurring in waters of the outer continental shelf. However, it has been recorded from both coastal areas and in deep water over 1,000 m. It is possible that they may occur within the Oil EMBA.

The grey nurse shark (*Carcharias Taurus*) listed as Critically Endangered under the EPBC Act is threatened largely by fishing, shark control activities, ecotourism and finning (DoE, 2014). Results of the NVCA search for grey nurse shark show a BIA along the New South Wales coast almost to the border with Victoria and is shown in Figure 4.13. This BIA overlaps the Oil EMBA where it extends into nearshore waters along the New South Wales coast. The BIA for grey nurse sharks is considered particularly important for breeding and foraging (DoE, 2014). Waters where they may occur lie east of Marlo from Sydenham Inlet up into NSW and Queensland hence some areas may fall within the Oil EMBA. Focus actions listed under the recovery plan relevant to the CGG Gippsland MSS are pollution and climate change (changes in sea temperature and ocean acidification).

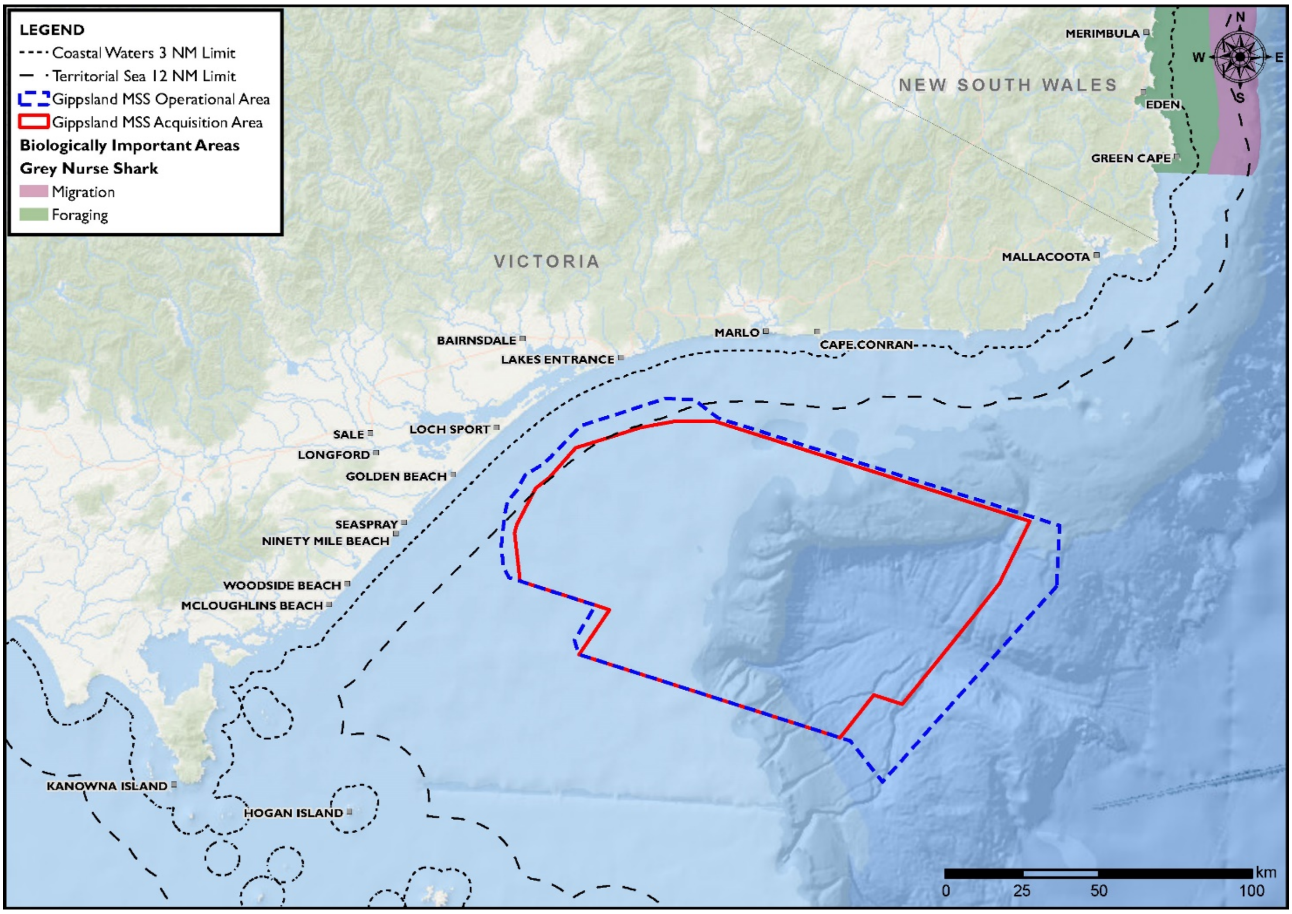

Figure 4.13 Grey nurse shark BIA

The giant manta ray (*Manta birostris*) has a circumglobal distribution in tropical and temperate waters. It appears to be a seasonal visitor to coastal and offshore sites. It may aggregate in large numbers to feed, mate or clean. There is little information available on the ecology of this species (http://www.iucnredlist.org/details/198921/0 accessed 27 Aug 2018).

The school shark (*Galeorhinus galeus*) is listed under the EPBC Act as Conservation Dependent. They are widely distributed, primarily between southern NSW and southern WA. It is a demersal species found mainly on continental and insular shelves, and occasionally in deeper offshore areas (Last & Stevens 2009). They form small groups, often of the same sex (Last & Stevens 2009) and undertake extensive mating migrations (McLoughlin 2007). Pupping occurs, after a gestation period of 12 months, between December and January in sheltered bays, including Port Phillip Bay, Western Port Bay and Corner Inlet, and the south-east coast of Tasmania (http://www.afma.gov.au/portfolio-item/school-shark/ accessed 23 Aug 2018). This preferred birthing habitat makes this species vulnerable to predation, fishing, habitat destruction and pollution. No impacts on the birthing habitat in Corner Inlet is anticipated from planned activities but isolated areas may fall within the Oil EMBA.

4.5.6.2 Australian grayling

The Australian Grayling (*Prototroctes maraena* is listed as 'vulnerable' under the EPBC Act. The species is diadromous, migrating between rivers, estuaries and coastal seas. It is endemic to south-eastern Australia, the key threats identified in the National Recovery Plan (Backhouse et al. 2008) include barriers to movement (e.g. weirs, dams), river regulation, poor water quality and siltation in catchments, introduced freshwater fish, climate change, disease and fishing (DotE 2013a). Spawning occurs in freshwater from late summer to winter. Newly-hatched larvae drift downstream and out to sea, where they remain for approximately six to ten months. Juveniles then return to the freshwater environment (around November of their first year), where they remain for the remainder of their lives (Backhouse et al. 2008; Berra 1982).

Given the wide distribution and range of habitats used by the species throughout its life, the National Recovery Plan for the Australian Grayling (Backhouse et al. 2008) does not specify habitat that is critical to survival but some habitats such as spawning, refuge and juvenile habitats are likely to be limited in distribution, Proposed recovery actions include identification of habitats used at critical stages of the grayling's life cycle (Backhouse et al. 2008).

Adults are unlikely to be encountered within the Operational Area but may larval and juveniles may occur in the shallows of the Oil EMBA.

4.5.6.3 Syngnathids

The PMST report (Appendix B) identified 27 species of syngnathids (Family Syngnathidae) that may be found in the Oil EMBA; 21 pipefishes, two seahorses, two pipehorses and the two known species of seadragons. Syngnathids are found in temperate and tropical seas across the world. Limited information has been published on syngnathids as they are generally well-camouflaged. Most species inhabit shallow, sheltered coastal waters where they typically are associated with seagrass meadows, macroalgal habitats, rocky reefs and sponge gardens located in shallow, inshore waters (e.g., protected coastal bays, harbours and jetties) less than 50 m deep (Bray 2017) Edgar 1997), but usually at depths of between 5 and 25 m (Kuiter 2000). It is possible that some Syngnathid species will occur in shallow waters of the Oil EMBA (e.g in seagrasses of Corner Inlet, or Mallacoota) but most of the Operational Area is too deep (more than roughly 95% of the Acquisition Area is deeper than 50m). None were listed as Endangered or Vulnerable and all had extensive habitats outside the Operational Area.

4.5.6.4 Commercial finfish and shark

The Operational Area is appropriate for identifying relevant commercial fish species because it defines the area in which fisheries will be physically impacted and where seismic sound will have most impact on fish (Sections 6.1 and 6.3). It is possible that the latter may extend a short distance (~ 500 m) in a NE and SW direction beyond the Operational Area, but this will not influence the list of relevant fish species. A list of commercially important finfish species likely to be captured by fisheries within the Operational Area is provided below in Table 4.11. Description of the biology and ecology of these species as well as others identified from stakeholder feedback is provided below.

Blue grenadier (*Macruronus novaezelandiae*) is a deep water species inhabiting continental slopes. The species can be found at depths of 200-700 m with juveniles occurring in shallower bays and inlets compared to adults. Blue grenadier aggregate near the sea bed during the day and move into the water column at night to forage. Spawning occurs in winter and early spring with the main spawning ground for the species located on the west coast of Tasmania. Adults are found on the continental slope in depths of 200-700 m.

Blue-eye trevalla (*Hyperoglyphe antarctica*, *Schedophilus labyrinthica*) is a benthic species inhabiting rocky ground and continental slopes. *H. antarctica* are generally found at depths of 200-900 m, whereas *S.labyrinthica* are usually found at depths of 40-500 m and are mostly associated with seamounts. *H. antarctica* generally remain close to the sea bed during the day and move up into the water column at night to forage. Spawning occurs in summer and autumn. Blue-eyed trevalla is a deep water fish that is often found in continental shelf and upper slope waters from 100-600 m and on seamounts and undersea features.

Blue warehou (*Seriolella brama*) is a bentho-pelagic species that inhabits continental shelf and slope waters. Adults are found at depths form 50-300 m. The species reach reproductive maturity at three years of age. Spawning occurs during winter and early spring, with primary spawning grounds off western Victoria and Tasmania. Females spawn approximately 3 times a spawning season. Blue warehou generally aggregate in schools close to the sea bed, with some juvenile groups found schooling near the surface in estuaries. Blue warehou are subject to a stock rebuilding strategy and currently cannot be targeted by commercial fishers (https://www.afma.gov.au/sites/g/files/net5531/f/uploads/2014/12/Blue-Warehou-Rebuilding-Strategy-2014.pdf). South East Reef historically produced large catches of blue warehou but catches declined significantly in the 1990s (Bax and Williams 2001).

Eastern school whiting (*Sillago flindersi*) is a benthic species that inhabits shallow tidal flats and other sandy habitats down to depths of 180 m (juveniles tend to be found in shallower waters than adults). Usually associated with sandy substrates. Sexual maturity is reached at about two years. Spawning varies considerably between regions, occurring from October to March in eastern Bass Strait and during winter in northern NSW. Eastern school whiting are found from southern QLD to Tasmania and South Australia (http://www.afma.gov.au/portfolio-item/eastern-school-whiting/ accessed 23 Aug 2018).

Elephant fish (*Callorhinchus milli*) is a demersal species that are often found in shallow bays and large estuaries, but also to depths of 200 m on the continental shelf. Juveniles inhabit shallow coastal waters for about three years and gradually move into deeper water as they mature. Elephant fish are oviparous (lay eggs). Adults aggregate in February to spawn, with eggs deposited in pairs over several weeks in sand or mud near river mouths and estuaries.

Gummy shark (*Mustelus antarcticus*) is a demersal species that inhabits the continental shelf from the near shore region to depths of 350 m. Newborn and juvenile gummy sharks aggregate in many areas across southern Australia, while young and adult sharks are more widely distributed. Gummy sharks are born during the summer months after an 11-12 month gestation period. Gummy sharks are generally fished in waters to a depth of 80 m however can be found as deep as 350 m.

King George whiting (*Sillaginodes punctatus*) is a benthic species found in bays, estuaries and inshore coastal areas throughout Victoria. Juveniles are abundant in shallow seagrass beds whereas adults are common on open sandy areas with seagrass and reef habitat. The species is considered one biological stock extending from Victoria into south eastern South Australian waters, although separate genetic stocks occur in each state.

Jackass morwong (*Nemadactylus macropterus*) is a temperate demersal species that inhabits the continental slope and upper slope (AFMA 2018a). The species is generally found at depths of 10-400 m with juveniles inhabiting shallow reefs. Spawning occurs multiple times form late summer to autumn, with females producing 0.1-1 million eggs per spawning season depending on their body size (AFMA 2018a).

John dory (*Zeus faber*) is a demersal species inhabiting sea bed environments close to coastal and continental shelf waters (AFMA 2018b). The species is associated with a variety of habitats including open sand, muddy grounds, rock structures and reefs, to depths of 200 m (AFMA 2018b). The species is known to spawn off the NSW coast in late summer and autumn, spawning multiple times during the spawning season.

Mirror dory (*Zenopsis nebulosa*) is a demersal species found close to the sea bed in coastal and continental shelf waters. Mirror dory are found at depths between 50-600 m (AFMA 2018c). Spawning occurs over an extended period in winter, with the species aggregating in waters along the NSW upper slope to spawn (AFMA 2018c).

Ocean perch (*Helicolenus barathri*, and *H. percoides*) are benthopelagic species that inhabits flat, hard seabeds on the continental shelf and upper slope (AFMA 2018d). Inshore ocean perch (*H. percoides*) is often found at depths of 80-350m, and offshore perch *(H. barathri*) is often found at depths of 250-350 m. Spawning occurs over an extended period from winter to early summer. Spawning is distinctive to the species in that fertilisation and larval development is internal (AFMA 2018d).

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Pink ling (*Genypterus blacodes*) is a demersal species inhabiting continental shelfs and slopes. The species can be found at depths of 20-1000 m. Juveniles tend to inhabit shallower waters than adult pink ling. The species occurs over a variety of different substrates, from rock grounds to soft sand and mud in which they burrow. Pink ling are relatively sedentary aside from movements regarding spawning. Spawning occurs over an extended period of time during late winter and spring.

Ribaldo (*Mora moro*) is a temperate deep water species that inhabit the continental shelf. The species can be found near the sea floor at depths of 450-2500 m, appearing most commonly at 500-1000 m (AFMA 2018e). The species is associated with sea mounts and rough sea beds. Juveniles are thought to be pelagic. Spawning for the species occurs in winter and early spring. The species is not thought to form large spawning aggregations (AFMA 2018e).

Saw shark (*Pristiophorus cirratus*. *P. nudipinnis, P. Peroniensis*) are common demersal species inhabiting continental shelfs and upper slopes. They can be found at depths up to 630 m depending on the species (AFMA 2018f). Sawsharks are occasionally found in large schools or feeding aggregations. Adults are generally found in deeper waters than juveniles. Sawsharks are aplacental viviparous. Young are born during winter in shallow coastal areas after a 12 month gestation period (AFMA 2018f).

School shark (*Galeorhinus galeus*) is captured incidentally by several fisheries. However this species is classified as Vulnerable by the IUCN Red List of Threatened Species and listed as Conservation Dependent under the EPBC Act and are managed under AFMA's School Shark Rebuilding Strategy (http://www.afma.gov.au/portfolio-item/school-shark/ accessed 23 Aug 2018). Refer to Section 4.7.6.1 for further details.

Silver trevally (*Pseudocaranx gergianus*) is a schooling species that inhabit estuarine and coastal waters, at depths of 10-230m (AFMA 2018g). Adult trevally inhabit inshore reefs and occur over grounds of sand or gravel, or in large bays and inlets. Juveniles usually inhabit estuaries, bays and shallow continental shelf waters. Older fish sometimes school near the surface in deeper waters over the continental shelf, which may be associated with spawning (AFMA 2018g). Spawning occurs over an extended period from spring to autumn, in both estuaries and deeper waters. Silver trevally are serial spawners with multiple batches of eggs being released over the spawning season.

Silver warehou (*Seriolella punctate*) is a bottom swelling species that occurs on the continental shelf and slope. They can be found at depths of 50-600 m (AFMA 2018h). Adults are usually demersal, with juveniles occurring offshore. Older juveniles move inshore and are often found in bays and inlets. Once mature, fish move out into deeper water (AFMA 2018h). The species aggregate to feed and spawn. Spawning occurs in late winter-early spring, with some variation in timing depending on location.

Snapper (*Pagrus auratus* / *Chrysophrys auratus*) is a widespread species ranging from marine to estuary environments. Individuals inhabit waters from 0-200m in depth (Hamer & Conron 2016). Juveniles inhabit inlets, bays and other shallow sheltered marine waters, often over mud and seagrass. Smaller individuals are common in inshore areas around reefs, adults venture into deeper waters near reefs, however remain over mud and sand substrates (Hamer & Conron 2016). Spawning generally occurs when water temperatures reach 18oC. The spawning season occurs from late spring to summer, with a common peak in December and January, through to late February. Adults move into bays, where spawning occurs in aggregations, and return to coastal waters in late summer/autumn. (Hamer & Conron 2016). Snapper stocks in Victorian waters are divided into two biological stocks: the eastern and western stocks. In eastern Victoria, except for Corner Inlet-Nooramunga, adult snappers are predominantly in coastal waters with juveniles dominant in estuaries (https://vfa.vic.gov.au/operational-policy/publications-and-resources/status-of-victorian-fisheries/snapper accessed 21 August 2018). Snapper spawn during summer in Victoria, which is similar to the November to January spawning pattern of snapper in South Australia. Port Phillip Bay is an important spawning area for snapper, however the extent of spawning in coastal waters is uncertain (Coutin et al, 2003).

Southern bluefin tuna (SBT, *Thunnus maccoyii*) is a large pelagic fish species that occurs throughout the southern hemisphere in waters between 30° S and 50° S, but is mainly found in the eastern Indian Ocean and in the south-western Pacific Ocean (TSSC 2010). SBT constitutes a single, highly migratory biological stock that spawn in the north-east Indian Ocean from September to April and migrates throughout the temperate southern oceans, supporting a number of international fisheries (Ellis & Kiessling 2016; Honda et al. 2010). SBT feed rapaciously in the epipelagic layers of oceans, opportunistically targeting fish, crustaceans, cephalopods, salps and other marine animals (Ellis and Kiessling 2016). Adults migrate south around Tasmania towards the end of spring/beginning of summer, moving across the south of Australia and then north along the western coastline of Australia to the spawning ground in the north-east Indian Ocean (Rogers et al. 2013).

Tiger flathead (*Neoplatycephalus richardsoni*) is a demersal species found at depths of 10-400 m (Rowling 1994). Juveniles inhabit shallower waters and move into the deeper outer shelf zone as they reach maturity. The species generally rests in areas of mud and sand on the sea bed during the day, moving into the deeper water column at night to feed. There is evidence that mature fish migrate to shallower waters prior to spawning. Spawning occurs over an extended period from spring to autumn, with some variation on the time of spawning depending on the location (Rowling 1994; http://www.afma.gov.au/portfolio-item/tiger-flathead/ accessed 17 Aug 2018).

4.5.6.5 Fish spawning

The commercially important fish species that occur within the Oil EMBA are largely broadcast spawners (i.e. species that release vast numbers of sperm and eggs into the water column, or in some cases scatter them on the substratum), with several species forming spawning aggregations on the continental shelf, shelf break and slope. The commercially important crustacean species fished in the vicinity of the Acquisition Area (eg southern rock lobster) also spawn eggs but hold them under their abdomen where they incubate until hatching. Spawning species may aggregate at locations and spawn all their eggs and sperm at a specific time within a certain period (e.g. on a lunar cycle for blue grenadier), batch spawn across a region multiple times during certain seasons (e.g. pink ling) or spawn continuously throughout the year (e.g. Gould's squid). Significant spawning aggregation areas are not known to occur in the vicinity of the Acquisition Area, although information regarding fish spawning is generally not well documented.

Consultation (Section 9) identified concerns over potential impacts to commercially important species spawning. Spawning periods for key species of Commonwealth and state-managed fisheries with a jurisdictional area that includes the Acquisition Area are shown in Table 4.5 and Table 4.6. Note that these tables do not include information for species that do not spawn within the south-east marine region (eg tuna, billfish, gemfish west, John dory and mirror dory) or during the proposed survey window (eg sawshark and ribaldo)

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ATable 4.5 Spawning summary for species targeted by relevant Commonwealth managed fisheries

Fishery	Key species	Depth range (m)*	Spawning period⁺ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Main source	Additional information
Southern and Eastern Scalefish and Shark Fishery (SESSF)	SESSF – Commonwealth Trawl Sector															
	Blue grenadier	0–1000						■	■	■	■				AFMA website	Spawn once during the spawning period. The main spawning areas are located off the central west coast of TAS
	Tiger flathead	10–400	■	■										■	AFMA website	Mature fish migrate to shallow continental shelf waters prior to the spawning period (AFMA 2017). Eggs and larvae are thought to be pelagic (Rowling 1994).
	Silver warehou	27–650							■	■	■	■			Kailola et al. (1993)	Form spawning aggregations close to the sea bed and spawn once during the spawning period (AFMA 2017). Major spawning areas are located off the west coast of mainland TAS and southern NSW (CSIRO 2002).
	Pink ling	40–700 (CSIRO 2002)			■	■	■	■	■	■	■	■			Kailola et al. (1993)	Spawn multiple times over an extended period. Move into shallower continental shelf waters prior to spawning with aggregations reported from the eastern Bass Strait, off the west coast of TAS and southern NSW (CSIRO 2002).
	Blue Warehou	50 – 300						■	■	■	■				AFMA website	Main spawning ground is off western Victoria and Tasmania. On average females spawn around three times per season.
	Eastern School Whiting		■	■	■							■	■	■	AFMA website	Spawning period varies between regions but in eastern Bass Strait occurs from October to March. Females spawn twice each year in deeper waters.
	SESSF – Gillnet, Hook and Trap Sector															

Fishery	Key species	Depth range (m)*	Spawning period+ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Main source	Additional information
	Blue-eye trevalla	40–1500													Kailola et al. (1993)	Move into shallower depths (320–400 m) and form spawning aggregations over rough ground and drop-offs on the continental slope, as well as over seamounts. Spawning is widespread across the South-east Marine Region (CSIRO 2002) although most spawning activity occurs in waters from central NSW to north-eastern TAS (AFMA 2017).
	Gummy shark	80 – 350													AFMA website	Pups are born during summer months after an 11-12 m gestation period
	Elephant fish	0 – 200													AFMA website	Adults aggregate to spawn in February, with eggs deposited in pairs over several weeks in sand or mud near river months and estuaries
	School shark	0 – 550													AFMA website	Pups are born in early summer after a 12 m gestation period. Birth occurs in shallow bays and estuaries
	Pink ling	See above	See above												See above	See above
Southern Squid Jig Fishery	Gould's squid	0–700													AFMA website	Spawn continuously throughout the year with 2 -3 peaks in spawning activity. Reproduction is highly variable depending on environmental conditions. Eggs are released in a free-floating jelly-like mass. Hatching occurs 1-2 m after fertilisation. Adults dies shortly after spawning (http://www.afma.gov.au/portfolio-item/goulds-squid/ accessed 21 Aug 2018).

+ Dark blue cells indicate spawning period
* Species depth ranges sourced from www.fishbase.org (Forese & Pauly 2018), unless otherwise stated.

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Table 4.6 Spawning summary for species targeted by relevant state managed fisheries

Key species	Depth range (m)*	Spawning period+ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Main source	Additional information
Southern rock lobster	<150						Spawning	Spawning	Spawning	Hatching	Hatching	Hatching		VFA (2018)	Following mating in late-summer and autumn, females spawn eggs and hold them below the abdomen until they hatch. The larval stages spend from 9–24 months at sea (the longest known for any marine organism) and become widely distributed before metamorphosing to post-larval puerulus, which swim towards the coast and settle.
Australasian snapper	0–200													Coutin et al. (2003)	Spawning generally occurs in waters less than 50 m deep (Kailola et al. 1993). Within Victorian waters spawning predominantly occurs in Port Phillip Bay, and the extent of spawning in coastal waters is uncertain. Snapper larvae remain inshore in shallow waters.
King George whiting	2–200													FRDC website Jenkins et al. (2016)	Spawning aggregations form around reefs on continental shelf waters up to a depth of 50 m.(Jenkins, Black & Hamer 2000) Larvae are planktonic for 120 days and move inshore to sheltered bays and estuaries.
Commercial scallop	0–120													Kailola et. al (1993) VFA (2017)	Spawning is thought to be initiated by a sudden rise in water temperature, with peaks in spawning activity varying between locations. In Victorian waters spawning occurs from August to November. Scallops are broadcast spawners and larval scallops drift as plankton for up to six weeks before settling.
Pale Octopus Maori octopus	7–725													Leporati et al. (2008)	In Tasmanian waters both species appear to spawn all year round with peaks in late summer and early autumn for pale octopus. Produce large eggs that are attached to the seabed.

+ Dark blue cells indicate spawning period
* Species depth ranges sourced from www.fishbase.org (Forese & Pauly 2018), unless otherwise stated.

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4.5.7 Commercially important invertebrates

Invertebrate diversity is high in southern Australian waters although distributions of species are patchy. Marine invertebrates in the region include porifera (sponges), cnidarians (jellyfish and octocorals), bryozoans (microscopic filter feeders), arthropods (sea spiders), crustaceans (rock lobster, giant crab), molluscs (scallops, sea slugs and squid), echinoderms (urchins, sea cucumbers) and annelids (polychaete worms).

Large species of crustacea, such as rock lobsters are significant commercial species in southern Australia waters. Molluscs such as scallops and abalone are also commercially important species residing in the cooler waters off the Victorian coastline. Many of these key commercial species exist on the shelf edge with biological restrictions confining them to depths of approximately 200 m.

4.5.7.1 Southern rock lobster

Southern rock lobsters (*Jasus edwardsii*) are distributed around southern Australia, however the majority of the population is found in the south eastern states of South Australia, Victoria and Tasmania where the species occur in depths from 1 to 200 m (Linnane, Penny & Ward 2008). Southern rock lobsters have a life span of over 20 years. The species reaches sexual maturity when the length of the carapace is between 59-122 mm, however this does depend on the region (FRDC 2015). Southern rock lobster generally inhabit bryozoan or aeolianite limestone reefs but can also be found in outcrops of igneous rocks such as granite (Linnane, Penny & Ward 2008).

Southern rock lobster is considered a single biological stock across southern Australia because the species occurs in a continuous distribution across this range and has extensive and protracted pelagic larval dispersal phase (FRDC 2015). Larval release occurs across the southern continental shelf, facilitating dispersal through the high currents of the area. Oceanographic modelling has indicated that the southern rock lobster larval dispersal occurs over large spatial scales, indicating that there is a single biological stock. This is further confirmed through genetic analysis of the species. Southern rock lobster mate from April to July and after mating the fertilised eggs are carried under the tail of the female for approximately three months before being released, typically between September and November (PIRSA 2017; https://vfa.vic.gov.au/commercial-fishing/rock-lobster/fishery-overview#fishery, accessed 26 July 2018). After hatching the larvae pass through a brief (10-14 day) nauplius phase into a planktonic, leaf-like phase called phyllosoma, which can be broadly distributed to 60 m and hundreds of kilometres offshore (Booth and Stewart 1992 in PIRSA 2013). Phyllosoma develop through a series of 11 stages over 12 – 23 months before metamorphosing in a puerulus (settlement) stage near the continental shelf break (PIRSA 2013). The puerulus actively swims inshore to settle onto reef habitat in depths from 50 m to the intertidal zone (PIRSA 2013).

4.5.7.2 Gould’s squid

Gould’s Squid (*Nototodarus gouldi*) inhabits temperate and subtropical waters of Australia and New Zealand. The species can be found in estuaries and pelagic environments to the depths of 825 m, however, it is most abundant over the continental shelf between depths of 50-200 m (AFMA n.d.). Genetic studies support the hypothesis of a single biological stock of Gould’s squid throughout south-eastern Australian Waters (FRDC 2016b). The genetic homogeneity of the species is suspected to be a function of egg mass and juvenile drift resulting from seasonal longitudinal ocean currents (FRDC 2016b). No formal stock assessment is available due to the short lifespan (less than 1 year) of the individuals (FRDC 2016b). Gould’s squid can grow up to a length of 40 cm and 1.6 kg, however, they are most commonly found at 0.7kg in weight (AFMA n.d.). Larvae and juveniles are often found in shallow coastal waters (AFMA n.d.). The species aggregate near the sea bed during the day and move into the water column at night to feed (AFMA n.d.). Gould’s squid reach reproductive maturity at an age of 6-9 months. The species spawn throughout the year with 2-3 peaks in spawning activity and die shortly after spawning (AFMA n.d.).

4.5.7.3 Commercial scallop

Commercial scallops (*Pecten fumatus*) are also known as the Southern scallop, Tasmanian scallop and king scallop. They have thin, equal-sized, circular shaped shells with about 15 radiating ribs. The lower valve (shell) is paler and more curved than the upper valve. The shell can be covered with irregular brownish patterning. Shell height can be up to 14.5 cm but commonly found at 8 9 cm in shell height. Growth rates vary depending on location. Life span is up to 10 years, but usually less than 7 years. Wild populations have been known to die off rapidly after only 3 5 years.

Typically commercial scallops are found buried in soft sediment ranging from mud to coarse sand. Scallops aggregate into beds and bury themselves so that only the top shell is visible. The orientation of scallop beds may be influenced by tidal currents. Commercial scallops are mainly found at depths of 10-20 m but may also occur down to 120 m. While mainly sedentary, scallops can swim by rapidly opening and closing their shells, usually when disturbed by predators (http://www.afma.gov.au/portfolio-item/commercial-scallop/ accessed 17 Aug 2018).

Commercial scallops feed on plankton and detritus while their predators include starfish, whelks and octopus. Individuals reach reproductive maturity after one year, but do not spawn until the second year. Spawning is thought to be triggered by a sudden increase in water temperature. Spawning occurs over an extended period during winter and spring. Commercial scallops are hermaphrodites and ‘broadcast spawners’ that release gametes into the water. There is a delay between the release of eggs and sperm to prevent self-fertilisation. Fecundity increases with shell size and age. An individual can produce up to one million eggs during spawning (http://www.afma.gov.au/portfolio-item/commercial-scallop/ accessed 17 Aug 2018).

4.5.7.4 Octopus

Three species of octopus are distributed in temperate waters around south-eastern Australia. These are the southern octopus (*Octopus australis*), the Maori octopus (*O. maorum*) and the pale octopus (*O. pallidus*). Southern octopus inhabit seagrass beds in bays and coastal waters. Pale octopus are primarily an inshore species, where they live on sandy substrates, but have been recorded to depths of 725 m. Maori octopus live both inshore on coastal reefs and to depths of 549 m (Kailola et al. 1993). All octopus have a short life cycle in which females produces a single egg mass and dies soon after the eggs have hatched. Female Maori octopus produce large numbers of small ovoid eggs (4 – 6 mm in length) whereas southern and pale octopus produce considerably larger eggs (length rages of 9 – 14 and 11 – 13 mm, respectively). The eggs are attached to the substrate. Southern octopus are of little commercial value due to their small size and are usually sold as bait. Maori octopus are the largest of the three species. In Victoria, pale octopus are taken as incidental catch by inshore trawlers and Danish seiners (Kailola et al. 1993). Stakeholder feedback indicates that there are a lot of octopus eggs in early spring, and that the adults are broadly distributed and usually sited on habitat comprised of old scallop shell and rubble in the vicinity of the Operational Area (Section 9). In Tasmanian waters, both pale and Maori octopus appear to spawn all year round with a peak in late summer/early autumn for the former (Emery and Hartmann 2016).

4.5.7.5 School and eastern king prawns

School prawns occur along the east coast of Australia between eastern Victoria and southern Queensland. They inhabit both estuaries (mostly as juveniles and sub-adults) and inshore coastal waters (adults). School prawns spawn in nearshore waters off NSW between February and May. After a larval stage of 2-3 weeks the post-larval prawn enters estuaries. By the following spring the adolescent prawn emigrates to coastal waters and has a life span of up to 18 months. Individuals may undertake oceanic migrations of up to 100 km. The main fisheries for this species are in Queensland, New South Wales and Victoria (Stewart et al. 2015).

Eastern king prawns occur along the eastern Australian coast from north-eastern Tasmania to Queensland. Across this range the species exhibits strong stock connectivity, primarily as a consequence of larval dispersal southwards by the East Australian Current. To achieve this adults migrate northward over long distances into deeper water as they grow, with spawning occurring in offshore waters, predominantly from northern NSW to Swains Reef in Queensland. The larval period is thought to last for three weeks and post-larvae/adolescents inhabit estuaries. In NSW they emigrate from estuaries over summer. Eastern king prawn live for up to three years and have been recorded in depths from 1 – 200 m. The species is primarily targeted by commercial trawl fisheries in NSW and QLD (Stewart et al. 2015, http://fish.gov.au/report/24-Eastern-King-Prawn-2016 accessed 29 Aug 2018).

4.5.8 Marine reptiles

Five species of marine turtle listed as MNES under the EPBC Act were identified by the PMST as potentially occurring in the Oil EMBA (Table 4.7). All are listed as both 'threatened' and 'migratory'. Loggerhead and flatback turtle habitat is known to occur within the Oil EMBA, whereas foraging, feeding or related behaviour is known within area for the other three species (Appendix B). All species of marine turtles in Australian waters are managed under the Recovery Plan for Marine Turtles in Australia (DoEE 2017).

No marine turtle BIAs (e.g. foraging, inter-nesting, mating and nesting) were identified within the Oil EMBA. There is, however, evidence that marine turtles utilise southern waters off South Australia, Victoria and Tasmania for foraging and migration to a greater extent than was previously thought. The South Australian Sea Turtle (SAST) project, an initiative of the Centre for Integrative Ecology (CIE) at Deakin University, has developed a database which compiles information from State and Commonwealth government wildlife databases, media articles, reports and historical anecdotal sightings from commercial and recreational fishers and other marine users, and the general public. Since 2014 when the study began a total of 209 sightings of five marine turtle species have been recorded in these southern waters. Whilst all species have been recorded within the Oil EMBA, virtually all are located along the shoreline with approximately ten sightings (mostly leatherbacks) observed along ninety mile beach in the vicinity of the proposed seismic survey (https://ciedeakin.files.wordpress.com/2014/08/sast-sighting-map-v2.jpg accessed 28 Aug 2018). Two sightings (both leatherbacks) have been recorded within the Operational Area.

Loggerhead turtles are known to forage in Australian coastal waters but are uncommon in SA, TAS and VIC (DoEE 2017). Individuals of this species are therefore expected to be occasional visitors to coastlines within the Oil EMBA, and less likely encountered in the deeper waters within the Operational Area.

Green turtles are found in subtropical and tropical waters around the world (Limpus 2008b). Green turtle hatchlings and young juveniles usually spend their first 5–10 years drifting on ocean currents until they settle in tidal and subtidal coastal habitats. These habitats include reefs, bays and seagrass beds where they feed on seagrass and algae (DoEE 2017; Limpus 2008b). The species has limited presence in NSW, VIC and SA (DoEE 2017), and may be occasional visitor to shorelines within the Operational Area and Oil EMBA.

Leatherback turtles are distributed throughout tropical, subtropical and temperate waters around the globe (Limpus 2009). They forage in oceanic waters for planktivorous prey (mainly jellyfish), and are most commonly observed in waters of the NT and south-western WA. In the eastern states, the species has been reported in coastal waters between southern QLD and central NSW, and in southern waters from TAS, VIC and eastern SA (Limpus 2009). Satellite tagging records indicate that leatherback turtles typically forage in warmer waters during autumn and spring, and only forage in cooler southern waters during summer (November to February) (Bailey et al. 2012). This is consistent with reports that leatherback turtles have been observed in the Bass Strait during summer (Limpus 2009). Leatherback turtles are unlikely to be present within the deeper waters of the operational area but may be found along shorelines within the Oil EMBA (CIE 2018).

Flatback turtles have a restricted distribution and are only found in tropical waters of northern Australia, Papua New Guinea and Irian Jaya. Nesting is confined to Australian coastal waters from Mon Repos in southern QLD to Exmouth in north-western WA. Flatbacks feed mostly on soft bodied prey such as sea cucumbers, soft corals and jellyfish found in subtidal, soft bottom habitats (https://environment.gov.au/marine/marine-species/marine-turtles/flatback accessed 28 Aug 2018). The habitat of flatback turtles is known to occur in NSW waters where the northern extent of the Oil EMBA extended (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59257 accessed 28 Aug 2018), however the species is not expected to be found within the Operational Area.

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Table 4.7 MNES listed marine turtles within the Oil EMBA

Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Listed threatened species[1]	Listed migratory marine species		
Caretta caretta	Loggerhead turtle	Endangered	Yes	No	Recovery Plan for Marine Turtles in Australia (2017)
Chelonia mydas	Green turtle	Vulnerable	Yes	No	
Dermochelys coriacea	Leatherback turtle	Endangered	Yes	No	
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Yes	No	
Natator depressus	Flatback turtle	Vulnerable	Yes	No	

4.5.9 Marine mammals

Thirty-five species of mammals listed under the EPBC Act may occur within the Oil EMBA, including 33 cetacean and two fur-seal species (Table 4.8, Appendix B). This list includes five threatened (sei, blue, fin, southern right and humpback whales) and eleven migratory species (including the threatened species). The BIA of three species overlap the Oil EMBA (blue pygmy, humpback and southern right whales).

Table 4.8 Marine mammal species (threatened, migratory and/or with a BIA) or species habitat within the Oil EMBA

Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Threatened	Migratory		
Cetaceans					
Balaenoptera acutorostrata	Minke whale	N/A	No	No	N/A
Balaenoptera bonaerensis	Antarctic minke whale	N/A	Yes	No	N/A
Balaenoptera borealis	Sei whale	Vulnerable	Yes	No	*Balaenoptera borealis* (sei whale) conservation advice (TSSC 2015a)
Balaenoptera musculus	Blue whale	Endangered	Yes	Yes	Blue Whale Conservation Management Plan (DoE 2015a)
Balaenoptera physalus	Fin whale	Vulnerable	Yes	No	*Balaenoptera physalus* (fin whale) conservation advice (TSSC 2015b)
Balaenoptera edeni	Brydes whale	N/A	Yes	No	N/A
Caperea marginata	Pygmy right whale	N/A	Yes	No	N/A
Berardius arnuxii	Arnoux's beaked whale	N/A	No	No	N/A
Eubalaena australis	Southern right whale	Endangered	Yes	Yes	Conservation Management Plan for the Southern Right Whale (DSEWPAC 2012)
Lagenorhynchus obscurus	Dusky dolphin	N/A	Yes	No	N/A
Megaptera novaeangliae	Humpback whale	Vulnerable	Yes	Yes	Conservation Advices for the Humpback Whale (DEE 2015)
Orcinus orca	Killer whale	N/A	Yes	No	N/A

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Scientific name	Common name	EPBC Act status		BIA within Oil EMBA	Relevant plan
		Threatened	Migratory		
Physeter macrocephalus	Sperm whale	N/A	Yes	No	N/A
Delphinus delphis	Common dolphin	N/A	No	No	N/A
Globicephala macrorhynchus	Short-finned pilot whale	N/A	No	No	N/A
Globicephala melas	Long-finned pilot whale	N/A	No	No	N/A
Grampus griseus	Risso's dolphin	N/A	No	No	N/A
Hyperoodon planifrons	Southern bottlenose whale	N/A	No	No	N/A
Kogia breviceps	Pygmy sperm whale	N/A	No	No	N/A
Kogia simus	Dwarf sperm whale	N/A	No	No	N/A
Lissodelphis peronii	Southern right whale dolphin	N/A	No	No	N/A
Mesoplodon bowdoini	Andrew's beaked whale	N/A	No	No	N/A
Mesoplodon densirostris	Blainville's beaked whale	N/A	No	No	N/A
Mesoplodon ginkgodens	Gingko-toothed beaked whale	N/A	No	No	N/A
Mesoplodon grayi	Gray's beaked whale	N/A	No	No	N/A
Mesoplodon hectori	Hector's beaked whale	N/A	No	No	N/A
Mesoplodon layardii	Strap-toothed whale	N/A	No	No	N/A
Mesoplodon mirus	True's beaked whale	N/A	No	No	N/A
Pseudorca crassidens	False killer whale	N/A	No	No	N/A
Tasmacetus shepherdi	Shepherd's beaked whale	N/A	No	No	N/A
Tursiops aduncus	Indian Ocean bottlenose dolphin	N/A	No	No	N/A
Tursiops truncatus s. str.	Bottlenose dolphin	N/A	No	No	N/A
Ziphius cavirostris	Cuvier's beaked whale	N/A	No	No	N/A
Pinnipeds					
Arctocephalus forsteri	New Zealand fur-seal	N/A	No	No	N/A
Arctocephalus pusillus	Australian fur-seal	N/A	No	No	N/A

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4.5.9.1 Threatened species

Blue whales (Balaenoptera musculus) are the largest baleen whales, with four subspecies recognised. At least two subspecies are found in the Southern Hemisphere; the pygmy blue whale (PBW) (B. m. brevicauda) and the Antarctic blue whale (ABW) (B. m. intermedia). Both are listed as ‘endangered’ under the EPBC Act. They are characterised by differences in morphology, distribution, genetics and vocal behaviour (DoE, 2015), and have overlapping but different spatial distributions. These two blue whale subspecies migrate between breeding grounds at lower latitudes, where mating and calving occur during winter, and summer feeding grounds at higher latitudes.

Three population groups of the two subspecies are known in Australian waters: Antarctic blue whales which travel along the entire western and southern coast of Australia; Eastern Indian Ocean (EIO) pygmy blue whales which migrate down Western Australia and along the southern coast as far as Bass Strait, and the Tasman-Pacific pygmy blue whale which occurs in the Tasman Sea and Pacific Ocean (McCauley et al. 2018). Vocalisations attributed to each of the three groups have been recorded in Bass Strait identifying this as a convergence zone (McCauley et al. in press). The migration route of the EIO population of pygmy blue whales, found off the western and southern Australian coasts, is located about 100 km off Australia’s west coast until reaching the North West Cape, where they head offshore towards Indonesia (Double et al. 2014). Migratory pathways of Antarctic blue whales are less clear but recordings suggest they travel along the west and south coasts between high latitudes in summer and low latitudes in winter (CoA, 2015). The migratory patterns of the Tasman-Pacific population in the southern Tasman Sea is also unclear. However, vocalisations typical of the Tasman-Pacific type have been recorded throughout the year on Bass Strait (McCauley et al., 2013) indicating that PBWs may be encountered in the Gippsland Basin region at any time.

Abundances of the EIO PBW have been estimated in WA of between 289 to 1,754 individuals (CoA, 2015). Uncertainty exists around what proportion of the PBWs that occur off Victoria are included in this estimate, but a logical inference is that it’s low as this is the eastward extremity of the migration route. No attempts at estimating the Tasman-Pacific PBW population is known of, and it is unclear how much of the population of Tasman-Pacific pygmy blue whales occur in or around the eastern approaches to Bass Strait. However, Bass Strait is thought to be the westward extremity of their distribution and it is therefore concluded to be frequented only by relatively low numbers of Tasman-Pacific PBW. An estimate of 2,280 (95% CI: 1,160-4,500) was derived for Antarctic blue whales in the 1992/93 season, but this was for the circumpolar population and did not attempt to estimate numbers in Australian waters.

Blue whales are lunge feeders, feeding on dense aggregations of planktonic prey, such as krill (Acevedo – Gutierrez, 2002, Butler et al, 2002). Australia has two known PBW seasonal feeding aggregations, supported by upwelling systems located at the Perth Canyon off WA and the Bonney Upwelling; which includes waters off the south coasts of SA and Victoria (roughly 550km west of the operational area; Figure 4.17) (Gill 2002; Gill et. al, 2011). Within season PBW distribution trends are related to sea surface temperature (SST) and the Bonney Upwelling system; which generally occurs first in the eastern GAB in November and December moves eastward along the shelf to South Australia and Victoria from January until April (Gill et al, 2011). PBW encounter rates in the eastern zone, off Victoria’s coast, peak in February, coinciding with peak upwelling intensity and primary production (Gill et al. 2011).

Outside of these recognised feeding areas, possible foraging areas for pygmy blue whales include Bass Strait off Victoria and off the West coast of Tasmania (Figure 4.14, DoE 2015). Anecdotal feeding areas include the East of Eden upwelling and Merimbula, NSW (especially during October) (Butt, 2001). The ‘possible foraging’ BIA in the Gippsland, as detailed in the Conservation Management Plan for the Blue Whale, (CoA 2015) is between the Bonney upwelling to the west, and East of Eden upwelling to the east. This BIA overlaps the seismic operational area and oil EMBA (Figure 4.14) but no data exist to describe seasonal use.

Few cetacean surveys have been conducted for the Gippsland Basin and available records are scant. Records held on the Atlas of Living Australia shows that blue whales have been recorded in the Gippsland Basin area in October through January, March and April with most records having been acquired in October and November. Sightings off Eden on the New South Wales coast are more numerous but have mostly been acquired in October and November from highly popular locations which may skew the appearances of abundance. Most of these records are attributed to blue whales and do not differentiate between B. m. brevicauda or B. m. intermedia. However, based on information in CoA (2015), it is thought more likely to be the pygmy form. It is therefore concluded that PBW may be encountered at any time during the survey, but in relatively low numbers.

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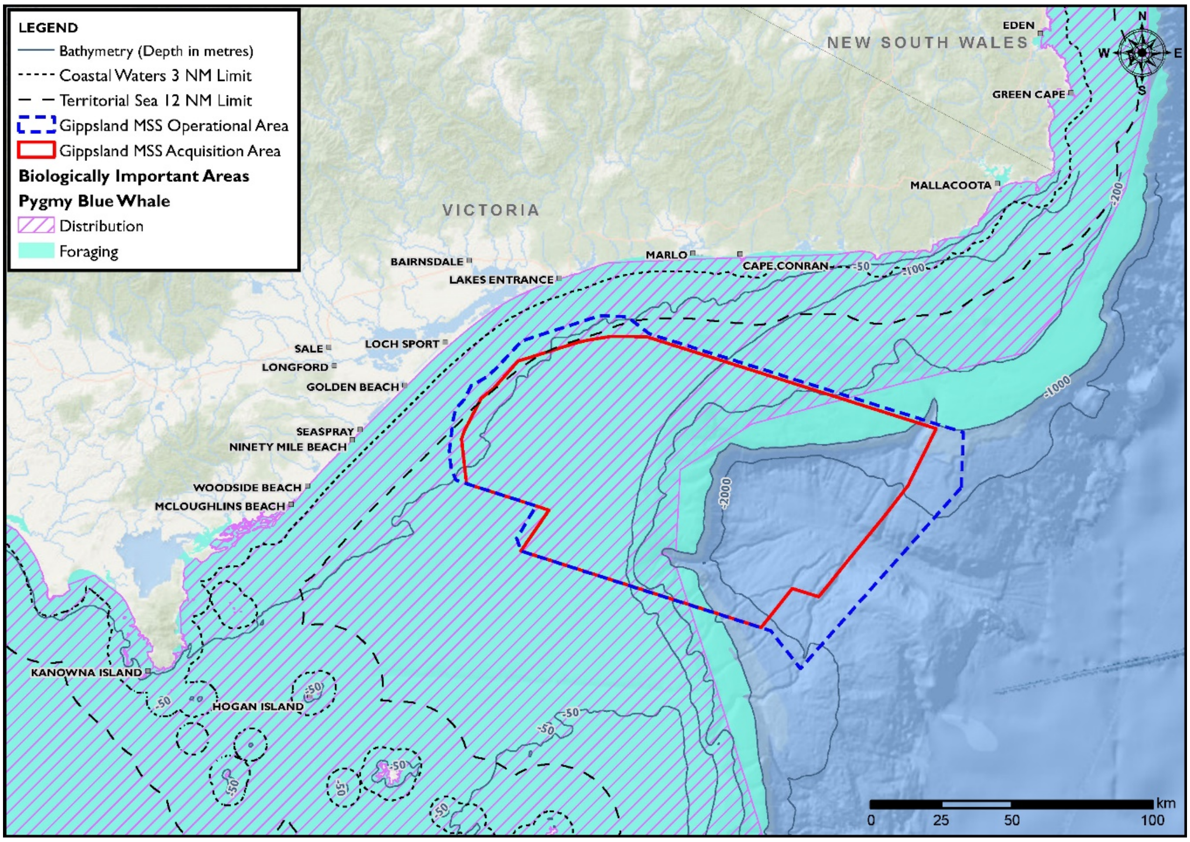


Figure 4.14 Pygmy blue whale – biologically important area for possible foraging

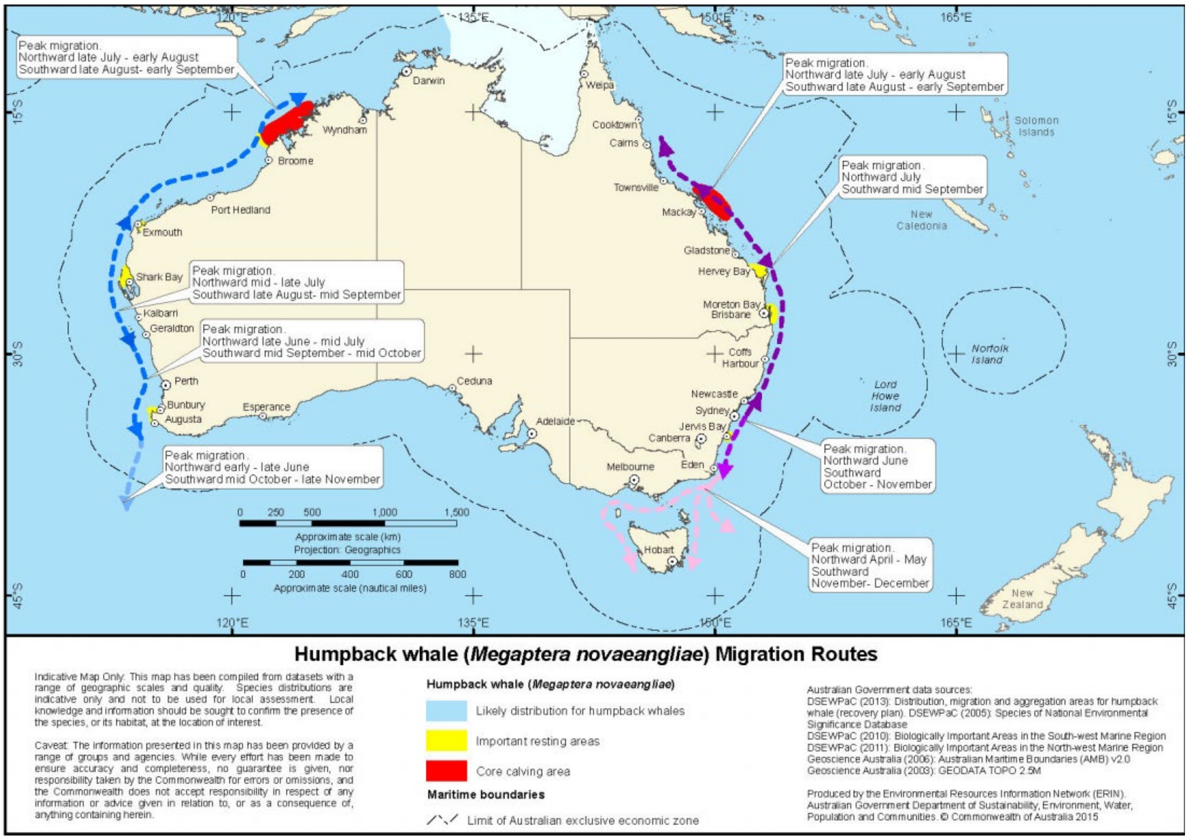
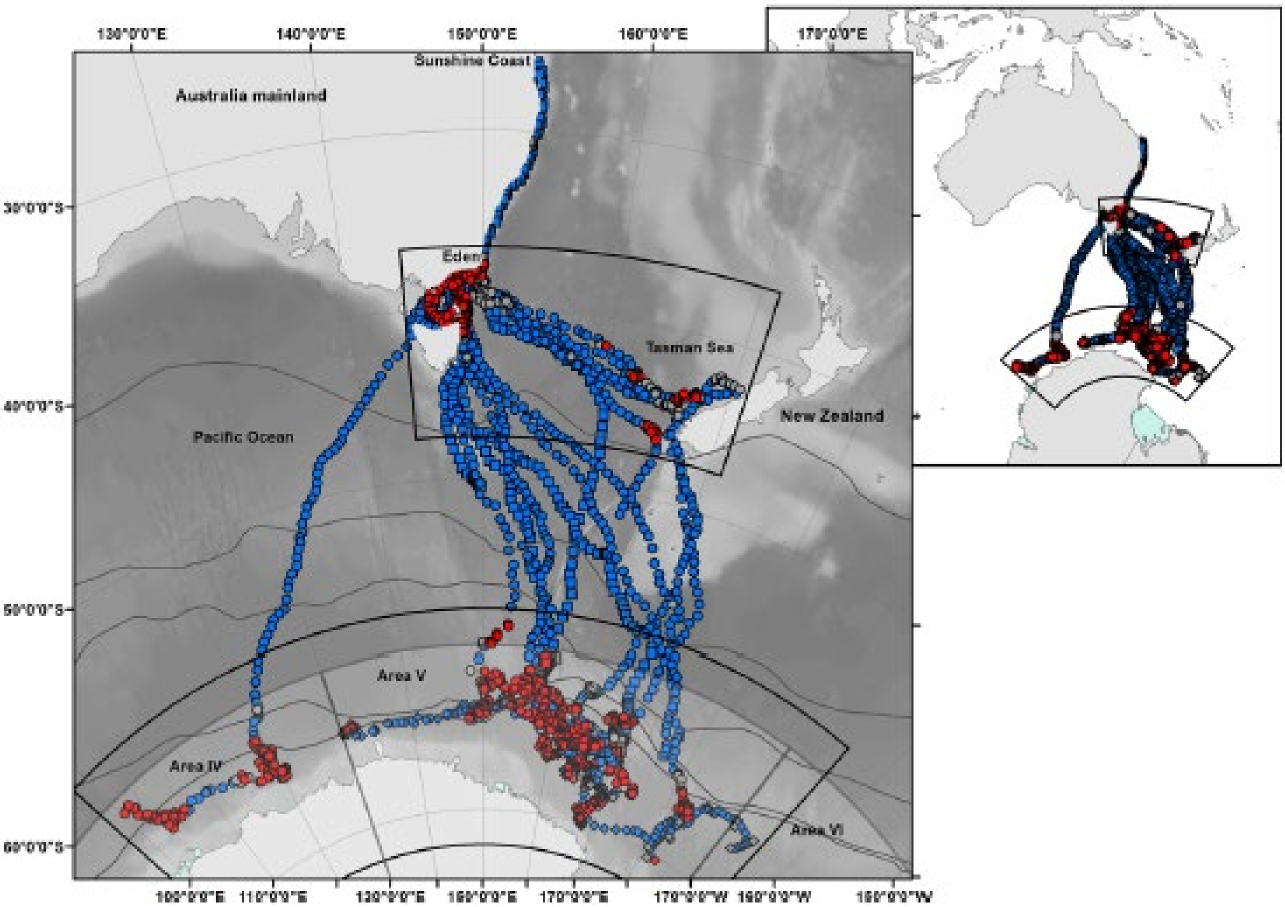


Figure 4.15 Pygmy blue whale – distribution around Australia

Humpback whales (*Megaptera novaeangliae*) migrate annually along the east coast of Australia between their summer feeding grounds in Antarctica and their winter calving grounds off Queensland (Figure 4.16, Andrews-Goff et al. 2018). They head north from about May to August, and south from about September to December in diffuse and irregular movements of whales (DEE 2015). Humpback whales (HBW) tend to migrate further offshore during their northward migration (Paterson et al., 1994; Noad & Cato 2001), though their precise route along the south-east coast is unknown when north-bound and is thought to be diffuse. HBWs travel much closer to shore when migrating southward, as many are cows with calves. While the main migration route is thought to pass along the eastern border of Bass Strait, a recent satellite tagging survey during the southern migration (Nov – Dec) had more than half of the tagged whales migrate through Bass Strait where they were tracked undertaking movements akin to searching for food (Figure 4.16). Thirteen of the tagged HBW travelled south and then west through Bass Strait and on to Antarctica (Andrews-Goff et al. 2018). Therefore, HBWs can be expected to pass through the operational area, ensonification area, and oil EMBA during the southern and northern migrations but in a diffuse manner and not within BIAs.

The east-coast HBW population has been estimated at 14,522 (95% CI: 12,777 – 16,504) individuals which is smaller than the west coast population but is increasing at a similar rate (TSSC, 2015). A small number of individual HBWs have been recorded in northern Queensland during the Austral summer (Chaloupka and Osmond, 1999), but the majority will migrate either through, along the eastern edge, or east of Bass Strait on their northward and southward migration.



Location estimates from the state-space model are coloured according to the behavioural state estimate: 'search' (red), 'transit' (blue) and 'uncertain' (grey)
Eden deployment – circles, Sunshine Coast deployment – squares

Figure 4.16 Migration pathways for 30 humpback whales, tagged off the eastern coast of Australia

HBW foraging has previously been observed in Australia's coastal waters, but this has traditionally been thought to be opportunistic and forming only a small portion of their nutritional requirements (Thiele et al. 2004, Thiele 2004). The BIA located off the New South Wales coastline for the HBW migration route shown in this study overlaps with the Oil EMBA (Figure 4.18). It is therefore concluded that no HBWs will be encountered during the seismic survey between January and April but a significant proportion of the population may be encountered between May and July when the majority of the population migrates northwards. However, due to the probable diffuse distribution and build up to peak numbers, the numbers encountered daily is likely to be low.

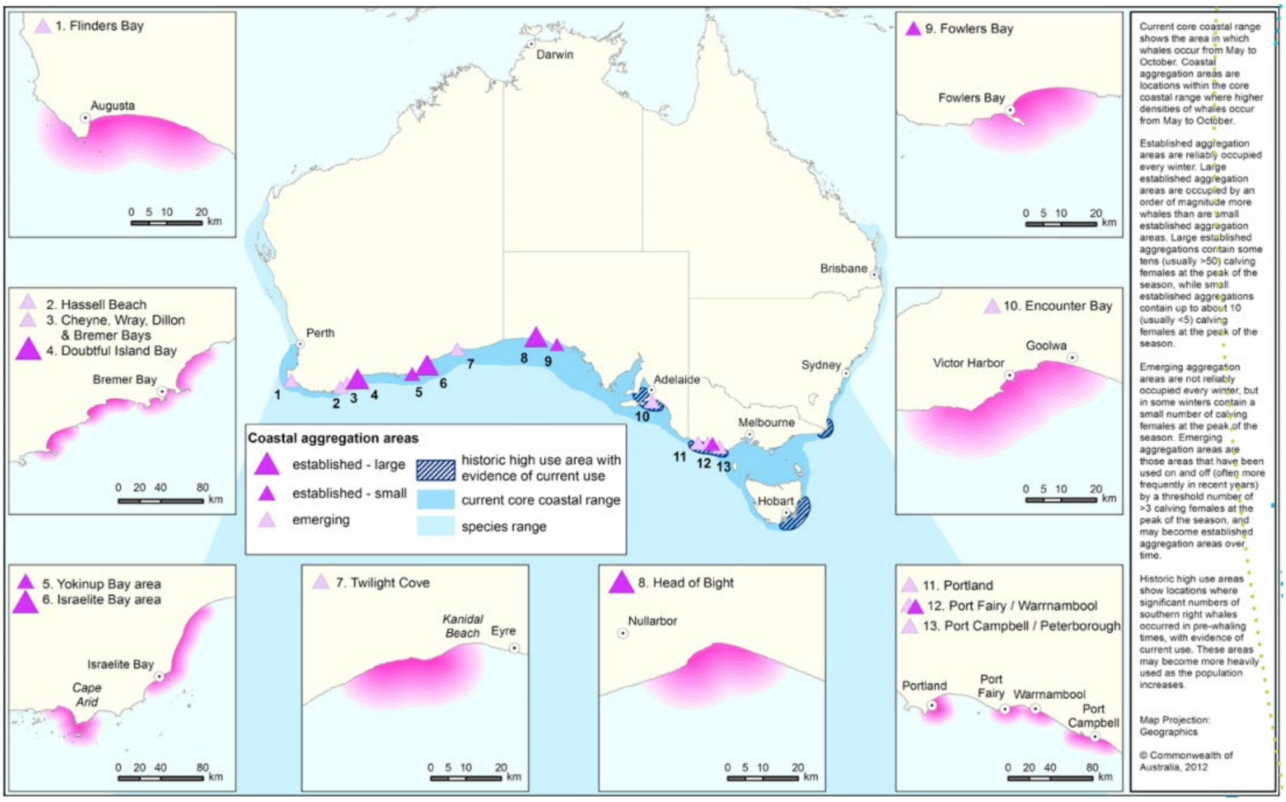


Figure 4.17 Humpback whale migration routes

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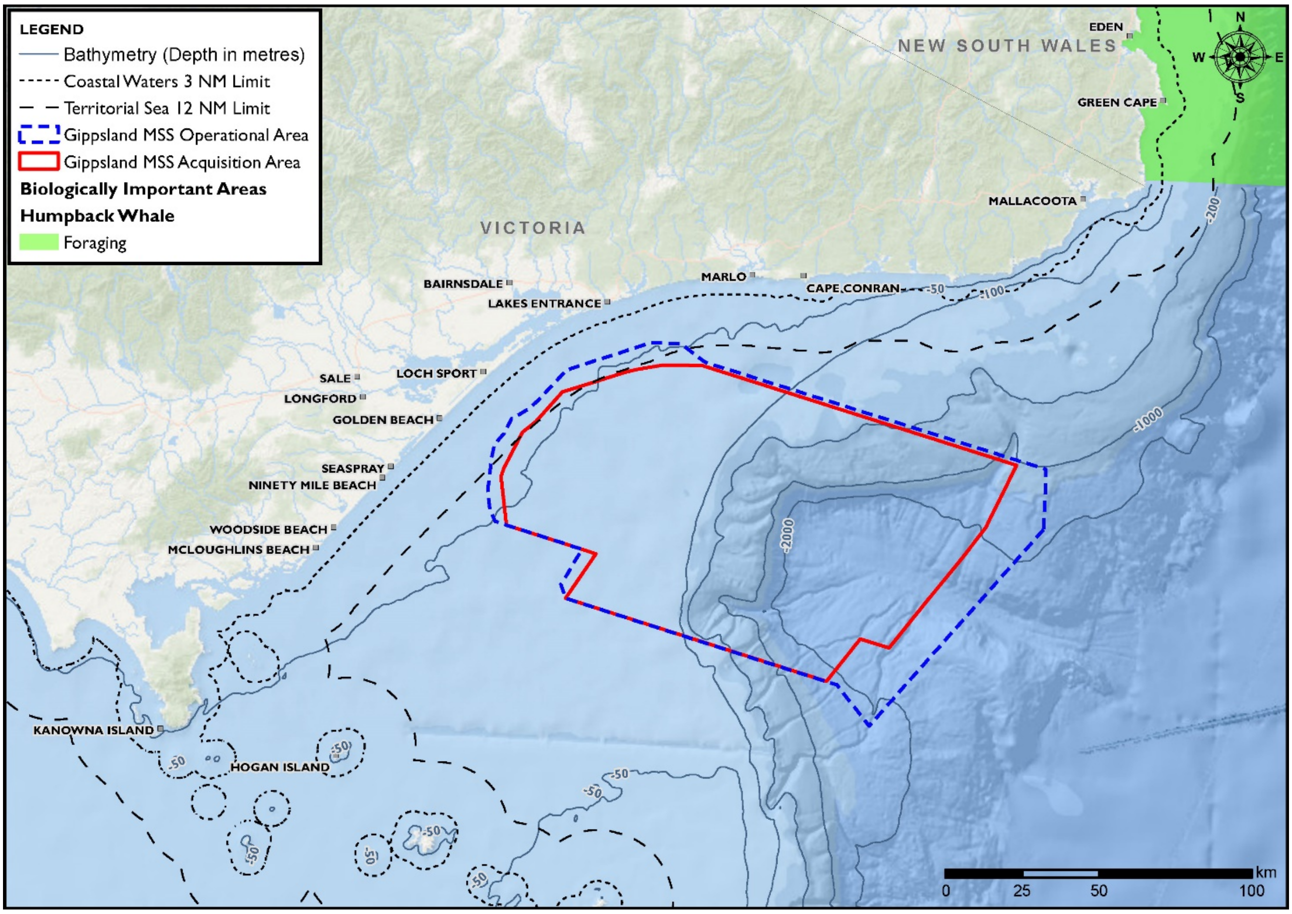

Figure 4.18 Humpback whales – biologically important area for foraging

Southern right whales (Eubalaena australis) are listed as 'endangered' under the EPBC Act, with the total Australian population estimated to comprise 3500 individuals (DSEWPaC 2012) and critically endangered by the Victoria State Government (DELWP 2018). These baleen whales are found along the southern coast of Australia in winter and spring (Kemper et al. 1997). The foraging ecology of southern right whales (SRW) is poorly understood however they probably feed on copepods and krill in waters south of Australia (between Latitudes 40°S and 65°S) (DSEWPaC 2012). Coastal Australian waters are not generally used for feeding (DSEWPaC 2012).

Emerging genetic information suggests there are two stocks of SRW found in Australian waters. A southwestern stock which can be found overwintering between Ceduna in SA and Cape Leeuwin in WA, and a south-eastern stock which includes the whales that overwinter in aggregation areas east of Ceduna. These areas include those occurring in Encounter Bay and off Portland and Warrnambool (Charlton 2017). The south-eastern Australian population of SRW is genetically closer to the New Zealand (NZ) population, as identified through mDNA analysis, than to the southwestern Australian population (Carroll et al. 2011). The population that over-winters in NZ was tracked using satellite tags to areas in which the SRW found in the south-eastern Australia sub-population are thought to feed during the Austral summer (Childerhouse et al. 2010). This east-west migratory band is contrary to previous assumptions of a strictly north-south migration. (DSEWPAC 2012). Winter is the peak time for southern right whale abundance, especially along the southern coast of Australia (Rhianne et al. 2014). At this time, calving adult females are spotted frequently inshore in shallow bays (Bannister et al. 1996). The nearshore zone along the Victorian coast is classified as a BIA (see Figure 4.20) for coastal connecting habitat and migratory movements (CoA, 2012) between known current and historic aggregation areas such as the calving and nursing area near Warrnambool in the west and the aggregation area in Twofold Bay, New South Wales to the north east (CoA, 2015).

Estimates of the SRW population has been assessed annually from 1976 (CoA, 2015) and is ongoing . These counts have taken place between Cape Leeuwin and Ceduna and indicate that up to 2,900 individuals pass along the coast annually (CoA, 2015). The entire Australian SRW population has been estimated to include around 3,500 individuals, while the south-eastern population estimate from Victoria State Government (DELWP 2018) is below 300 animals. While the western population has been recovering at rates close to its biological maximum, evidence suggests this is not the same for the eastern sub-population (CoA, 2013). An absolute abundance estimate of 2,148 SRWs that summer in NZ was calculated by Jackson et al. (2018) using DNA sampling and mark-recapture analysis.

The migratory paths of SRW between southern feeding areas and coastal calving areas are not well understood (DSEWPaC 2012) and assessment of the historic whaling records by Torres et al. (2011) only concluded broad north-south movement patterns rather than pathways. There is substantial movement along the coast indicating that connectivity of coastal habitat is important (Pirzl 2008) with a seasonal westward movement in coastal habitat (Burnell 2001, Kemper et al. 1997). The winter distribution of SRW is unknown but may include offshore habitat where mating occurs. Although sighted along the Victorian coast and a few records on the broader Gippsland Basin, the Operational Area is outside of the nearest known southern right whale calving and nursery zone, located in the inshore waters of western Victoria around Warrnambool and Peterborough (Figure 4.19) and historic use off Eden. However, the EMBA overlaps their coastal range including resting and migration areas. Southern right whales are thought to be solitary during migration or accompanied by a dependent calf or occasionally a yearling offspring (DSEWPAC 2012). Most NSW sightings are May-Nov, hence migrating SRW could be encountered within the Activity and Oil EMBAs but the majority are thought to be in waters further west at this time. Records of SRWs in Victorian waters held in the Atlas of Living Australia have also been collected between May and November with some having been recorded in the deeper offshore areas. It is concluded that few or no SRWs will be encountered in the Gippsland Basin region during the early half of the seismic survey (Jan-Apr) but low numbers may occur from May to July, though most of the east-coast population are expected to be transiting towards the calving grounds around Warrnambool at this time. A small number of SRWs may occur in the coastal BIA along the coast between May and July but these are thought more likely to be non-breeding animals.

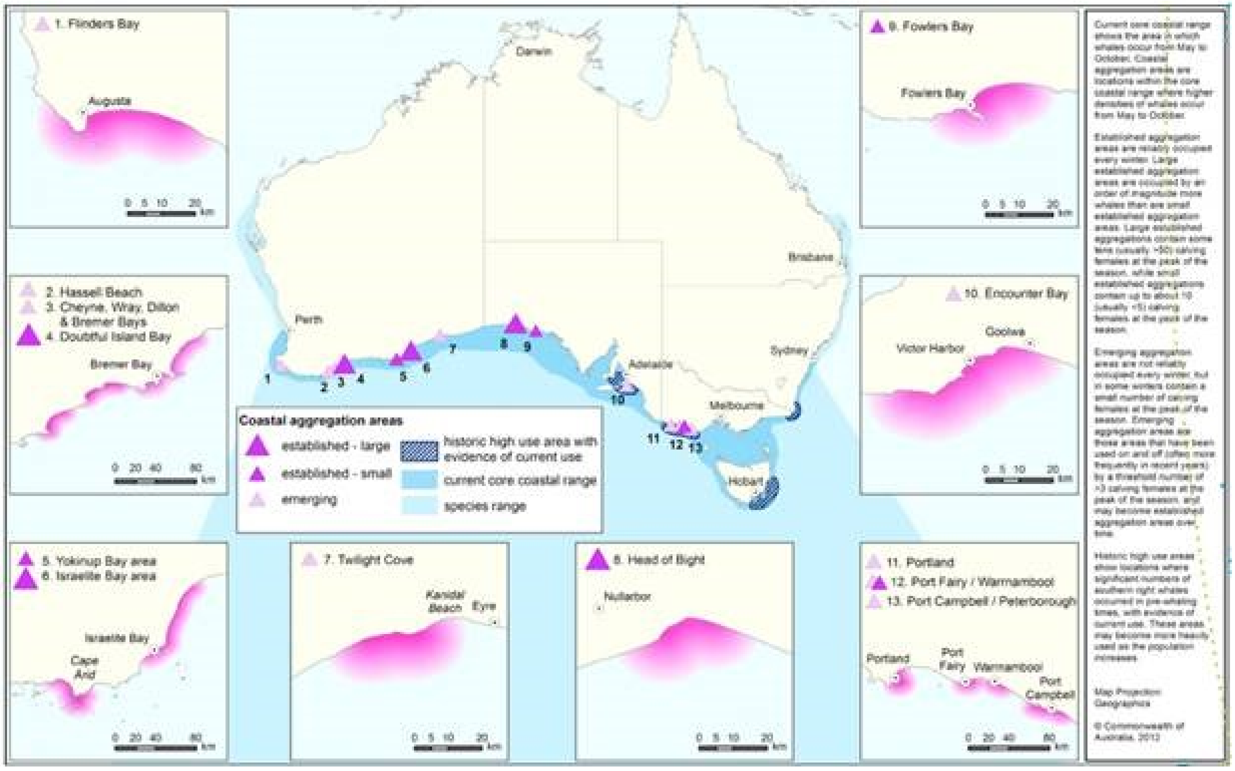

Figure 4.19 Southern right whales – coastal aggregations

RPS

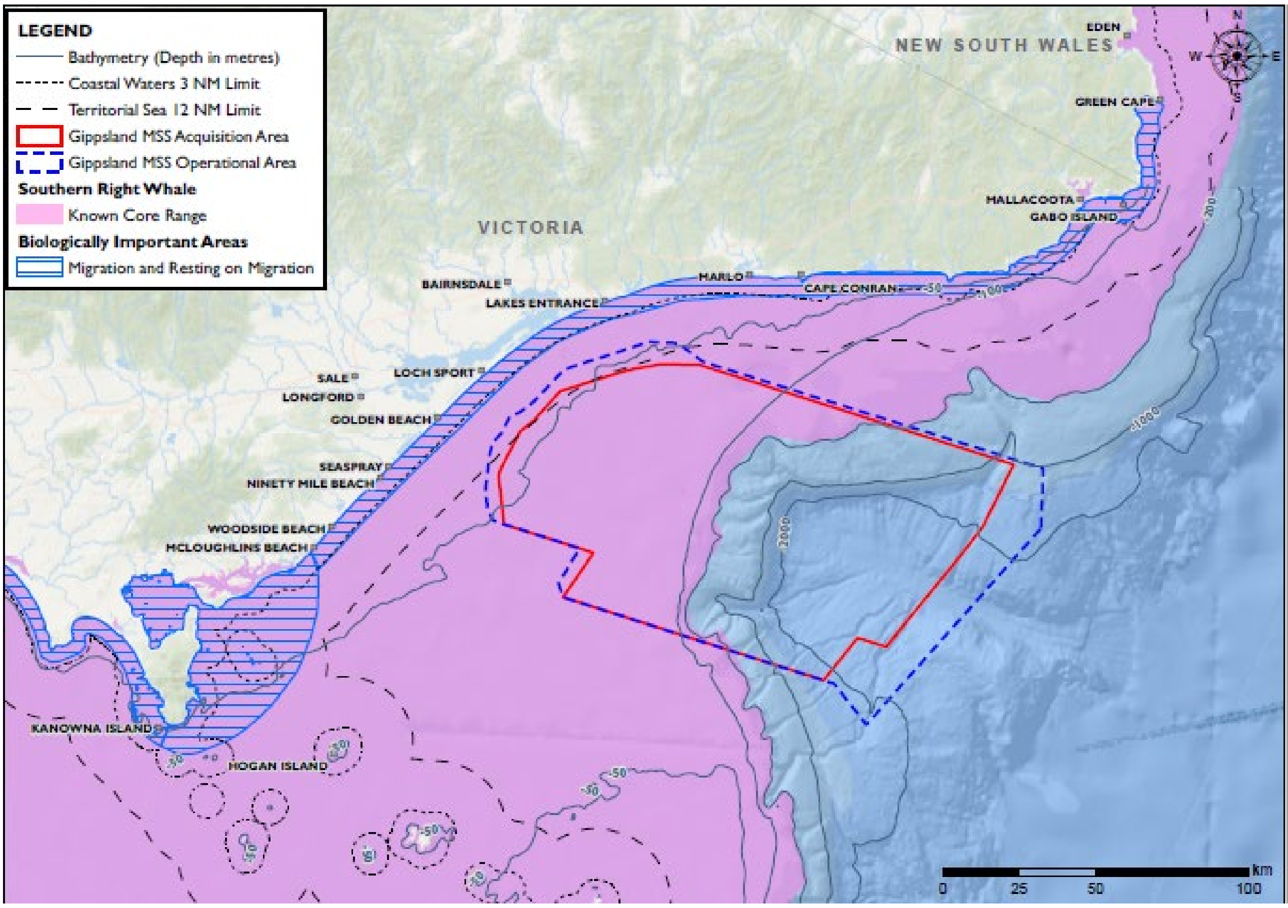

Figure 4.20 Southern right whale – biologically important area for migration, connecting habitats and resting

4.5.9.2 Other cetaceans

4.5.9.2.1 Baleen whales

The Sei whale Sei whales (Balaenoptera borealis) are considered a cosmopolitan species, ranging from polar to tropical latitudes, and are usually found in deeper waters. Their global population is estimated to have declined by 80% over the previous three-generation period (TSSC 2018) and they are currently listed under the EPBC Act as 'vulnerable'. For Australian waters, there are no population estimates for the sei whales nor is it known if there are any mating or calving areas (TSSC 2018).

Sei whales move between lower latitude winter breeding grounds through Australian waters to sub-Antarctic feeding areas (e.g. Subtropical Front), completing long annual seasonal migrations, but details of this migration, and whether it involves the entire population, are unknown (TSSC 2018).

Sei whales have been sighted west of the Gippsland in areas such as the Bonney Upwelling off South Australia (Miller et al. 2012), where opportunistic feeding has been observed between November and May (Gill et al. 2015). A small number of sei whale females and calves have also been observed about 40 km south of Hobart, Tasmania (Ensor et al. 2002).

Fin whales (*Balaenoptera physalus*)are listed as Vulnerable (TSSC, 2015b), considered a cosmopolitan species, occurring from polar to tropical waters, and rarely inshore. The full extent of their distribution in Australian waters is uncertain, but they occur within Commonwealth waters and have been recorded in most State waters and in Australian Antarctic Territory waters (TSSC, 2015b). These whales are generally thought to undertake long annual migrations from higher latitude summer feeding grounds to lower latitude winter breeding grounds (Bannister 2008; Aguilar 1987) and hence could traverse the EMBA between Antarctic feeding areas (the Southern Ocean); subantarctic feeding areas (the Southern Subtropical Front); and tropical breeding areas (Indonesia, the northern Indian Ocean and south-west South Pacific Ocean waters) (TSSC, 2015b). Fin whales have been sighted inshore in the proximity of the Bonney Upwelling, Victoria, along the continental shelf in summer and autumn months (Gill 2002). Threats and consequence ratings of these threats are the same as for sei whales. Although the lack of records in the Gippsland region suggest the presence of fin whales are unlikely, the SPRAT distribution maps indicate fin whale species may occur in the oil EMBA (TSSC 2015).

Dwarf minke whales (*Balaenoptera acutorostrata* unnamed subsp.) are found year-round, primarily in tropical and warm temperate coastal waters of the Southern Hemisphere and known to occur as far north as 11° S in the western Pacific off Australia (Perrin and Brownell Jr 2002). Studies on the northern Great Barrier Reef have recorded the subspecies from March to September (Minke Whale Project 2018).

Like other baleen whales, the various populations of minke whales appear to migrate from high latitude feeding grounds in the summer to low latitude grounds in winter months (Minke Whale Project 2018) but the detailed pattern of migration is still unclear and may be quite complex. There is not enough evidence to plot migration patterns for dwarf minke whales (Minke Whale Project 2018).

Dwarf minke whales may occur broadly from Victoria to northern Queensland between March and October (Minke Whale Project 2018). They have also been reported between December and March in the sub-Antarctic and Antarctic, with most sightings between 53 and 62° S. Scattered sightings and strandings from southern Queensland and northern New South Wales early in the season (May–June) and late in the season (September) suggest a migration route along the east Australian coast but records are too few to document movements of the whales (Minke Whale Project 2018).

Antarctic minke whales (Balaenoptera bonaerensis) appear to occupy primarily offshore and pelagic habitats throughout the Southern Hemisphere from 55° S to the Antarctic ice edge during the austral summer (Perrin & Brownell 2002). Most retreat to breeding grounds at mid-latitudes between 30° S and 10° S (Perrin & Brownell 2002). In these areas, the distribution of the Antarctic minke whale is mainly oceanic, beyond the continental shelf break (Best 1985; Perrin & Brownell 2002; Zerbini et al. 1997). The SPRAT distribution map (DoEEc,2018) suggests it is possible they could be encountered in the Oil EMBA.

Bryde’s whales (Balaenoptera edeni) occur in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40°N and 40°S, or the 20 °C isotherm (Bannister et al. 1996). They have been recorded from all Australian states except the Northern Territory (Bannister et al. 1996). The coastal and offshore forms may be distinguished by their prey preferences (Best 1977), with the smaller coastal Bryde's Whales feeding on schooling fishes, such as pilchard, anchovy, sardine, mackerel, herring and others. In contrast, the larger offshore form appears to feed on small crustaceans such as euphausids, copepods and pelagic red crabs (Pleuroncodes), plus cephalopods (DoEEc, 2018). The SPRAT distribution map (DoEEc,2018) suggests it is possible they could be encountered in the Oil EMBA

Pygmy right whales (*Caperea marginata*) The pygmy right whale (*Caperea marginata*) is a baleen whale found in temperate and sub-Antarctic waters in oceanic and inshore locations and is listed as ‘migratory’ under the EPBC Act. The species, which has never been hunted commercially, is thought to have a circumpolar distribution in the Southern Hemisphere between about 30S and 55S. Distribution appears limited by the surface water temperature as they are almost always found in waters with temperatures ranging from 5 to 20°C (Baker 1985). The northern distribution may be limited on the east coast of Australia by the warm, south-flowing East Australian current.

There are few confirmed sightings of pygmy right whales at sea (Reilly et al. 2008), with few or no records from eastern Victoria and no population estimates available for Australian waters (DoEE 2017). The largest reported group sighted (100+) was near Portland, Victoria, in June 2007 (Gill et al. 2008). They have primarily been recorded in areas associated with upwellings and with high zooplankton abundance, particularly copepods and small euphausiids which constitute their main prey (Kemper 2002; Sekiguchi et al. 1992).

RPS

4.5.9.2.2 Odontocetes (toothed whales)

Sperm whales (Physeter macrocephalus) are found in pelagic, offshore, deep waters of 600 m or more and are uncommon in waters less than 300 m deep (NOAA Fisheries Fact Sheet 2006). Female sperm whales are generally found in deep waters (at least 1,000 m) of low latitudes (less than 40° N). They are a deep diving species and perform long and deep dives, often lasting 60–90 minutes (DoEE, 2018) often avoiding detection. They have been recorded offshore from all Australian states (Bannister et al. 1996). The key localities for the sperm whale are: between Cape Leeuwin and Esperance, WA, close to the edge of the continental shelf (averaging 20 to 30 nautical miles offshore); south-west of Kangaroo Island, SA; off the Tasmanian west and south coasts; off New South Wales, including Wollongong; and off Stradbroke Island, Queensland (Bannister et al. 1996). There is a generalised movement of sperm whales to higher latitudes in summer, and corresponding movement to lower latitudes in winter, as per the SPRAT distribution map (DoEE, 2018) that suggests sperm whales could traverse the deeper waters of the Operational Area and Oil EMBA. However, Torres et al. (2011) analysed available whaling records for sperm whales and found no evidence of large-scale changes in seasonal distributional patterns.

Pygmy sperm whales (*Kogia breviceps*) The pygmy sperm whales are reported to stay in deeper water off the continental shelf, apparently not approaching as close inshore (Bannister et al. 1996; Ross 1984). The SPRAT distribution map (DoEE, 2018h) suggests the species or species habitat may be located in the deeper waters east of Tasmania up towards the Victoria/NSW border on the east of the Activity and Oil EMBA.

Short-finned pilot whales (*Globicephala macrorhynchus*) occur in tropical (22-32oC) to temperate (10–22 °C) oceanic waters (DoEE, 2018k), generally at the edge of the continental shelf and over deep submarine canyons (Carwardine, 1995), although they may also approach coastal seas (Culik 2003). They feed mainly on squid, cuttlefish, octopus and some fish. Inshore-offshore movements are probably determined by the timing of squid spawning (outside the squid season Short-finned Pilot Whales are usually found offshore) (Culik 2003). Generally nomadic, with no known migration patterns, the distribution map in the SPRAT Database suggests it is possible short finned pilots could be present on the deeper eastern part of the Oil EMBA during the Gippsland MSS.

Long-finned pilot whale (*Globichephala melas*) is highly gregarious, usually travelling in small, socially cohesive groups of around 10–50 individuals but are also encountered in large herds of several hundred and occasionally of over 1,000 individuals (Bloch 1998; Zachariassen 1993). Mass strandings of long-finned pilot whales on Australian coasts have occurred on average once per year since 1970. All but three events have occurred between September and March, with 60% occurring from December to March (Ross 2006). This implies there may be extreme fluctuations in the numbers of long-finned pilot whales within Australian territorial waters, possibly due to seasonal onshore movements (Bannister et al. 1996). Some long-finned pilot whales appear to live permanently either offshore or inshore, while others make seasonal migrations, moving inshore in summer and autumn and offshore in winter and spring (Culik 2003). Given the distribution map in the species profile and Threats Database (DoEE, 2018m), it is possible long-finned pilot whales would be present in the Oil EMBA and possibly traverse the Operational Area during the Gippsland MSS.

Arnoux's beaked whales (*Berardius arnouxii*) are an oceanic species known from only five stranded specimens in Australia (South Australia, south-west Western Australia (two), Tasmania and the sub-Antarctic) ((DoEE, 2018n). Possible sightings of Arnoux's beaked whales inshore off South Australia and the south coast of NSW have also been recorded (Ross 2006). Most sightings have been made in the Tasman Sea and around the East Pacific Rise. No key localities are known in Australian waters (Bannister et al. 1996). Given this whale is a deep-water species primarily living off the continental shelf, it is not expected to be encountered in the Operational Area but could be present in the Oil EMBA (DoEE, 2018n).

Andrews beaked whale (*Mesoplodon bowdoini*) have a small head with a dolphin-like beak. No key localities are known in Australian waters (Bannister et al. 1996) and the whale is considered to have a southern, circumpolar distribution north of the Antarctic convergence, between 32° S and 54°30' S, preferring deep oceanic temperate waters between 10–20 °C. Records of Andrew’s beaked whale in Australian waters are from spring and summer, possibly related to a movement into warmer coastal waters for calving and mating

(Bannister et al. 1996). No information on habitat is available, although these whales are presumed to feed at depth on mid- and deep-water squid and fish (Bannister et al. 1996). Given the sparse reported sightings recorded, this whale is unlikely to be encountered during the survey but the SPRAT distribution map (DoEE, 2018x) suggests they may traverse the deeper waters on the eastern extremities of the Oil EMBA.

Several other beaked whales are listed in the PMST report as species or species habitat may occur within the area. These include the Blainville's beaked whale (*Mesoplodon densirostris*), Gingko-toothed beaked whale (*Mesoplodon ginkgodens*), Gray's beaked whale (*Mesoplodon grayi*), Hector's beaked whale (*Mesoplodon hectori*), Strap-toothed beaked whale (*Mesoplodon layardii*), True's beaked whale (*Mesoplodon mirus*) and Shepherd's beaked whale (*Tasmacetus shepherdi*). Each species was examined and only those of regional significance have been described in more detail above. The rest, due to small numbers of reported sightings in the region their likely habitats or distribution from November to June, are considered unlikely to be encountered in the Operational Area

4.5.9.2.3 Dolphins

Killer whales (Orcinus orca) are the largest member of the dolphin family. The killer whale is listed as ‘migratory’ under the EPBC Act and is noted as the most cosmopolitan of all cetaceans and may be seen in any marine region. The species is most common in coastal waters and cooler regions where biological productivity is high and are most abundant in the Antarctic south of 60° S, as well as being regularly reported in Australian waters (DOEE 2018e).

In Australia they are recorded from all states, with concentrations reported around southern Western Australia, Victoria and around Tasmania (DOEE 2018). Sightings are also frequent in South Australia (Ling 1991). Killer whales are more common in cold, deep waters but have often been observed along the continental slope and shelf particularly near seal colonies (Bannister et al. 1996). In Victoria, sightings peak in June/July, where they have been observed feeding on sharks, sunfish, and Australian fur seals (Mustoe 2008). The breeding season is variable, and the species moves seasonally to areas of food supply (Bannister et al. 1996; Morrice et al. 2004). The SPRAT distribution map (DoEE, 2018) suggests killer whales could traverse the Activity and Oil EMBA.

Dusky dolphins (*Lagenorhynchus obscurus*) predominantly occur in temperate subantarctic zones inshore around New Zealand but can also be pelagic at times (Bannister et al. 1996). In Australia, they are known from only 13 reports since 1828 (DoEE, 2018p), with two sightings in the early 1980s (Bannister et al. 1996). They occur across southern Australia from Western Australia to Tasmania (Gill et al. 2000), with unconfirmed sightings south of continental Australia but confirmed sightings near Kangaroo Island, South Australia, and off Tasmania, and a recent stranding in the latter state. It is considered unlikely that groups would be encountered during the survey but the SPRAT distribution map (DoEE, 2018p) suggests they may traverse the Oil EMBA.

Bottlenose dolphins (*Tursiops truncatus*) have a worldwide distribution from tropical to temperate waters and are generally found in coastal, estuarine, pelagic and oceanic habitats. There are two forms of bottlenose dolphin, a nearshore form and an offshore form. The nearshore form occurs off the southern coast of Australia (DoEE 2018). Most populations are relatively discrete and reside primarily in one area, such as individual resident populations in Port Phillip Bay and Westernport Bay, in Victoria. (DoEE 2018d).

4.5.9.2.4 Common dolphin

Common dolphins are an abundant species, widely distributed from tropical to cool temperate waters, and have been recorded in waters off all Australian states and territories. They generally occur further offshore than bottlenose dolphins, although small groups may venture close to the coast and enter bays and inlets. Stranding statistics indicate that common dolphins are active in Bass Strait year-round, though less so in winter (DoEE 2015).

Risso’s dolphin (Grampus griseus) is a widely distributed species, usually gregarious, living in groups of 25 to several hundred individuals although they may also be solitary (Leatherwood & Reeves 1983). They are found in deep waters of the continental slope and outer shelf from the tropics to temperate regions. Risso’s dolphins prefer warm temperate to tropical waters with depths greater than 1000 m, although they do sometimes extend their range into cooler latitudes in summer (Bannister et al. 1996).

In Australia, Risso's dolphins been recorded from all states except Tasmania and the Northern Territory. Fraser Island (off the southern Queensland coast) has the only suspected 'resident' population in Australia (Bannister et al. 1996). There are no known calving areas in Australian waters.

4.5.9.2.5 Seals

The Australian sea lion is not found in Bass Strait, and unlikely to be encountered in the vicinity of the Gippsland MSS activities according to the SPRAT database. Two seal species, the Australian fur seal (*Arctocephalus pusillus*) and the New Zealand fur seal (*Arctocephalus forsteri*) occur in Bass Strait. Both species are listed under the EPBC Act. A recovery plan for the Australian fur seal is in final draft and not currently available.

Critical habitat for Australian seals comprises breeding colonies and waters adjacent to breeding colonies on the Australian mainland, favoured feeding places of seals and the vicinity of fishing vessels and fishing nets. Identified threatening processes include direct killing, interaction with fisheries, entanglement, oil spills and chemical contaminants, disturbance by aircraft, vessels and humans, tourism, disease, seismic survey activity and climate change.

4.5.9.2.6 Australian fur seal

The Australian fur seal has a relatively restricted distribution around the islands of Bass Strait, parts of Tasmania and southern Victoria. The Australian fur seal has established breeding areas on islands in Bass Strait (Kirkwood et al. 2006). There are ten established breeding colonies of Australian fur seals that are restricted to islands in the Bass Strait (Figure 14 and Figure 15); six off the coast of Victoria and four off the coast of Tasmania. The largest established colonies are at Lady Julia Percy Island, west of Wilsons Promontory, (26% of the breeding population) and at Seal Rocks (25% of the breeding population), in Victoria; though, pup numbers declined by 11.6% and 5.3% per annum at these colonies, respectively, between censuses in 2007 and 2013 (McIntosh et al. 2018). Moriarty Rocks, Tenth Island, Judgement Rocks, West Moncoeur and Reid Rocks Nature Reserves are significant as Tasmania's only Australian fur seal breeding colonies, which provide approximately half the global habitat for the species (Kirkwood et al. 2010).

Other breeding colonies in Bass Strait include (Kirkwood et al. 2009, Shaughnessy 1999; OSRA):

- Rag Island (1,500 total in 2007; 277 pups in 2007 and 295 pups in 2013)
- Kanowna Island (15,000 adults in 2007; 2,913 pups in 2007 and 2,430 pups in 2013)
- Judgment Rock in the Kent Island Group (2,387 pups in 2007 and 1,710 pups in 2013).

The nearest breeding colonies to the operational area are Rag Island, Kanowna Island (off Wilsons Promontory) and Judgement Rocks in Tasmania. There have been a number of sightings along the coastline of Lakes Entrance near rocky shore islands, coupled with flat open terrain. Satellite tracking of seals from both Kanowna Island and the Skerries has shown that Australian fur seals commonly occur in the Gippsland Basin (Arnould and Kirkwood 2008). Seals are frequently seen resting and foraging on the Bass Strait oil and gas platform structures and are likely to be encountered in the shallower areas of the operational area, especially given the proximity of haul-out sites at White Rocks and Rag Island immediately east of the wind farm area.

Preferred habitat, especially for breeding, is a rocky island with boulder or pebble beaches and gradually sloping rocky ledges. Australian fur seals are present in the region all year. Pups begin to forage in June/July and are generally weaned by September/October (Shaughnessy 1999). Australian fur seals are also regularly seen resting and foraging on and around the petroleum production platforms off the Gippsland coast.

Australian fur seal haul-out sites occur around the southern coast of Australia, with the northernmost site at Steamers Head, near Jervis Bay, NSW (Burleigh et al. 2008). In Bass Strait, haul-out sites include (Barton et al. 2012; Carlyon et al. 2011):

- White Rock and Rag Island
- Beware Reef (where seals are present most of year)
- Gabo Island (a haul-out site for 30–50 individuals)
- Hogan Island group (a haul-out site for around 300 individuals).

During the summer months, Australian fur seals travel between northern Bass Strait islands along the Tasmania east coast to their destination in southern Tasmania waters, although lactating female fur seals and some territorial males are restricted to foraging ranges within Bass Strait waters (Shaughnessy 1999). Male Australian fur seals are bound to colonies during the breeding season from late October to late December, and outside of this they time forage further afield (up to several hundred kilometres) and are away for long periods (Hume et al. 2004; Kirkwood et al. 20010).

4.5.9.2.7 New Zealand fur seal

New Zealand fur seals (also known as long-nosed fur seals), *Arctocephalus forsteri*, are mostly found in central South Australian waters (Kangaroo Island to South Eyre Peninsula); 77% of their population is found there (Shaughnessy 1999). They prefer the rocky parts of islands with jumbled terrain and boulders, and prefer smoother igneous rocks over rough limestone.

New Zealand fur seals feed on small pelagic fish, squid and seabirds, including little penguins (Shaughnessy 1999). Juvenile seals feed primarily in oceanic waters beyond the continental shelf, lactating females feed in mid-outer shelf waters (50–100 km from the colony) and adult males forage in deeper waters (DoEE 2018).

Most breeding sites for the New Zealand fur seals in Australian waters are outside Victoria, with only lower density breeding areas in Victoria (Shaughnessy 1999). New Zealand fur seals breeding locations in Victoria occur at Rag Island, Kanowna Island and the Skerries (Kirkwood et al. 2009) (Figure 14 and Figure 15). Haul outs include Beware Reef Kanowna Island, the Hogan Islands Group West Moncoeur Island (near Wilson’s Promontory). Breeding colonies in the Bass Strait include (Shaughnessy 1999; OSRA mapping):

- Rag Island (1,000 adult fur seals and 235 pups in 2006)
- Kanowna Island (10,700 adults and 2,700 pups)
- Anser Group of Islands
- Judgment Rock in the Kent Island Group (2,500 pups per year, Kirkwood et al. 2009).

During the non-breeding season (November to January), the breeding sites are occupied by pups/young juveniles while adult females alternate between the breeding sites and foraging at sea (Shaughnessy 1999).

New Zealand fur seal haul-out sites occur around the southern coast of Australia, with the northernmost site at Steamers Head, near Jervis Bay, NSW (Burleigh et al. 2008). In Bass Strait (Figure 1.9) haul-out sites include (Barton et al. 2012; OSRA mapping):

- Beware Reef, a haul-out for approximately 300 individuals
- Hogan Islands Group
- West Moncoeur Island (near Wilsons Promontory).

They could be encountered in the Activity and Oil EMBAs, in the shallow coastal waters and possibly around the Eden Upwelling.

4.5.10 Birds

4.5.10.1 Seabirds

There are 38 birds listed under the EPBC Act that may occur in the Oil EMBA (Table 4.9). Twenty-four of these are listed as Threatened and 23 are listed as Migratory. Many are protected by international agreements (Bonn Convention, JAMBA, CAMBA and ROKAMBA) and they periodically pass through the Gippsland Basin on their way to or from the Bass Strait islands and mainlands of Victoria and Tasmania.

RPS

The Victorian coast and neighbouring islands provide feeding and nesting habitats for many coastal and migratory bird species. Seabirds spend much of their lives at sea in search of prey only to return for a short time to breed and raise chicks. Most species tend to forage on their own, though large feeding flocks will gather at rich or passing food sources. Squid, fish and krill are common sources of food.

Bass Strait islands are nesting sites for many seabird species, many of which migrate to these islands each year. Colonies of seabirds occur to the west of the Operational Area in Corner Inlet and on the islands around Wilsons Promontory, and to the east at the Skerries, Tullaberga Island and Gabo Island (Harris & Norman 1981). Species that nest and breed on these islands include the little penguin (*Eudyptula minor*), white-faced storm petrel (*Pelagodroma marina*), short-tailed shearwater (*Puffinus tenuirostris*), fairy prion (*Pachyptila turtur*), common diving petrel (*Pelecanoides urinatrix*), black-faced cormorants (*Phalacrocorax fuscescens*), and the pacific gull (*Larus pacificus*). Eastern Bass Strait is also a foraging area for at least 15 species of albatross, three species of petrel and one species of skua.

Table 4.9 MNES listed seabird species or species habitat with BIAs that may occur within the Oil EMBA

Scientific name	Common name	EPBC Act status			BIA within Oil EMBA	Relevant plan
		Listed threatened species	Listed migratory marine species	Type of presence		
Albatrosses (family Diomedeidae)						
Diomedea antipodensis	Antipodean albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC 2011c)
Diomedea epomophora	Southern royal albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	-	
Diomedea exulans	Wandering albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Diomedea gibsoni	Gibsons albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area		
Diomedea sanfordi	Northern royal albatross	Endangered	Yes	Foraging, feeding or related behaviour likely to occur within area	-	
Phoebetria fusca	Sooty albatross	Vulnerable	Yes	Species or species habitat likely to occur within area	-	
Thalassarche bulleri	Buller's albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Thalassarche eremita	Chatham albatross	Endangered	Yes	Foraging, feeding or related behaviour likely to occur within area	-	
Thalassarche cauta	Shy albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Thalassarche steadi	White-capped albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	

Scientific name	Common name	EPBC Act status			BIA within Oil EMBA	Relevant plan
		Listed threatened species	Listed migratory marine species	Type of presence		
Thalassarche chrysostoma	Grey-headed albatross	Endangered	Yes	Species or species habitat may occur within area	-	
Thalassarche carteri	Indian yellow-nosed albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Thalassarche impavida	Campbell albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Thalassarche melanophris	Black-browed albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	
Thalassarche salvini	Salvin's albatross	Vulnerable	Yes	Foraging, feeding or related behaviour likely to occur within area	-	
Cormorants (family Accipitridae)						
Phalacrocorax fuscescens	Black-faced cormorant	-	-	Foraging, feeding or related behaviour likely to occur within area	Yes	-
Eagles (family Accipitridae)						
Haliaeetus leucogaster	White-bellied sea-eagle	-	-	Species or species habitat may occur within the area	-	-
Aquila audax fleayi	Wedge-tailed eagle	Endangered	-	Species or species habitat may occur within the area	-	-
Ospreys (family Accipitridae)						
Pandion haliaetus	Osprey	-	Yes	Species or species habitat may occur within the area	-	-
Terns (family Laridae)						
Sternula nereis nereis	Australian fairy tern	Vulnerable	-	Breeding known to occur within area	-	-
Sterna albifrons	Little tern	-	Yes	Breeding known to occur within area	-	-
Sterna bergii	Crested tern	-	-	Breeding known to occur within area	Yes	-
Sterna caspia	Caspian tern	-	-	Breeding known to occur within area	-	-
Gannets (family Sulidae)						
Morus serrator	Australasian gannet	-	-	Breeding known to occur within area	-	-
Penguins (family Spheniscidae)						
Eudyptula minor	Little penguin	-	-	Breeding known to occur within area	Yes	-

RPS

Scientific name	Common name	EPBC Act status			BIA within Oil EMBA	Relevant plan
		Listed threatened species	Listed migratory marine species	Type of presence		
Petrels, prions and shearwaters (family Procellariidae)						
Ardenna carneipes	Flesh-footed shearwater	-	Yes	Breeding known to occur within area	Yes	-
Ardenna tenuirostris	Short-tailed shearwater	-	Yes	Breeding known to occur within area	Yes	-
Ardenna pacifica	Wedge-tailed shearwater	-	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	-
Fregetta grallaria grallaria	White-bellied storm-petrel	Vulnerable	-	Species or species habitat likely to occur within area	Yes	Lord Howe Island Biodiversity Management Plan (DECC 2007)
Halobaena caerulea	Blue petrel	Vulnerable	-	Species or species habitat may occur within area	-	Conservation Advice *Halobaena caerulea* blue petrel (TSSC 2015c)
Macronectes giganteus	Southern giant petrel	Endangered	Yes	Foraging, feeding or related behaviour likely to occur within area	Yes	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC 2011c)
Macronectes halli	Northern giant petrel	Vulnerable	Yes	Species or species habitat may occur within area	Yes	-
Pachyptila turtur subantarctica	Southern fairy prion	Vulnerable	-	Species or species habitat may occur within area	-	Conservation Advice *Pachyptila turtur subantarctica* fairy prion (southern) (TSSC 2015d)
Pachyptila turtur	Fairy prion	-	-	Species or species habitat may occur within area	-	
Pterodroma leucoptera leucoptera	Gould's petrel	Endangered	-	Breeding known to occur within area	Yes	Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan (DEC 2006)
Pterodroma mollis	Soft-plumaged petrel	Vulnerable	-	Breeding known to occur within area	Yes	Conservation Advice *Pterodroma mollis* soft-plumaged petrel (TSSC 2015f)
Swifts (family Apodidae)						
Apus pacificus	Fork-tailed swift	-	Yes	Species or species habitat likely to occur within area	-	-
Skua (family Stercorariidae)						
Catharacta skua	Great skua	-	-	Species or species habitat may occur within area	-	-

1 Listed threatened species: A native species listed in Section 178 of the EPBC Act as either extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent.
2 Listed migratory species: A native species that from time to time are included in the appendices to the Bonn Convention and the annexes of JAMBA, CAMBA and ROKAMBA, as listed in Section 209 of the EPBC Act.

RPS

4.5.10.2 Albatrosses and giant petrels

The National recovery plan for threatened albatrosses and giant petrels 2011–2016 (DSEWPaC 2011) lists the key critical habitat for the southern giant petrel as breeding and foraging habitats, particularly below 25°S. Due to the absence of nesting habitat within the Activity and Oil EMBAs to support this species, it is likely that presence will be restricted to birds transiting through and foraging in the area, and therefore limited to individuals.

The key threats to albatrosses and giant petrels are impacts at their breeding sites (including feral animals), marine pollution and debris, impacts from longline fishing and trawling, ingestion of hooks and plastics, intentional shooting/killing, and collisions with gear used on fishing boats (DSEWPaC 2011). There are 15 species of albatrosses and two species of giant petrel which are listed as Threatened and Migratory. Albatrosses and giant petrels breed at only six localities under Australian jurisdiction (DSEWPaC 2011). These are

- Macquarie Island (including Bishop and Clerk islets) (wandering albatross, black-browed albatross, grey-headed albatross, southern giant petrel, northern giant petrel)
- Albatross Island (shy albatross)
- Pedra Branca (shy albatross)
- Mewstone (shy albatross)
- Heard and McDonald islands (black-browed albatross, southern giant petrel)
- Australian Antarctic Territory (Giganteus Island, Hawker Island and the Frazier islands (Nelly Island, Dewart Island and Charlton Island)) (southern giant petrel).

Albatross Island is the closest locations to the Operational Area and is over 260 km away. It is possible that albatrosses and giant petrels will be encountered foraging in the Activity and Oil EMBAs.

The southern royal albatross breeds on Campbell Island and in the Auckland Islands (NZ) (Pizzey & Knight 1999). It is migratory, and during the non-breeding season, it has a wide and possibly circumpolar distribution, (Robertson & Kinsky 1972, moderately common throughout the year in offshore waters of southern Australia, mostly off south-eastern NSW, Victoria and Tasmania. Off South Australia, they are mostly seen May to September (Pizzey & Knight 1999). It feeds pelagically (in the open ocean) primarily on squid and fish (Marchant & Higgins 1990).

The northern royal albatross ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia (DSEWPaC 2011). It feeds regularly in Tasmanian and South Australian waters, and less frequently in NSW waters (Garnett & Crowley 2000). Most (99%) breed at the Chatham Islands where there is an estimated breeding population of 6500 to 7000 pairs. There is a projected total population of 20,000 individual birds (DSEWPaC 2011).

Antipodean albatrosses are endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW (Elliott & Walker 2005; Garnett & Crowley 2000).

The Tristan albatross has a length of 110 cm and a wingspan of approximately 3.5 m. They are very similar in plumage to the wandering albatross. The “at sea” distribution of this species is yet to be defined. There is currently only one definitive record from Australian waters (DSEWPaC 2011).

Gibson’s albatross has been recorded foraging between Coffs Harbour, NSW, and Wilson’s Promontory, Victoria (Garnett & Crowley 2000). There are no breeding colonies in Australian territory. This albatross visits Australian waters while foraging and during the non-breeding season (Environment Australia 2001).

The wandering albatross breeds on Macquarie Island (DSEWPaC 2011; Marchant & Higgins 1990). A single breeding pair has also been recorded on Heard Island (Woehler 1991). It feeds in Australian portions of the Southern Ocean (Nicholls et al. 1997) mainly in pelagic, offshore and inshore waters, hunting squid and fish, but also crustaceans and carrion (Marchant & Higgins 1990).

The sooty albatross has sometimes been observed foraging in inshore waters in southern Australia (Thiele 1977). It is a rare, but probably regular migrant to Australia, mostly in the autumn to winter months, occurring north to south-east Queensland, NSW, Victoria, Tasmania and South Australia (Pizzey & Knight 1999).

Buller's albatross breed in New Zealand (Snares, Solander and Chatham Islands), but are regular visitors to Australian waters. They are frequently seen off the coast from Coffs Harbour, south to Tasmania and west to Eyre Peninsula (Blakers et al. 1984; Stahl et al. 1998), however, some of these birds may be the Pacific albatross (DSEWPaC 2011). Buller's albatross are most common off south-east Tasmania between January–April (Environment Australia 2001). This species does not appear to be as strongly associated with fishing boats as other albatrosses (Marchant & Higgins 1990).

Shy Albatrosses appear to occur over all Australian coastal waters below 25° S. It is most commonly observed over the shelf waters around Tasmania and south-eastern Australia (Barton 1979; Blakers et al.1984; Tickell 2000). It appears to be less pelagic than many other albatrosses, ranging well inshore over the continental shelf, even entering bays and harbours (del Hoyo et al. 1992).

Salvin's albatross breeds on Bounty, Snares and Chatham Islands, south of New Zealand, as well as on Crozet Island in the Indian Ocean (Gales 1998). The species forages over most of the southern Pacific Ocean, where it is particularly common in the Humboldt Current, off South America. There are small numbers in the Indian Ocean and sometimes in the South Atlantic Ocean (Marchant & Higgins 1990). It is a non-breeding visitor to Australian waters.

The grey-headed albatross breeds on the southern and western flanks of Petrel Peak, Macquarie Island (Copson 1988). Breeding and non-breeding birds disperse widely across the Southern Ocean, at more southerly latitudes in summer than in winter, when they frequent the waters off southern Australia and New Zealand (Marchant & Higgins 1990; Waugh et al. 1999). Most Australian records come from south and west of Tasmania, and occasionally in Victorian waters.

Breeding for the Chatham albatross is restricted to Pyramid Rock, Chatham Islands, off the coast of New Zealand (Gales 1998). The principal foraging range for this species is in coastal waters off eastern and southern New Zealand, and Tasmania (DSEWPaC 2011; Marchant & Higgins 1990). It is a rare vagrant to south-east Australian waters (Marchant & Higgins 1990).

The black-browed albatross breeds within Australian jurisdiction on Heard Island (Kirkwood & Mitchell 1992; Woehler 2006; Woehler et al. 2002), McDonald Islands (Gales 1998; Woehler 2006; Woehler et al. 2002), Macquarie Island (Copson 1988; Gales 1998; Scott 1994) and Bishop and Clerk Islets (Scott 1994; Gales 1998). During this time, the species is an uncommon visitor to the continental shelf-break of southern Australia – reaching South Australia, Tasmania and western and eastern Bass Strait in the south-east and Antarctica (Reid et al. 2002; Terauds et al. 2006; Woehler et al. 2002). The population migrates northward towards the end of the breeding season (Brooke 2004; Marchant & Higgins 1990; Reid et al. 2002; Tickell 2000; Woehler et al. 2002) and the species is common in the non-breeding period at the continental shelf and shelf-break of South Australia, Victoria, Tasmania, western and eastern Bass Strait and NSW (Barrett et al. 2003; Barton 1979; Blakers et al. 1984; Marchant & Higgins 1990; Milledge 1977; Reid et al. 2002; Tickell 2000; Woehler et al. 2002; Wood 1992).

The Campbell albatross is a non-breeding visitor to Australian waters. Non-breeding birds are most commonly seen foraging over the oceanic continental slopes off Tasmania, Victoria and New South Wales (DSEWPaC 2011). After breeding, birds move north and may enter Australia's temperate shelf waters (Marchant & Higgins 1990).

The southern giant petrel is widespread throughout the Southern Ocean (Woehler et al. 2001). It breeds on six subantarctic and Antarctic islands in Australian territory (DSEWPaC 2011; Woehler et al. 2001). In summer, it predominantly occurs in subantarctic to Antarctic waters. The winter dispersal is circumpolar, extending north from 50° south to the Tropic of Capricorn (23° south) and sometimes beyond these latitudes. The waters off south-eastern Australia may be particularly important wintering grounds (Marchant & Higgins 1990). In south-eastern Australia, birds (mostly immatures) were recorded in all months except February, but most were recorded between June and December (Reid et al. in press).

The northern giant petrel breeds in the sub-Antarctic, and visits areas off the Australian mainland mainly during the winter months (May to October). Immature and some adult birds are commonly seen during this period in offshore and inshore waters from around Fremantle (WA) to around Sydney (NSW) (Pizzey & Knight 1999). Banded birds from Macquarie Island are frequently observed in Australian waters (particularly along the southern coast) throughout the colder months, the majority of which (94%) are pre-breeding birds (Environment Australia 2001).

4.5.10.3 Other birds

Bass Strait islands are nesting sites for many seabird species, many of which migrate to these islands each year. Colonies of seabirds occur to the west of the project area in Corner Inlet and on the islands around Wilsons Promontory, and to the north east at Tullaberga Island and Gabo Island. Species that nest and breed on these islands include the little penguin (*Eudyptula minor*), white-faced storm petrel (*Pelagodroma marina*), short-tailed shearwater (*Puffinus tenuirostris*), fairy prion (*Pachyptila turtur*), common diving petrel (*Pelecanoides urinatrix*), black-faced cormorants (*Phalacrocorax fuscescens*), white-fronted tern (*Sterna striata*) and the pacific gull (*Larus pacificus*).

The little penguin is an EPBC listed and migratory species with a BIA in the wider region. Over 270,000 breeding pairs are estimated for the Furneaux Islands (Woehler 2013). It may be encountered given distant populations on Babel, Betsy, Forsyth and similar Bass Straits islands near Tasmania; however, the Operational Area is outside of the foraging ranges.

The short-tailed shearwater is an EPBC listed and migratory species with a BIA in the wider region. It has a large breeding population in the Furneaux Islands (approximately seven million breeding pairs) (Woehler 2013). It is likely to be encountered in the Activity and Oil EMBAs while foraging.

The wedge-tailed shearwater is an EPBC listed and migratory species with a BIA in the wider region. It is a pelagic, marine bird known from tropical and subtropical waters. The species tolerates a range of surface-temperatures and salinities, but is most abundant where temperatures are greater than 21 °C and salinity is greater than 34.6%. In tropical zones, the species may feed over cool nutrient-rich waters. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope with sea-surface temperatures of 13.9–24.4 °C (Drummond 1985; Reid et al. 2002) and usually off the continental shelf in north-west Australia (Marchant & Higgins 1990). It may be encountered in both EMBAs, but is not expected to be present in large numbers.

The white-faced storm petrel is an EPBC listed species with a BIA in the wider region. It is listed as Vulnerable on the Advisory List of Threatened Vertebrate Fauna in Victoria: 2013 list. It has an extremely large range. It breeds on remote islands in the South Atlantic, such as Tristan da Cunha (St Helena to UK) and is also known to breed at Tullaberga Island and the Furneaux Islands (approximately 60,000 breeding pairs – Woehler 2013), approximately 170 km to the east-north-east and 140 km to the south, respectively, of the Operational Area. The status of storm petrels at Tullaberga Island is currently unknown (Underwood & Bunce 2005). It may be encountered in both EMBAs but is not expected to be present in large numbers.

The common diving petrel (*Pelecanoides urinatrix*) is an EPBC listed species with a BIA in the wider region. It is listed as Near Threatened under the Advisory List of Threatened Vertebrate Fauna in Victoria: (2013 list). Common diving petrels nest on coastal plains and slopes on cliff edges and behind stable dunes. They nest in burrows or tunnels 25–150 cm long, 0.2–1.0 m deep and with an entrance 5–8 cm in diameter. They are widely distributed over southern Australian and New Zealand waters. They have been recorded breeding during winter months (June–July) throughout the Seal Islands Group (east of Wilsons Promontory) (Schumann et al. 2008). As the survey is outside of the breeding season, it is expected that only foraging birds may be encountered in both EMBAs.

The white-bellied storm petrel (Tasman Sea) breeds on small offshore islets and rocks in the Lord Howe Island group, including Roach Island and Balls Pyramid (Baker et al. 2002; Hutton 1991; Mayr & Cottrell 1979; McAllan et al. 2004). It has also been recorded over near-shore waters off the coasts of Queensland (Palliser 1985), NSW (Cooper 1989; Holmes 1977; Lindsey 1985) and Tasmania (Atlas of Australian Birds 2018). It could possibly be encountered during the survey and in the Oil EMBA.

The blue petrel has been recorded off the Australian coast between East Gippsland in Victoria and the Perth area of Western Australia. It is recorded regularly in small numbers in Victoria and Tasmania, and occasionally in NSW. It occurs predominantly between July and September in Australia Marchant & Higgins 1990). The Australian breeding population of the Blue Petrel is between 500 and 600 pairs, which all breed on offshore stacks around Macquarie Island (Brothers 1984). It could possibly be encountered during the survey and Oil EMBA.

The osprey is considered moderately common in Australia (Olsen 1998). The species is most abundant in northern Australia, where high population densities occur in remote areas (Garnett 1993; Johnstone & Storr 1998). It has been recorded in coastal areas around much of Australia (DotE 2013f). It could possibly be encountered during the survey and Oil EMBA.

The flesh-footed shearwater is a locally common visitor to waters of the continental shelf and continental slope off southern Australia (south-western Western Australia to south-eastern Queensland) (DoE 2013g). They breed on 41 islands off the coast of south-western Western Australia (Burbidge & Fuller 1996), on Smith Island off the south-eastern coast of Eyre Peninsula in South Australia (Robinson et al. 1986) and on Lord Howe Island (Priddel et al. 2006). It could possibly be encountered during the survey and Oil EMBA.

The white-fronted tern is an EPBC listed species with a BIA (breeding and foraging) in the wider region of Flinders, Cape Barren and Clarke Islands off north-eastern Tasmania (Threatened Species Section 2014). This species is the most common tern of New Zealand with a conservation status of Least Concern under the IUCN. Juvenile birds may winter in south-eastern Australia. They may be encountered in both EMBAs.

4.5.10.4 Shorebirds

Shorebirds are only noted as potential visitors to the Oil EMBA. Also known as waders, they are members of the order Charadriiformes that inhabit intertidal areas of coastal and freshwater wetlands. Shorebirds are principally found along the shores of beaches, estuaries, rock platforms and wetlands, where they feed mainly on invertebrates taken from mud and other soft substrates. They tend to have long legs in relation to their body size, no webbing on their feet and do not swim.

Shorebird species listed as threatened and/or migratory in the EPBC Act PMST Report (Appendix B) are identified in Table 4.10. Migratory shorebirds are described together given that they follow a common pathway, arrive and depart during the same seasons, have similar habitat preferences and tend to congregate at a limited number of sites, often in mixed flocks. Migratory shorebirds associated with wetlands bordering on the Oil EMBA are unlikely to be affected by the planned activities, as the migratory pathway used by avian species is the east Asian flyway to the south of the Operational Area.

Migratory shorebirds make an annual return journey often of many thousands of kilometres between their breeding grounds in the northern hemisphere and their non-breeding grounds in the southern hemisphere (DoE 2015). Around two million migratory shorebirds travel from Arctic regions during the non-breeding season to feed at Australian coastal and freshwater wetlands each year (DoEE 2016). The migratory shorebird populations that visit Australia travel along a similar pathway throughout their annual cycle known as the East Asian–Australasian Flyaway (EAAF) (Bamford et al. 2008). The EAAF extends from breeding grounds in the Russian tundra, Mongolia and Alaska southwards through east and south-east Asia, to non-breeding areas in Indonesia, Papua New Guinea, Australia and New Zealand (Bamford et al. 2008).

Migratory shorebirds are generally gregarious and congregate at Ramsar sites (such as Corner Inlet and Gippsland Lakes), gathering in mixed flocks, but also occur in single-species flocks or feed and roost with resident shorebird species such as stilts, avocets, oystercatchers and plovers. The DoE (2015b) Wildlife Conservation Plan for Migratory Shorebirds provides a framework to guide the conservation of migratory shorebirds and their habitat in Australia.

Migratory shorebird species are not expected to be present in the Operational Area but may be found around wetlands along the shoreline of the Oil EMBA (Table 4.10).

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Table 4.10 MNES listed shorebird species or species habitat bordering on or within the Oil EMBA

Scientific name	Common name	EPBC Act status			BIA on/ within Oil EMBA
		Listed threatened species	Listed migratory marine species	Type of presence	
Charadrius leschenaultii	Greater sand plover	Vulnerable	-	Roosting know to occur within area	Yes
Charadrius mongolus	Lesser sand plover	Endangered	-	Roosting know to occur within area	Yes
Thinornis rubricollis rubricollis	Hooded plover (eastern)	Vulnerable	-	Species or species habitat known to occur within area	Yes
Charadrius bicinctus	Double-banded plover		Yes	Roosting know to occur within area	Yes
Pluvialis fulva	Pacific golden plover		Yes	Roosting know to occur within area	Yes
Rostratula australis	Australian painted snipe	Endangered	-	Species or species habitat may occur within area	Yes
Limosa lapponica baueri	Bar-tailed godwit (baueri)	Vulnerable	-	Species or species habitat may occur within area	Yes
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit	Critically Endangered	-	Species or species habitat may occur within area	Yes
Numenius madagascariensis	Eastern curlew	Critically Endangered	-	Species or species habitat known to occur within area	Yes
Calidris Canutus	Red knot	Endangered	-	Species or species habitat know to occur within area	Yes
Calidris ferruginea	Curlew sandpiper	Critically Endangered	-	Species or species habitat know to occur within area	Yes
Calidris tenuirostris	Great knot	Critically Endangered	-	Roosting know to occur within area	Yes
Gallinago hardwickii	Latham's snipe		Yes	Roosting know to occur within area	Yes
Gallinago megala	Swinhoe's snipe		Yes	Roosting know to occur within area	Yes
Gallinago stenura	Pin-tailed snipe		Yes	Roosting know to occur within area	Yes
Limosa lapponica	Bar-tailed godwit		Yes	Species or species habitat known to occur within area	Yes
Numenius minutus	Little curlew		Yes	Roosting know to occur within area	Yes
Numenius phaeopus	Whimbrel		Yes	Roosting know to occur within area	Yes
Tringa brevipes	Grey-tailed tattler		Yes	Roosting know to occur within area	Yes
Tringa glareola	Wood sandpiper		Yes	Roosting know to occur within area	Yes
Tringa nebularia	Common greenshank		Yes	Species or species habitat known to occur within area	Yes

Scientific name	Common name	EPBC Act status			BIA on/ within Oil EMBA
		Listed threatened species	Listed migratory marine species	Type of presence	
Tringa stagnatilis	Marsh sandpiper		Yes	Roosting know to occur within area	Yes
Actitis hypoleucos	Common sandpiper		Yes	Species or species habitat known to occur within the area	Yes
Arenaria interpres	Ruddy turnstone		Yes	Roosting know to occur within area	Yes
Calidris acuminata	Sharp-tailed sandpiper		Yes	Roosting know to occur within area	Yes
Calidris alba	Sanderling		Yes	Roosting know to occur within area	Yes
Calidris melanotos	Pectoral sandpiper		Yes	Species or species habitat known to occur within the area	Yes
Calidris ruficollis	Red-necked stint		Yes	Roosting know to occur within area	Yes

The hooded plover (*Thinornis. rubricollis*) is listed as 'vulnerable' under the EPBC Act. This is a resident shorebird species that inhabits sandy beaches, consuming invertebrates (such as sandhoppers, small bivalves and soldier crabs) from the sand near the water's edge and laying eggs in sand dunes or upper beach areas. While not an abundant species, they do have a widespread distribution from Jervis Bay in NSW through to Perth in WA (Birdlife Australia 2015).

The lesser sand plover (*Charadrius mongolus*) is listed as 'endangered' under the EPBC Act. This migratory wader species occurs in coastal regions throughout Australia, feeding on invertebrates and insects in extensive, freshly exposed areas of intertidal sandflats and mudflats in estuaries or beaches.

The greater sand plover (*Charadrius leschenaultia*) is listed as 'vulnerable' under the EPBC Act and occurs in coastal areas in all states. The species generally feed from the surface of wet sand or mud on open intertidal flats consuming molluscs, worms and crustaceans. The species does not breed in Australia. Plovers are unlikely to be encountered in the vicinity of the Operational Area but may occur within the Oil EMBA.

The Australian painted snipe (*Rostratula benghalensis*) is listed as 'endangered' under the EPBC Act. This species has been recorded at wetlands in all states of Australia; but is most common in eastern Australia, with records throughout much of QLD, NSW, VIC and south-eastern SA. Australian painted snipes generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They are unlikely to be encountered in the vicinity of the Operational Area or within the Oil EMBA.

Two species of knots are included in Table 4.10; the red knot (*Calidris canutus*) and great knot (*C. tenuirostris*), listed as 'endangered' and 'critically endangered' migratory species under the EPBC Act, respectively. The great knot has been recorded in all states of Australia but the number of birds present in Victoria has shown a marked decline. The species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. The great knot does not breed in Australia.

The migratory wading red knot has been recorded in all states, typically inhabiting intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours. This species does not breed in Australia. These species are unlikely to be encountered in the vicinity of the Oil EMBA.

The curlew sandpiper (*Calidris ferruginea*) is listed as 'critically endangered' under the EPBC Act. In Australia, curlew sandpipers occur along the coast and are also quite widespread inland (though in smaller numbers). They mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, in both fresh and brackish waters. Curlew sandpipers have been recorded in all states but is widespread and common in coastal bays in VIC. This species does not breed in Australia. This species is unlikely to be encountered in the vicinity of the Operational Area but may occur within the Oil EMBA.

The eastern curlew (*Numenius madagascariensis*) is listed a 'critically endangered' under the EPBC Act. The eastern curlew has a primarily coastal distribution, with the species recorded in all states, particularly the north, east, and south-east regions including TAS. In VIC, they are mostly found around the Gippsland Lakes, from Corner Inlet to Port Phillip Bay, and on the far west coast. Eastern curlews are found on islands in Bass Strait and the north and east coasts of TAS. The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The eastern curlew does not breed in Australia. This species is unlikely to be encountered in the vicinity of the Operational Area but may occur within the Oil EMBA.

4.5.11 Plankton

Planktonic communities include phytoplankton (photosynthetic microalgae) and zooplankton (fauna). Phytoplankton are primary producers at the base of the food web which drive the energetics of the pelagic biosystem in the region (Bax and Williams, 2000). Most plankton drift with currents in the photic zone, although some species have the ability to migrate short distances using ciliary hairs. The waters off southeastern Australia have been shown to generally have low chlorophyll a concentrations compared with other areas of Australia but are characterised by seasonal spring blooms associated with elevated nutrients, temperature and sunlight (Bax and Williams, 2000).

Zooplankton include small crustaceans such as krill and fish larvae and eggs. More than 170 species of zooplankton have been recorded in the eastern and central Bass Straits with copepods making up approximately half of the species encountered (Watson & Chaloupka, 1982). They are also transported by currents, although some are motile and can influence their movement through vertical migration into differing water masses (CoA 2015). The early life stages of many commercial fish and crustacean species live as plankton before settling to the benthic habitat as juveniles or sub adults. Bax and Williams (200) showed that while zooplankton is generally lower off the Victorian coast in Bass Strait compared with waters off the NSW coast it can be highly patchy; most of their Victorian Euphausid samples had low densities compared with other nearshore and offshore areas but were interspersed with occasional higher densities.

The Upwelling East of Eden is an area of high productivity in which dynamic eddies of the East Australian Current cause episodic nutrient enrichment events that drive phytoplankton blooms that are the basis of a productive and diverse food web that includes zooplankton, krill and small pelagic fish at its base, and larger top order predators such as marine mammals, sharks and seabirds at higher levels. The Upwelling East of Eden is also one of two areas in southeastern Australia that blue and humpback whales have been recorded feeding (CoA 2015). The East of Eden upwelling is generally associated with the higher levels of productivity found off the southern NSW coast.

4.6 Socio-economic environment

The productive areas of east Gippsland have historically supported Aboriginal people, principally the Gunai (and/or Kurnai) people, and Europeans since the late 1890s. At that time, small-scale farming, gold mining, fishing and forestry were the most common livelihoods in small communities.

Currently the communities of East Gippsland are supported by (primary) industries including agriculture, fishing, tourism, retail, and oil and gas. Residential use has expanded along parts of the east Gippsland coast to support these industries with the 2016 census reporting around 45,000 residents in the East Gippsland Shire The population of Lakes Entrance is approximately 4810 residents (2016 census), who provide services to the coastal industries and surrounding farming communities. Marlo has a population of

560, increasing to around 2000 during the summer. Smaller communities occur at Orbost (approximately 2230) and along Ninety Mile Beach at Golden Beach (approximately 300), Pointt Hicks (approximately 350) and Seaspray (approximately 350).

4.6.1 Telecommunications, wind farm and outfalls

The Basslink HVDC Interconnector connects the 220 kV Tasmanian transmission network at George Town Substation with the 500 kV Victorian Transmission network at Loy Yang Substation. The total transmission length between the two substations is about 375 km, including 290 km of subsea cable. It enters the marine environment from McGaurans Beach roughly 15 km from the Operational Area (Figure 4.21). During consultation (Section Error! Reference source not found.) Basslink did not express any concerns with the activity as comparable studies (Centrica Morcombe Bay 2012). had shown vibrations are considered too low for any potential impacts

Consultation was also undertaken with the Department of Communications and the Arts (subcables@ communications.gov.au) and Telstra (environment@team.telstra.com). No concerns have been expressed (Section 9).

Offshore Energy is planning the development of Australia’s first offshore wind farm, 10 to 25 kilometres off the coast of Gippsland, near Port Albert in eastern Victoria, roughly 10 km from the Activity Area. The wind farm will include up to 250 turbines within a 574-square-kilometre area in Commonwealth waters. In June 2017 it was announced that the feasibility phase is expected to take another 3 years – hence no impacts from the Gippsland survey are forecast for 2018/19.

Gippsland Water operates two ocean outfalls (Delray Beach and at McGuarans Beach) which dispose of large volumes of highly saline treated wastewater.

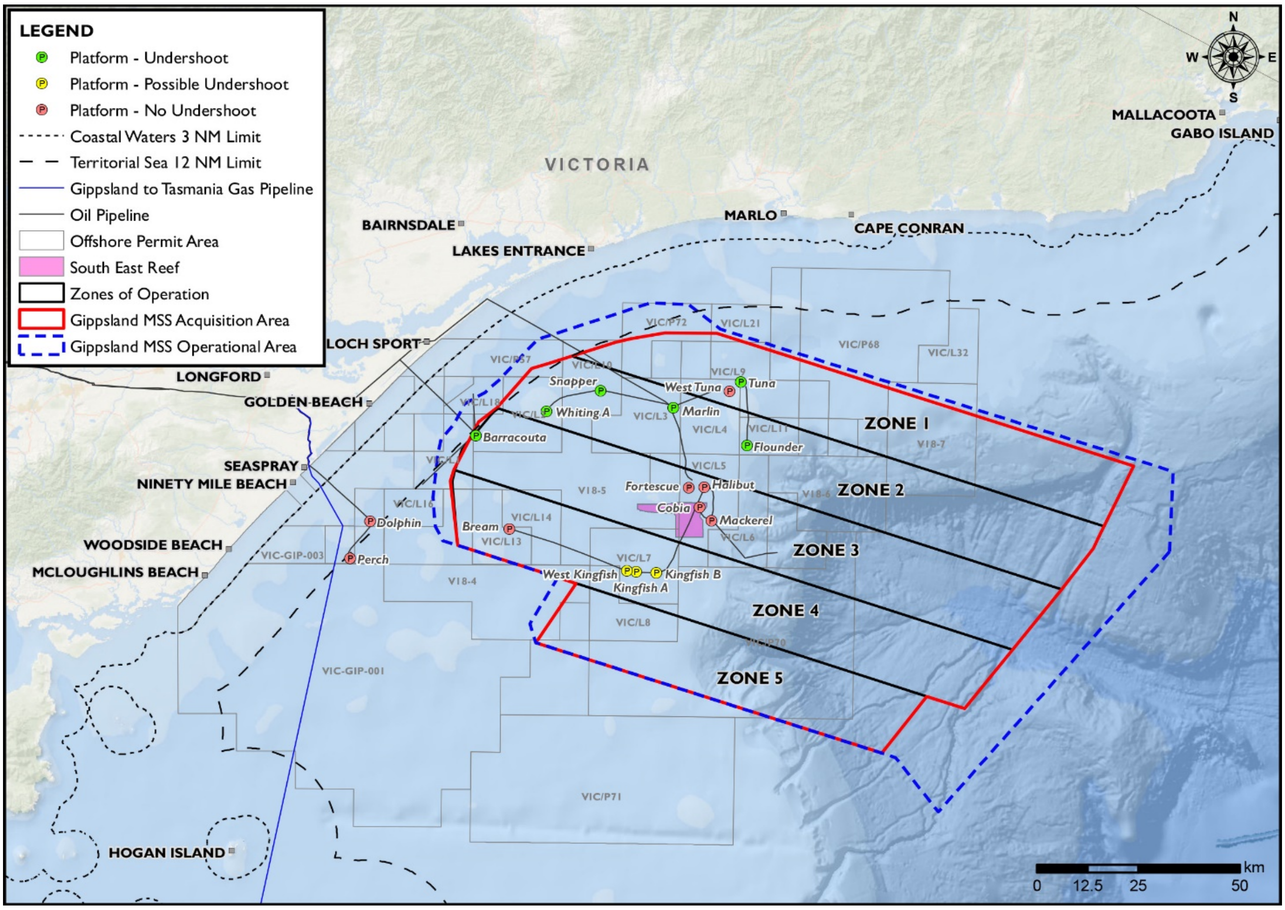


Figure 4.21 Marine infrastructure within the operational area

RPS

4.6.2 Oil and gas

The oil and gas industry is a significant stakeholder in the region. Exploration activities commenced in the late 1960s with a number of wells drilled in the Gippsland Basin. First production was from the Barracouta platform in 1969. Bass Strait has 17 developed offshore oil and gas fields; 24 offshore production facilities (platforms, mono-towers and subsea completions) and over 600 km of pipeline network. Onshore oil and gas processing facilities are located at both Longford and Orbost. Most of this infrastructure is operated by Esso Australia Resources Pty Ltd on behalf of the Gippsland Basin Joint Venture with BHP Billiton Limited.

There are a number of facilities and connecting pipelines within the Operational Area (Figure 4.21). These each have a 500 m exclusion zone around them.

The Operational Area encompasses a number of Greenhouse Gas (GHG) Assessment Permits and Petroleum titles. The platforms, facilities, permits and titles are listed in (Table 4.11). Consultation with the greenhouse and oil and gas industry largely around simultaneous operation, safety zones and undershooting requirements, is included in Section 9. Operators consulted include Emperor Energy, Carnarvon Hibiscus Pty Ltd, Cooper Energy, Llanberis Energy Pty Ltd, Esso Australia Resources Pty Ltd. and SGH Energy.

Table 4.11 Platforms (operators) and permits within the operational area

Permit	Type	Basin	Status	Operator
GGAP006386(V)	Exploration Permit	Gippsland	Granted	The Crown in Right of Victoria
V18-4	Gazettal	Gippsland	Available	N/A
V18-5	Gazettal	Gippsland	Available	N/A
V18-6	Gazettal	Gippsland	Available	N/A
V18-7	Gazettal	Gippsland	Available	N/A
VIC-GIP-001	Exploration Permit	Gippsland	Renewing	The Crown in Right of Victoria
VIC-GIP-002	Exploration Permit	Gippsland	Granted	The Crown in Right of Victoria
VIC-GIP-003	Exploration Permit	Gippsland	Granted	The Crown in Right of Victoria
VIC-GIP-004	Exploration Permit	Gippsland	Granted	The Crown in Right of Victoria
VIC/L1	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L10	Production Licence	Gippsland	Renewing	Esso Australia Resources Pty Ltd
VIC/L11	Production Licence	Gippsland	Renewing	Esso Australia Resources Pty Ltd
VIC/L13	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L14	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L15	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L16	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L17	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L18	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L19	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L2	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L20	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L21	Production Licence	Gippsland	Granted	Cooper Energy (PBF) Pty Ltd
VIC/L25	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L29	Production Licence	Gippsland	Granted	SGH Energy VICP54 Pty Ltd
VIC/L3	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd

Permit	Type	Basin	Status	Operator
VIC/L31	Production Licence	Gippsland	Granted	Carnarvon Hibiscus Pty Ltd
VIC/L32	Production Licence	Gippsland	Granted	Cooper Energy (Sole) Pty Ltd
VIC/L4	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L5	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L6	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L7	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L8	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/L9	Production Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/P43(V)	Exploration Permit	Gippsland	Granted	Petro Tech Pty Ltd
VIC/P44(V)	Exploration Permit	Gippsland	Granted	Petro Tech Pty Ltd
VIC/P47	Exploration Permit	Gippsland	Granted	Emperor Energy Ltd
VIC/P57	Exploration Permit	Gippsland	Granted	Carnarvon Hibiscus Pty Ltd;
VIC/P68	Exploration Permit	Gippsland	Granted	Bass Oil Ltd
VIC/P70	Exploration Permit	Gippsland	Granted	Esso Deepwater Gippsland Pty Ltd
VIC/P71	Exploration Permit	Gippsland	Granted	Llanberis Energy Pty Ltd
VIC/P72	Exploration Permit	Gippsland	Granted	Cooper Energy (MGP) Pty Ltd
VIC/RL1	Retention Licence	Gippsland	Granted	Esso Australia Resources Pty Ltd
VIC/RL13	Retention Licence	Gippsland	Granted	Cooper Energy Ltd
VIC/RL14	Retention Licence	Gippsland	Granted	Cooper Energy Ltd
VIC/RL15	Retention Licence	Gippsland	Granted	Cooper Energy Ltd
VIC/RL1(V)	Retention Licence	Gippsland	Granted	Cape Energy (Victoria) Pty Ltd
VIC/RL4	Retention Licence	Gippsland	Renewing	Esso Australia Resources Pty Ltd

4.6.3 Aboriginal heritage update

Aboriginal occupancy by the Gunai (and/or Kurnai) people pre-dates the time at which the sea reached its present level by many thousands of years; thus, many early hunting grounds are now under the sea. In the past, coastal wetlands were highly productive areas for hunter-gatherer people, having a variety of habitats and species, so the majority of archaeological sites in Victoria are found within 1 km of the coast (LCC 1993). Along the Gippsland coast, stone artefacts that have been found were mostly made from silcrete and quartz from the hinterland.

In the past, Aboriginal people from the area now known as Wilsons Promontory were likely to have visited offshore islands, particularly during summer when seals and mutton birds would have provided plentiful food sources coinciding with periods of calm weather, as evidenced by middens on offshore islands (Jones & Allen 1979).

In 2010, the Gurnaikurnai people entered into a settlement agreement with the Victorian and Commonwealth Governments under Victoria's Traditional Owner Settlement Act 2010. The agreement formally recognises the Gunaikurnai as traditional owners in Gippsland, granting them land rights to an area extending from west Gippsland near Warragul, east to the Snowy River, and north to the Great Dividing Range. It also includes 200 m of sea territory offshore and takes in 10 parks and reserves that will be jointly managed by traditional owners and the state government. The state entered into a Traditional Owner Land Management Agreement to establish a Gunaikurnai Land Management Board to manage jointly 10 national parks and reserves in their agreement area.

The Gippsland coastline has significant Aboriginal cultural heritage significance in terms of coastal fishing with fishing methods including hand gathering, lines, rods and reels, nets, traps and spears (DoE, 2015a). Aboriginal cultural heritage sites and objects areas along the coastline are listed in Victorian Aboriginal Heritage Register but not all information is available publicly.

Aboriginal shell middens along the coast include crustacean shells (e.g., rock lobster, crab) and shellfish. Such middens are sometimes found as dunes, banks or cliff tops are exposed and may contain charcoal from fires, and items such as bone and stone artefacts, and are often located within sheltered positions in the dunes, coastal scrub and woodlands.

Consultation has been initiated with the National Native Title Tribunal (NNTT), Aboriginal Victoria (AV), and the Gunaikurnai Land and Waters Aboriginal Corporation (GLWAC) as described in Section 9.0. Should vehicle access to parts of the beach be required under certain emergency circumstances, further engagement will be undertaken.

4.6.4 Historic shipwrecks

The Historic Shipwrecks Act 1976 protects historic wrecks and associated relics that are more than 75 years old, and those declared by the Minister, and in Commonwealth waters. A search of the Australian Historic Shipwrecks Database found two historic shipwrecks with a protection zone (a no-entry zone of 500-m radius around a particularly significant and/or fragile shipwreck), the Glenelg SS within the Operational Area in around 75m water depth and the Clonmel lying in about 5m water depth about 54km south west of the Operational Area near Corner inlet. Three other wrecks lie in the Operational Area.

The Eliza Davies and the Cambridge are noted as heritage sites in the Beagle Marine Park Management Plan both lying more than 70km south west. The Google Earth plugin revealed additional shipwrecks as listed in Table 4.12 and shown in Figure 4.22. The SS Trinculo, an iron sailing barque (1879) is located on the beach near Golden Beach.

Table 4.12 Shipwrecks in the Oil EMBA

Shipwreck ID number	Vessel name	Type of vessel	Year wrecked	Location
6360	*Leven Lass*	Unknown	1854	Off Gippsland Coast
6066	*City of Hobart*	Screw steamer	1877	111 km NE of Wilsons Promontory
6574	*Cambridge*	Screw steamer	1940	7 km SE of Wilsons Promontory
6700	*Unknown*	Unknown	unknown	40 km SE of Seaspray
6550	*Result*	Sailing vessel	1880	unknown
6547	*Rembrandt*	Sailing vessel	1861	Bass Strait off Ninety Mile Beach
6231	*Glenelg*	Screw steamer	1900	Near Lake Entrance
6151	*Eliza Davies*	Sailing vessel	1924	Bass Strait, 18 km east of Wilsons Promontory
6072	*Clonmel*	Paddle steamer	1841	SW tip of Clonmel Island
6018	*Blackbird*	Screw steamer	1878	S end of Clonmel Island
6482	*P.S. Thistle*	Schooner	1859	S of southern end of Clonmel Island

(Australian National Shipwreck Database https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/search.do)

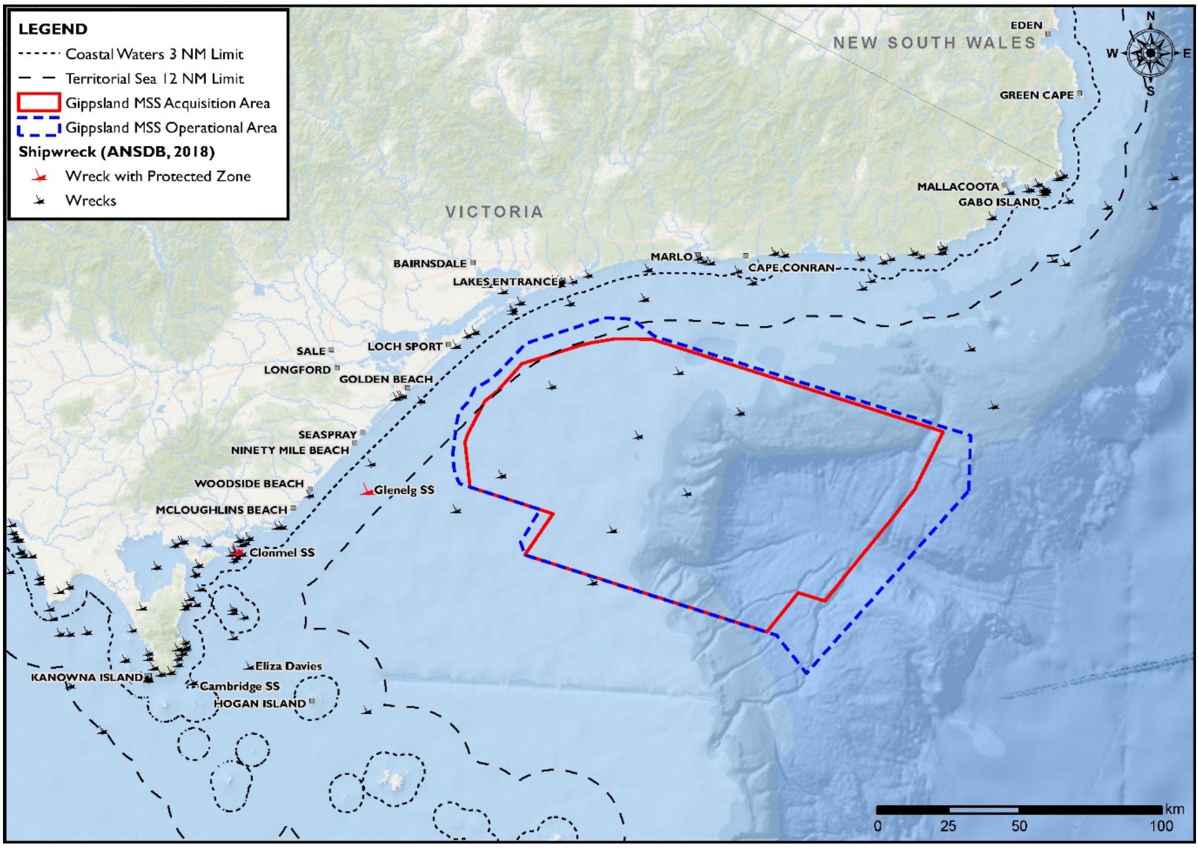


Figure 4.22 State and Commonwealth protected shipwrecks in the vicinity of the Gippsland MSS

4.6.5 Commercial fisheries

Commercial fishing in south-east Victoria includes inshore coastal waters (mainly state managed fisheries) and areas along the continental slope (mainly Commonwealth managed fisheries). The majority of the commercial fishing (volume basis) occurs in Commonwealth waters along the continental shelf and the upper continental slope. Commercial fisheries with jurisdictions overlapping the Operational Area are described in Appendix E. Those fisheries that are expected to be active within the Operational Area include:

- Commonwealth managed fisheries
  - Southern and Eastern Scalefish and Shark Fishery
    - Commonwealth Trawl Sector
    - Gillnet, Hook and Trap Sectors
    - Scalefish Hook Sector
  - Southern Squid Jig Fishery
- Victorian state managed fisheries
  - Rock Lobster Fishery
  - Scallop (Ocean) Fishery
  - Ocean (General) Fishery
  - Purse Seine (Ocean) Fishery
  - Inshore (Ocean) Trawl Fishery.

These fisheries are described below.

RPS

4.6.5.1 Commonwealth managed fisheries

Commonwealth managed fisheries that are likely to be operating within the Operational Area at the time of the proposed survey are described below. Further detail on these fisheries is provided in Appendix E.

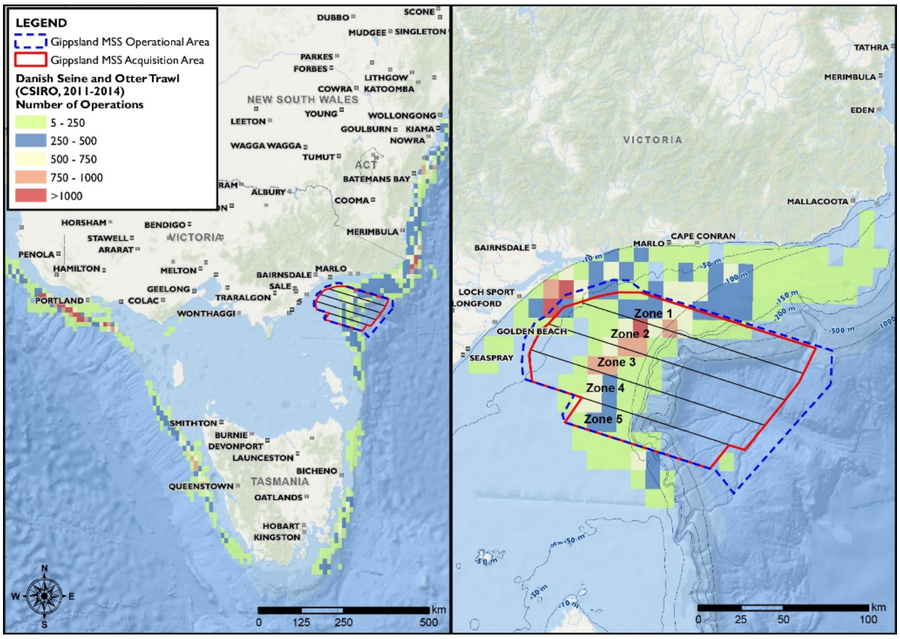
4.6.5.1.1 Southern and Eastern Scalefish and Shark Fishery

The Southern and Eastern Scalefish and Shark Fishery (SESSF) is a multisector, multigear fishery that targets a variety of finfish, squid and shark stocks. The management area covers almost half of the AFZ, with the Commonwealth Trawl, the Gillnet, Hook and Trap, and the Scalefish Hook Sectors of the SESSF overlapping the Operational Area (Patterson et al. 2017). More than 100 species are regularly landed in the SESSF but only the main species are managed under quotas. At present there are 34 fish stocks subject to total allowable catches (TACs; Table 4.13). Only those in bold are generally found in the vicinity of the Operational Area (SETFIA 2018).

Commonwealth Trawl Sector

The area of the Commonwealth Trawl Sector (CTS) extends from Sydney southwards around Tasmania to Cape Jervis, SA (DAWR 2018a). The sector catches a range of fish species but target species include pink ling, blue grenadier, flathead and silver warehou (Patterson et al. 2017). The fishery operates year-round using demersal otter trawl and Danish seine nets. Otter trawls are towed along the seabed for periods lasting between ten minutes to several hours. In contrast, Danish seine nets are run out in a circle and then retrieved, with each 'shot' lasting about seventy minutes (SETFIA 2018). Catch effort for 2016-17 in the CTS resulted in 7,634 t caught (Patterson et. al 2017). This catch and effort is low compared to historic levels, with the relative proportion caught by Danish seine increasing. There are 57 boat statutory fishing rights allocated in the CTS, although in 2015-16 and 2016-17 the number of active vessels were 37 and 34, respectively. Fishing effort by otter trawlers is widely distributed (Figure 4.23), however since 2005 (when trawling was prohibited in most waters deeper than 700 m) the effort has become increasingly concentrated on the shelf rather than the slope or in deeper water (Patterson et al. 2017).

In contrast to otter trawlers, effort data for Danish seiners demonstrates considerable overlap between the spatial extent of fished area and the Operational Area (Figure 4.23). The number of Dutch seiners within this area has ranged from 13 – 16 between 2008 and 2017. The top two species landed by these vessels (by weight) were tiger flathead and eastern school whiting (SETFIA 2018).



Data does not inclued areas where less than five boats operated. Data is for the period 2011-2014 and published 24 June 2017 by CSIRO Marine and Atmospheric Research.

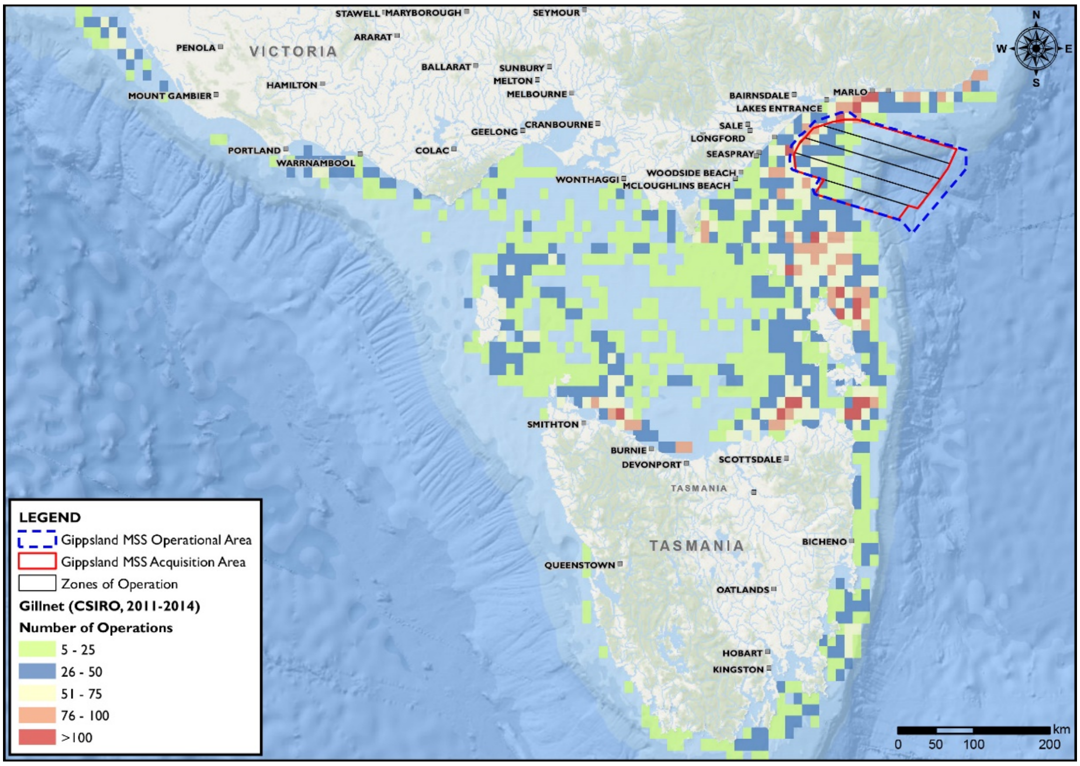
Figure 4.23 Spatial extent of AFMA log book data showing fishing effort for the Commonwealth demersal otter trawl (left) and Danish seine (right) fishing methods

RPS

Shark Gillnet and Shark Hook Sectors

The Shark Gillnet and Shark Hook Sectors (SGSHS) of the SESSF extend from the NSW – VIC border to the SA – WA border. The fishery targets gummy shark but catches various bycatch species such as elephant fish and sawsharks. The fishery operates year round using demersal gillnet and longline (Patterson et. al 2017). Before spatial closures, which have been progressively implemented since 2003 to protect pupping areas and reduce the risk of interaction with Australian sea lions and dolphins, effort in the SGSHS was spread across the waters of SA and eastern Victoria. However, spatial closures have resulted in gillnet effort becoming concentrated in Victorian waters ; Figure 4.24) The fishery is managed using a combination of input and output controls including current closures of waters deeper than 183 m to gillnet fishing and closure of waters shallower than 183 m to auto-longlining fishing (Patterson et. al 2017).

Total catches by the SGSHS during 2015-16 and 2016-17 were 2,233 and 2,118 t, respectively, and remain relatively low compared to historic levels (Appendix E). The number of gillnet permits in the sector was 61 during 2015-16 and 2016-17 although the number of active gillnetting vessels was 37 and 36, respectively, in these years (Patterson et. al 2017). Relative fishing intensity by the shark gillnet sector was high in western parts of the Operational Area (Figure 4.24), but low by the shark hook sector for the same area. Gillnet fishing effort in the Operational Area is also highly seasonal, peaking in May and low from September through to April (Appendix E; SETFIA 2018).



Data does not inclued areas where less than five boats operated. Data is for the period 2011-2014 and published 24 June 2017 by CSIRO Marine and Atmospheric Research.

Figure 4.24 Spatial extent of AFMA log book data showing fishing effort for the Commonwealth shark gillnet fishing method

Scalefish Hook Sector

The Scalefish Hook Sector (SHS) extends from Sydney southwards around TAS to the SA–WA border (Patterson et. al 2017). The key species targeted by the fishery are the same as the CTS and include mixed fish species, particularly blue-eyed trevalla, pink ling, blue grenadier, flathead and silver warehou. Because of this overlap, catch and effort statistics for the SHS are reported with data for the CTS despite the sector being managed as part of the Gillnet, Hook and Trap Sector of the SESSF. The SHS operates year round employing a variety of longline and dropline hook fishing methods, some of which are automated (Patterson et. al 2017).

There are currently 37 scalefish hook statutory fishing rights, with 18 and 17 vessels actively fishing in the sector during 2015-16 and 2016-17, respectively (Patterson et al. 2017). Because 100% and 74% of the TAC for two target species for this fishery (blue-eyed trevalla and pink ling, respectively), were caught during the 2016-17 season it is unlikely that there will be a significant increase in fishing effort by this fishery (SETFIA 2018). Effort by this fishery is widely distributed but concentrated in shelf and slope waters (<800 m). There is also an area closure in deeper waters within the Operational Area to protect pink ling stocks. Automatic longlining is not allowed in waters shallower than 183 m (Patterson et al. 2017). Catches by the SHS were 656 and 729 t in 2015-16 and 2016-17, respectively (Patterson et al. 2017). These catches, and associated effort are at historically low levels. Relative fishing intensity by the sector during these years was relatively low within the Operational Area (Appendix E).

Table 4.13 2018-19 TACs (whole fish unless otherwise stated) for SESSF quota species (AFMA, 2018 in SETFIA 2018)

Species	TAC (t)	Species	TAC (t)
Alfonsino	1,017	Orange Roughy (GAB)	50
Bight Redfish (GAB)	800	Orange Roughy (Cascade)	500
Blue Eyed Trevalla	462	Orange Roughy (East)	698
Blue Grenadier	8,810	Orange Roughy (South)	53
Blue Warehou	118	Orange Roughy (West)	60
Deepwater Flathead (GAB)	1,128	Oreo (smooth Cascade)	150
Deepwater Shark (East)	23	Oreo (smooth other)	90
Deepwater Shark (West)	264	Oreo (basket)	185
Elephant Fish	114	Pink Ling	1,117
Flathead	2,501	Redfish	100
Gemfish East	100	Ribaldo	430
Gemfish West	200	Royal Red Prawn	381
Gummy Shark	1,736	Saw Shark	430
Jackass Morwong	505	School Shark	215
John Dory	263	School Whiting	820
Mirror Dory	253	Silver Trevally	307
Ocean Perch	241	Silver Warehou	600

Species that are likely to be caught in the operational area are underlined

4.6.5.1.2 Southern Squid Jig Fishery

Jurisdiction of the Southern Squid Jig Fishery (SSJF) extends across AFZ waters adjacent to SA, TAS, NSW, VIC and southern QLD however most fishing occurs in continental shelf waters near Portland, VIC (Patterson et. al 2017). SSJF vessels typically operate at night in depths of 60 to 120 m using the jigging method. The fishery operates year-round although fishing generally occurs from January to June. Squid are also caught in the CTS by demersal trawling (Patterson et al. 2017). The target species of the SSJF is Gould's squid, which occurs as a single biological stock throughout southern Australian water. Because of the fisheries highly variable stock and recruitment parameters, the SSJF harvest strategy relies on within-season monitoring against catch triggers for the jig and trawl sectors.

There were seven vessels actively fishing using squid jigs in both 2015 and 2016 (Patterson et. al 2017). The numbers of vessels in the fishery varies considerably but has shown a downward trend through time (Appendix E). Annual catches have fluctuated between 1,569 t in 2005 and 2 t in 2014). In 2016, 384 and

597 t of squid were captured in the SSJF and combined trawl fisheries, respectively (Patterson et. al 2017). Recent data on fishing intensity demonstrate the broad area over which squid are caught, particularly by trawlers. Fishing effort within the Operational Area by the SSJF was low but higher by the CTS (Appendix E). Nine different vessels fished in the Operational Area, landing 120 t over 96 days during 2008 – 2017. However, because of the small number of operators in the fishery, details of catches within the Operational Area cannot be presented because of data confidentiality reasons (SETFIA 2018).

4.6.5.2 State (Victorian) managed fisheries

4.6.5.2.1 Rock Lobster Fishery (eastern zone)

The Rock Lobster Fishery (RLF) extends along the entire Victorian coastline and across Commonwealth waters under an OCS. It is Victoria's second most valuable fishery. Commercial vessels fish nearshore waters to depths around 150 m, with the majority of catches taken in depths less than 100 m (DEDJTR 2016). This area is divided into two separately managed zones: Western Zone and Eastern Zone, with jurisdiction of the latter overlapping the Operational Area. In the Eastern Zone, most catch is landed through Queenscliff, San Remo and Lakes Entrance (https://vfa.vic.gov.au/commercial-fishing/rock-lobster/fishery-overview#fishery accessed 13 Aug 2018).

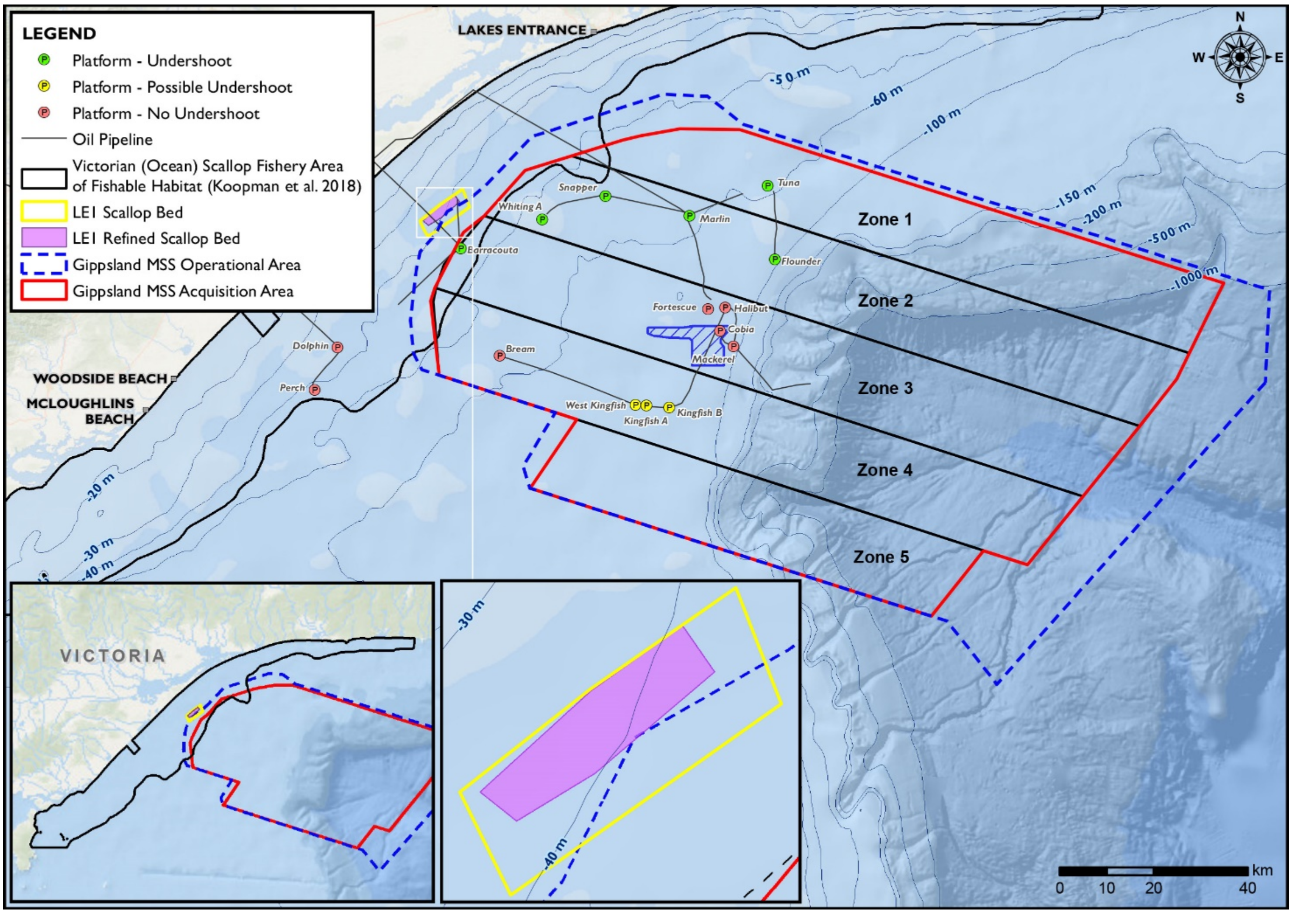
The key target species is southern rock lobster, considered a single biological stock throughout southern Australian waters as the species occurs in a continuous distribution across this range and has extensive and protracted pelagic larval dispersal phase (DEDJTR 2016). Baited commercial pots are the fishing method used and the primary management method is individual transferable quota units and total allowable commercial catch (TACC). The maximum number of licenses in the Eastern Zone is 47. The fishery is closed from 1st June to 15th November (females) and 15th September to 15th November (males) (https://vfa.vic.gov.au/commercial-fishing/rock-lobster/fishery-overview accessed 13 Aug 2018).

Based on stock assessment results, the TACC have been reduced across south-eastern Australia over the past decade to reduce fishing mortality. The 2015/16 TACC was 59 t. The catch was 46 t during the fishing year (November to (September) and 58 t during the quota year (July – June; Appendix E) (DEDJTR 2016). During 2016-17 a total of 53 t was landed in the Eastern Zone, compared to 209 t in the Western Zone (SETFIA 2018). Catch and effort during 2016/17 in the Eastern Zone were highest in August and December. They declined in January and were at relatively low levels from February through to June before starting to rise again in July (SETFIA 2018).

Historic fishing effort by the RLF shows very little effort (< 5 vessels) in the area of the Operational Area (SETFIA 2018). The small number of operators did not allow the catch by the fishery to be reported separately, however anecdotal evidence suggests that < 10% of the Eastern Zone TACC is caught from within the Operational Area (SETFIA 2018).

4.6.5.2.2 Scallop (Ocean) Fishery

The Scallop (Ocean) Fishery (SOF) extends the length of the Victorian coastline from high tide mark to 20 NM offshore, although the area of fishable habitat is less than this area (Figure 4.25). Scallops are mostly fished from Lakes Entrance and Port Welshpool using the scallop dredge method. The target species is commercial scallop (VFA 2017). The fishery is characterised by highly variable catches (Appendix E). It is open year-round although most fishing occurs from winter to early summer (SETFIA 2018). The fishery is managed via limited entry, gear restriction and a Total Allowable Commercial Catch (TACC). Temporary closures may also be enforced when stocks are low to allow scallop beds to recover. An abundance survey was undertaken for the eastern Victorian ocean scallop between December 2017 and January 2018 (Koopman et. al 2018). This is the first abundance survey to take place in the fishery since 2012 and the TACC was previously set at zero tonnes for the 2010/11, 2011/12 and 2013/14 years due to poor stock status. The TACC has since remained at a low level of 135 t since 2014/15 to allow for exploratory fishing. However, the recent 2017/18 survey confirmed a continued low level of abundance and recruitment throughout the fishery and the TACC has remained the same (https://vfa.vic.gov.au/commercial-fishing/scallop accessed 14 Aug 2018). While Koopman et al. (2018) concluded that the abundance of scallops in the Gippsland Basin was still below commercial viability levels, an area with increased scallop biomass was identified in an area adjacent the northern edge of the Acquisition Area (Figure 4.25). This area was described by Koopman et al. (2008) as the LE1 Scallop Bed, which lies 3.7 km from the area ensonified by seismic sound at levels that may affect scallops (Section 6.1). The area of the scallop bed refined after further sampling (the LE1 Refined Scallop Bed) lies 7 km from this ensonified area. It is possible that some scallop fishing will occur within the Activity EMBA in coming years, although the impact of the proposed MSS on the SOF is likely to be very low or nil (SETFIA 2018).



The red polygon shows the LE1 Bed in which commercial quantities of scallops were found during the survey by Koopman et al. (2018)

Figure 4.25 (a) Area of the Victorian (Ocean) Scallop Fishery defined by Koopman et al. (2018) after removal of habitat unfishable by scallop fishers. (b) Location of the LE1 Scallop Bed relative to the seismic survey area

4.6.5.2.3 Ocean (General) Fishery

The Ocean (General) Fishery (OGF) extends the length of the Victorian coastline from the high tide mark to 20 NM offshore. The Ocean General Access License authorises the 171 license holders to undertake fishing activities using a variety of gear types in marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea (https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production#fp-molluscs accessed 14 Aug 2018). Fishing methods include line (dropline, longline, handline), dip net, bait traps, octopus traps, landing nets, gaffs, seine nets, mesh nets and bait pumps. Catches in the OGF mostly comprise snapper, octopus and gummy shark (catches of abalone, jellyfish, southern rock lobster, giant crab, commercial scallop and sea urchins are prohibited). Management measures for the fishery include limited access and gear restrictions. Operators in this fishery usually undertake day trips in small vessels (< 10 m) and may fish at anchor or underway. Most of the fishing effort by the OGF has historically occurred in western Victorian waters. A relatively small amount occurs off Lakes Entrance during April to July (SETFIA 2018).

Stakeholder feedback (Section 9) confirms that octopus (mainly *O. pallidis* but also *O. maorum*) are targeted by a small number of fishers undertaking day trips from Lakes Entrance in vessels up to 18 m in length. Their fishing area is located within the Activity Area, with the area of one fisher covering approximately 650 m^2 between the Barracouta, Whiting and Bream platforms in depths between 40 – 60 m (Figure 3.1). Within their fishing area the octopus fishers target habitat containing old scallop shell in areas avoided by Danish seine fishers. Octopus are captured in open-ended demersal pots attached to lines approximately six kilometres in length. Typically a line can have 900 – 1000 pots attached, and ten lines may be deployed at a time, each connected to a retrieval line and surface buoy. Select lines are retrieved on a rotational basis after a 'soak' time of about three weeks. Depending on catches, the lines will be re-deployed at the same location or moved about 500 m.

4.6.5.2.4 Purse Seine (Ocean) Fishery

The Purse-seine (Ocean) Fishery (POF) extends the length of the Victorian coastline from the high tide mark to 20 NM offshore. Target species are Australian salmon, Australian sardine, sandy sprat and Australian anchovy (SETFIA 2018). There is only one POF license issued in Victoria, enabling the operator to fish marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea using a purse seine or lampara net (VFA 2017 in SETFIA 2018). This fisher is based in Lakes Entrance and typically does day trips. The fisher generally operates very close to shore however details of catch and effort are not available due to confidentiality reasons (SETFIA 2018). Overlap in activities by this fisher with the Operational Area are expected to be minimal.

4.6.5.2.5 Inshore Trawl Fishery

There are 54 Inshore Trawl Licenses, however most of these are not active (VFA 2017 in SETFIA 2018). These licences allow the operators to fish the same waters as the Ocean (General) Fishery and the Ocean Purse Seine Fishery, using otter-board trawls (SETFIA 2018). The Inshore Trawl Fishery targets crustaceans (eastern king and school prawns), and to a lesser extent bugs, crabs and limited finfish (SETFIA 2018; http://

www.afma.gov.au/static/annual-report-2010-11/fisheries/south-eastern-scalefish.html accessed 14 Aug 2018). Historically, effort by the Inshore Trawl Fishery was focussed off eastern Victoria, particularly near Lakes Entrance (SETFIA 2018). However the boundary of the fishery shows little overlap with the Operational Area.

4.6.6 Recreational fishing and diving

Recreational fishing requires a license in Victoria. Other management measures include species specific bag and possession limits, closed seasons and restricted fishing locations (https://vfa.vic.gov.au/recreational-fishing/recreational-fishing-guide accessed 23 Aug 2018). VRFish is the peak body representing recreational fishers in Victoria. Recreational fishing is a key attraction to the east Gippsland region with a wide variety of species (typically snapper, King George whiting, flathead, bream, and Australian salmon) and locations including along Ninety Mile Beach and in offshore waters (http://www.visiteastGippsland.com.au/things-to-see-a-do/water-based-activities accessed 23 Aug 2018). Boat based fishing includes charter operations and private craft launched from boat ramps in the region. Boat ramps are located at Port Albert, Port Welshpool, McLoughlins Beach, Manns Beach and Lakes Entrance. Rocky reefs near Marlo, Cape Conran and Lakes Entrance are the main sites for boat based fishing and recreational diving. Fishing clubs such as the Lakes Entrance Game and Sports Fishing Club are active in the region and host regular club competitions in marine waters.

Gippsland's rugged coastline is protected by a number of marine parks and has some of the best diving sites in Australia, including areas near Cape Conrad Coastal Park such as Beware Reef, located approximately 36 km outside the Operational Area (https://www.visitvictoria.com/Things-to-do/Outdoor-activities/Water-sports/Scuba-diving/ accessed 23 Aug 2018).

4.6.7 Tourism

Gippsland attracts 10.8 million visitors each year and the Gippsland Visitor Economy generates an estimated $2.8 billion in direct and indirect expenditure per year. More than 3,000 businesses derive the majority of their income from visitors (DEDJTR 2018) The East Gippsland International Tourism Action Plan 2016-2018 identifies the increasing international market that includes visitors primarily from Asian backgrounds attracted by fishing opportunities on the Gippsland Lakes. In particular, Lakes Entrance is the centre of the Gippsland Lakes tourism industry, being ideally situated between Melbourne and Sydney, easily accessed, and with a Mediterranean-like climate. Tourism and recreational activities offered by the region include sailing, swimming, fishing, diving and bird watching (http://www.liveeastGippsland.com.au/invest/why-east-Gippsland accessed 23 Aug 2018). Most recreational activities are expected to occur in the nearshore areas in the vicinity of coastal towns, caravan parks and easily accessible beaches.

4.6.8 Shipping

Bass Strait is one of the busiest shipping routes in Australia with more than 3000 vessels making the east-west passage each year (NOO 2002). Shipping includes passengers and freight between the Australian mainland and Tasmania and other through traffic operating between Australian Ports and to/from New Zealand (DoE, 2015).

A vessel traffic separation scheme has been instituted south of the Kingfisher B Platform and Wilson Promontory to enhance maritime safety in the area separating shipping into discrete one direction lanes (north east and south west, Figure 4.26). Heavy vessel traffic may be encountered entering and exiting both Traffic Separation Schemes (TSS) throughout the survey activities. Most of the Operational Area will also encounter local and support vessels for the offshore petroleum industry activities as well as fishing vessels.

An IMO designated “Area to be Avoided (ATBA)” lies in the Operational Area. This excludes, without permission from NOPSEMA, entry of all ships over 200 t (gross) and restricts commercial vessel traffic to shipping channels to the east and south of the area. The total area of the ATBA is 5,645 km^2.

The MSS area overlaps both the ATBA and traffic separation scheme Figure 4.26 shows the traffic (vessels fitted with AIS) between January and March 2018 as supplied by AMSA. This excludes small domestic commercial vessels such as fishing trawlers and coastal craft. Approximately 12 vessels per day use the Gippsland TSS, with over 90% comprising cargo vessels, such as container ships and bulk carriers, or tankers (AMSA, 2018). Most traffic is in the southern and eastern sectors of the Operational Area.

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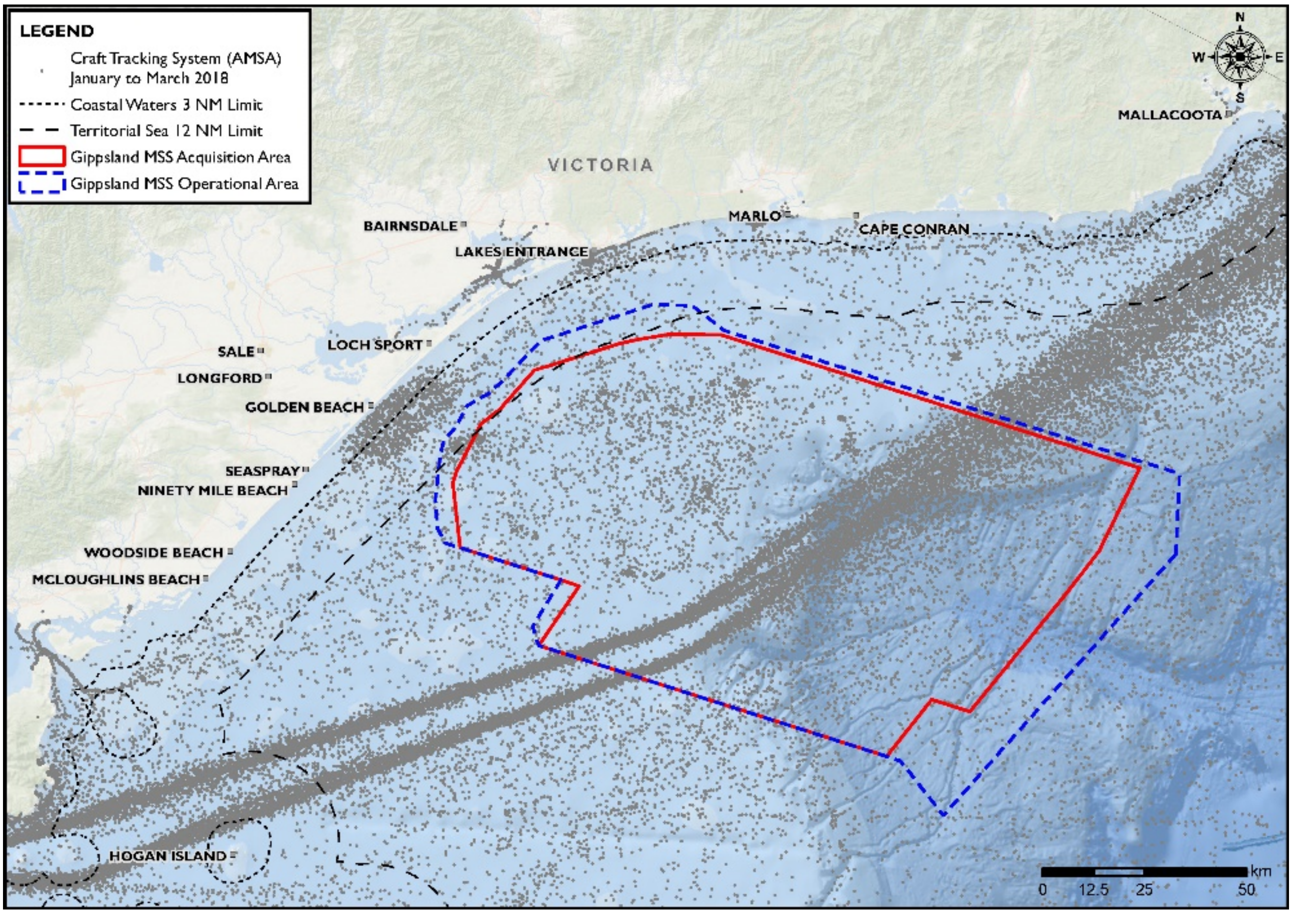


Figure 4.26 AIS ship traffic (January–March 2018)

4.6.9 Defence

Defence activities that may take place in the area include the transit of naval vessels, training exercises, hydrographic surveys, surveillance and enforcement and search and rescue. There are no training areas within the EMBA (Figure 4.27).

The Operational Area lies underneath a Defence restricted airspace (R258D), administered by the Joint Airspace Control Cell (JACC), Department of Defence (Figure 4.28).

The Department of Defence (Defence Support Group) has been consulted about the proposed survey (see section 9.0). As for the oil and gas industry established in the Bass Straits, helicopter access to the vessels is subject to the restricted airspace in the vicinity.

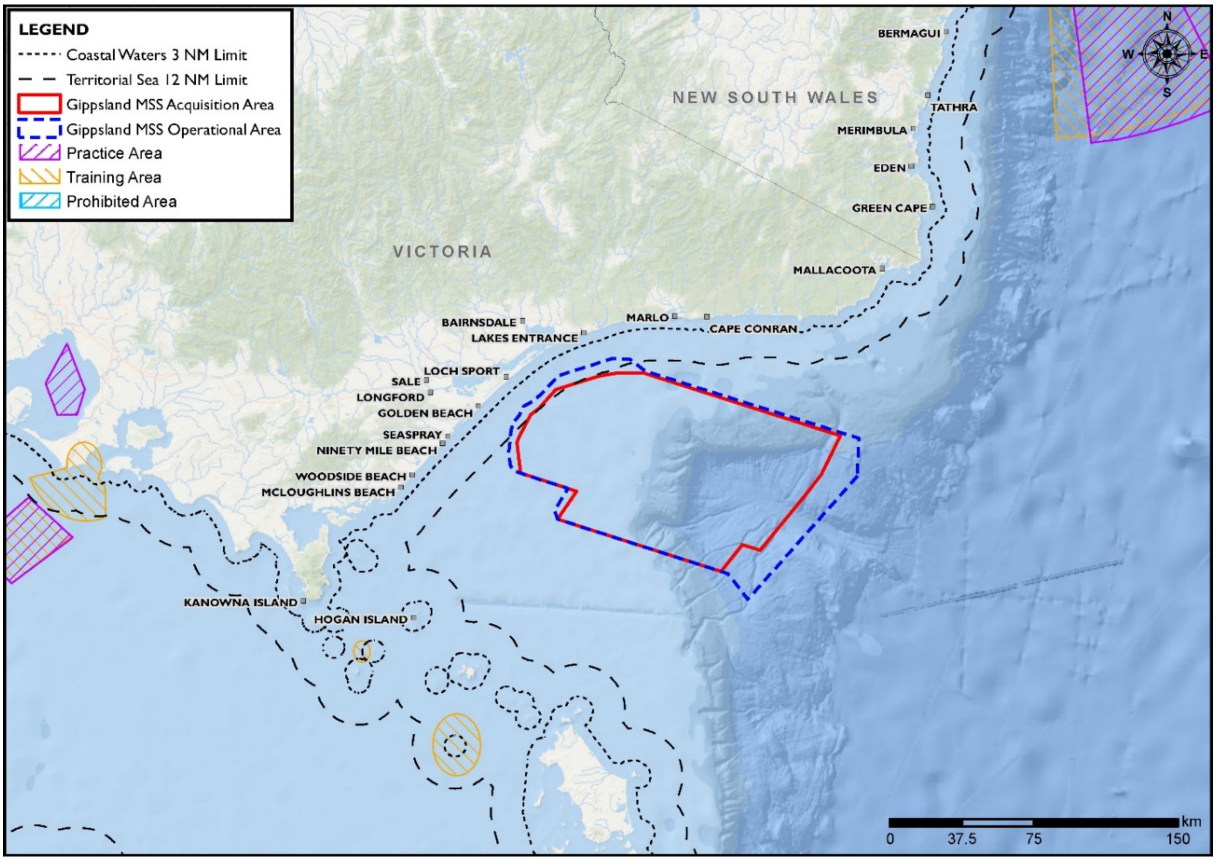
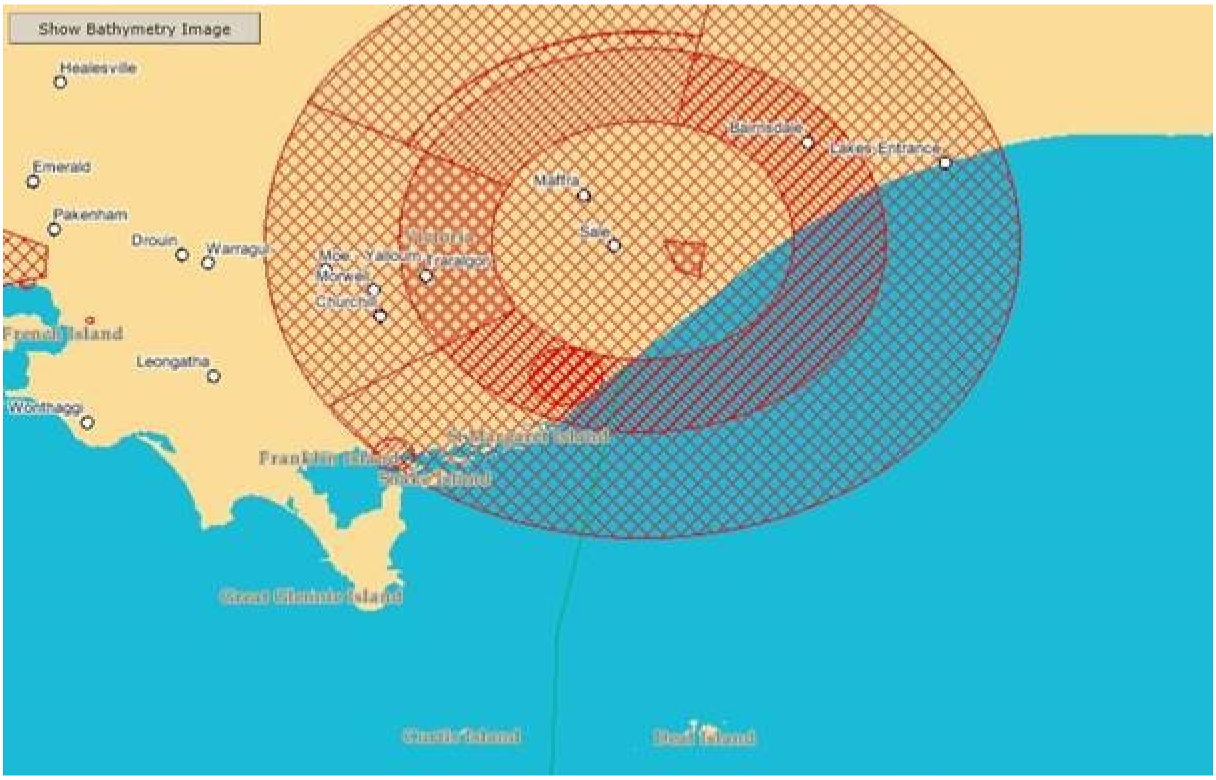


Figure 4.27 Defence activities in the vicinity of the Gippsland MSS



http://www.ga.gov.au/imf-amsis2/

Figure 4.28 Restricted airspace in the vicinity of the Gippsland MSS

5 Environmental impact and risk assessment methodology

5.1 Introduction

Regulations 13(5) and 13(6) of the OPGGS(E) Regulations require CGG to identify, analyse and evaluate the risks and potential environmental impacts associated with the CGG Gippsland MSS.

CGG's impact and risk management process is based on the principles, framework and processes defined by the International Standards Organization (ISO) 31000:2009 Risk Management – Principles and Guidelines (Figure 5.1). The following sections describe the steps in the risk management process, including the legislative framework, approach taken to identify and evaluate potential impacts associated with the activity and risk treatment (control) measures that will be adopted to reduce the impacts and risks to as low as reasonably practical (ALARP) and to an acceptable level.

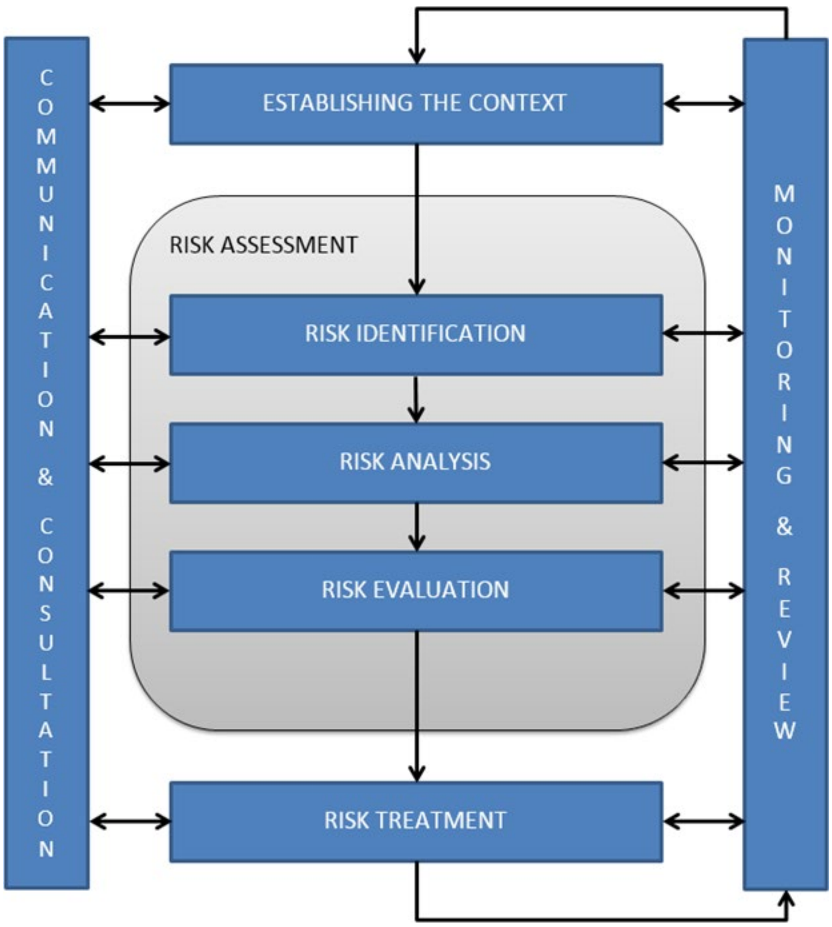


Figure 5.1 CGG's impact and risk management process

5.2 Communication and consultation

Communication and consultation with internal and external stakeholders take place during all stages of the risk management process. The ISO 31000:2009 standard requires effective stakeholder communication and consultation in order to ensure that those accountable for implementing the risk management process (namely, CGG and any appointed contractors), and stakeholders understand the basis on which decisions are made, and the reasons why particular actions are required. This is also consistent with NOPSEMA's guidance.

The OPGGS Act and OPGGS(E) Regulations are guiding principles that underpin the process of external stakeholder communication and consultation in the development of EPs. NOPSEMA's Information Paper "Consultation requirements under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009" (N-04750-IP1411 Revision No. 2 December 2014) outlines how the regulations relate to EPs and its recommendations have been followed herein.

CGG is committed to consulting with relevant stakeholders who may be affected by the activity, to identify and understand any concerns and issues, to mitigate impacts and risks highlighted in meritorious submissions and to openly communicate the process with the stakeholders. Input from stakeholders will help to inform the preparations for and execution of the CGG Gippsland MSS as appropriate. The process of stakeholder engagement is described in Section 9.

5.3 Establishing the context

The purpose of establishing the context in the risk management process is to define the external and internal parameters to be taken into account when managing risk, and to define the risk criteria. This requires assessment of the external and internal environments in which CGG seeks to achieve its objectives.

The external context comprises the description of the activity (Section 3), the physical, biological and socio-economic environments (Section 4) and associated potential environmental impacts and risks specific to the nature and scale of the activity (Sections 5 to 7), the legislative framework, applicable management plans, standards and guidance (Section 2) and the perceptions and values of external stakeholders (Section 9 and Appendices I and J).

The internal context relates to CGG's culture, processes, structure and strategy, and includes anything within the organisation that can influence the way in which environmental risk is managed. CGG's commitment to minimising environmental harm and to operating and maintaining a safe and healthy work environment for its employees, contractors and project partners is reflected in its corporate HSE Policy (Appendix A) and HSE management framework (Section 8).

5.4 Impact and risk assessment

The environmental impact and risk assessment process uses a systematic, evidence-based approach in order to evaluate and interpret the impacts and risks associated with its activity and the potential for harm to physical, biological and human receptors. The environmental impacts and risks associated with the Gippsland MSS have been assessed using the following steps:

- definition of the activity (Section 3) and identification of associated aspects and hazards with potential for environmental harm (i.e. physical, chemical or biological entity or incident which induces an adverse response or impact e.g. operation of airguns)
- identification of the environmental values within the area that may be affected by the activity, i.e. the environmental context of the activity (Section 4)
- identification of aspects of the activity with potential for environmental harm (e.g. underwater noise, light, seabed disturbance) in the context of its nature and scale and location (Section 5.4.1)
- definition of acceptable levels for each impact and risk (Section 5.5.6)
- identification of impacts from routine aspects and risks from unplanned/accidental events, and the inherent impact or risk (Section 5.4.2, Section 6 (planned events) and Section 7 (unplanned risks)
- identification of the 'decision context' and 'assessment technique' relevant to the impact or risk (Section 5.4.1)
- identification of control measures to be implemented for each aspect in order to reduce the impacts and risks to ALARP (Section 5.5)

- determination of the residual risk of each environmental impact and risk with identified control measures adopted (Section 5.5)
- determination of whether the residual risk is acceptable
- in the event that an impact or risk is not considered acceptable, further practical control measures are considered and adopted until the impacts and risk are considered ALARP and acceptable (Section 5.5).

5.4.1 Hazards, impact and risk identification

Information used in identifying the impact and risks associated with the activity has been obtained from the following sources:

- CGG's description of the location, timing of survey and activities to be undertaken in acquiring seismic data (e.g. airgun discharges, sail lines)
- an understanding of general vessel activities/operations during seismic surveys and the potential threats and hazards to stakeholders and the marine environment and where appropriate, terrestrial environments
- literature reviews on the environmental sensitivity of the receiving environment with respect to species' presence, "biological calendars", habitat distribution and location of environmentally sensitive areas (breeding, migration, resting areas); identification of environmental values at risk within an adjacent to the Acquisition Area;
- feedback from stakeholders (onshore and marine) to understand socio-economic activities that may be affected by the proposed activity.

The identified environmental impacts and risks associated with activities proposed under this EP are listed below and assessed within Section 6 and Section 7

- impacts (expected to occur during routine operations)
  - underwater sound – seismic operations
  - underwater sound – vessel operations
  - physical interaction with other marine users
  - light emissions – vessels
  - routine discharges – vessels
  - atmospheric emissions – vessels
- risks (not expected to occur during routine operations)
  - physical interaction – collision with marine fauna or equipment entanglement
  - invasive marine species – introduction and establishment via vessel hull fouling or ballast water
  - seabed disturbance – loss of solid materials and emergency anchoring
  - accidental release – hazardous and non-hazardous materials (oily wastes / chemical spills)
  - accidental oil spill – re-fuelling or vessel collision/grounding
  - oil spill response.

5.4.2 Impact and risk analysis and evaluation

The hazards for each potential environmental aspect were identified using a qualitative assessment process in accordance with the methods and principles described by the ISO 31000:2009 Risk Management – Principles and Guidelines (2009), and Standards Australia Handbook HB 203:2012, Managing Environment-related Risk (2012). Some useful definitions from the ISO guidelines and the associated Handbook on Environmental Risk Management – Principles and Process (Standards Australia 2006), are included in Table 5.1.

Table 5.1 Risk management terms

Term	Synonymous terms	Meaning
Stressor	Source of risk Hazard Environmental aspect	Physical, chemical or biological entity or incident which induces an adverse response or impact.
Impact	Effect Consequence	Change to the environment, adverse or beneficial, relating to an organisation's activities. May be defined in terms of severity of consequences
Consequence	Outcome Impact	Impact of an event or incident e.g. a loss, injury or concern. May be expressed qualitatively or quantitatively.
Likelihood	Probability Frequency Qualitative likelihood	Note: with environmental risk, the likelihood component of the risk definition applies specifically to the end point environmental impact, and not the probability solely of the initial incident or hazard event. The series of 'conditional probabilities' or conditional likelihoods' for the chain of events leading to an impact, need to be factored into determining final likelihood of environmental impact occurring.
Risk		Chance of something impacting on objectives. Considered in terms of environmental consequences of a given severity, and the likelihood of that particular consequence occurring.
Residual risk		Risk remaining when controls are in place.

The Gippsland MSS impact and risk assessment is based on the evaluation of impacts and risks that are credible, realistic and appropriate to the nature and scale of the activity, and the values and sensitivities of the environment that may be affected (EMBA).

Each impact and risk associated with the planned seismic activity has been evaluated by determining the consequences or effects, including the extent, duration, timing and potential for recovery (Table 5.2 and Table 5.3), and assessing the likelihood or probability that those consequences may occur (Table 5.4). Potential maximum quantities released, time-scale of release, biological exposure and sensitivities, and regulatory requirements were considered in determining the consequence of the impact/risk. The likelihood of the effect or consequence is based largely on professional judgement of the conditional likelihoods leading to the effect, including the presence of the stressor (impact/risk), the exposure of receptors to the stressor and the sensitivity of the receptors to the stressor.

Table 5.2 Definition of consequence terms

Term	Meaning
Localised	Operational Area extent
Extensive / Medium scale	Within Oil EMBA extent
Regional / Large scale	Bass Strait extent
Short-term	Days to weeks
Medium term	<12 months
Long-term	>12 months

All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 5.5). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable

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(i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

The outcome of this evaluation provides the 'inherent' impact or risk ranking, i.e. the impact/risk without the application of control measures. The shaded region of the risk matrix signifies the tolerability of the risk ranking.

Table 5.3 Definition of consequence

	Category	Environment	Socio-economic
0	Negligible	No, or very limited, effect on ecosystems, species or habitats. Full recovery expected in days to weeks	No or very limited effect on commercial and/or recreational users
1	Minor	Minor disruption and temporary effect (days) on individuals within a protected species, including impacts on health, critical habitats, or critical behavioural processes. No overall threat to populations. Localised scale (immediate area) and temporary effect on other habitats/communities. No effects on ecosystem function. Full recovery expected in days to weeks	Minor disruption, localised scale (immediate area) and temporary effect (days) on commercial and/or recreational users
2	Moderate	Moderate disruption and short-term effect (weeks) on a proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Localised scale and short-term effect (weeks) on other habitats/communities. No effects on ecosystem function. Recovery in months to 1 year.	Moderate disruption, localised scale and short-term effect (weeks) on commercial and/or recreational users
3	Severe	Moderate disruption and effect (months) on a significant proportion of a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Localised scale and medium term effect (months) on other habitats/communities. No effects on ecosystem function. Recovery >1 to 3 years.	Moderate disruption and effect (months) on commercial and/ or recreational users.
4	Major	Major disruption and medium to long-term effect (years) on a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Injury or death of individuals of a protected species. Medium scale and medium term effect (years) on other habitats/communities. Effects are at an ecosystem function level. Recovery >3 to 10 years.	Major disruption and medium to long-term effect (years) leading to loss of commercial and/or recreational use
5	Catastrophic	Extensive disruption and long-term effect (decades) on a protected species' population, including impacts on health, critical habitats or critical behavioural processes. No overall threat to populations. Injury or death of a significant proportion of a protected species population. Large scale and long-term effect (decades) on other habitats/communities. Effects are at an ecosystem function level. Recovery >10 years.	Extensive disruption and long-term effect (decades) leading to loss of commercial and/or recreational use.

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Table 5.4 Definition of likelihood

Category		Definition/experience (history of occurrence)	Probability
A	Rare	Almost impossible / unheard of in the industry	Event occurs once within 10 years
B	Unlikely	Could occur but would not be expected / has occurred once or twice in the industry	Event occurs once within 5 years
C	Possible	Might occur at some point / has occurred many times in the industry but not before within CGG	Event occurs once a year
D	Likely	Will probably occur at some point / has occurred frequently within the company	Event occurs monthly
E	Almost Certain	Expected to occur in most circumstances / has occurred at the location	Event occurs weekly

All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 5.5). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable (i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

Table 5.5 CGG environmental impact and risk assessment matrix

Consequence		Likelihood				
		A	B	C	D	E
		Rare	Unlikely	Possible	Likely	Almost certain
0	Negligible					
1	Minor					
2	Moderate					
3	Severe					
4	Major					
5	Catastrophic					

Term	Definition
Low	No effect, or those that are beneath levels of perception, within normal bounds of variation. Good industry practice (including legislation and standards) have been applied. Acceptable without further reduction measures being required.
Medium	Acceptable (tolerable), providing that it can be shown that all practicable control measures have been implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, with continual review of these measures and any potential new ones. Deemed to be “as low as reasonably practical” (ALARP) and acceptable.
High	Undesirable, CGG management decision required to accept risks and proceed. Additional control measures are required to be considered and implemented, if the cost is not grossly disproportionate to the environmental benefit gained, to prevent or reduce the impact/risk to ALARP and an acceptable residual level.
Very High	Unacceptable (intolerable) and may require re-design of project and/or its parameters, additional control measures are required to be implemented (regardless of cost) to prevent or reduce the impact/risk to ALARP and be acceptable.

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5.5 Impact and risk treatment

The treatment of the inherent impacts and risks identified in the assessment process requires application of control measures to reduce them ALARP and acceptable levels. CGG has taken the following approach for each of the identified impacts and risks during the assessment

- determination of inherent risk (potential risk) without controls
- identification of appropriate control measures aligned with the decision type (refer to Section 5.5.1)
- demonstration of ALARP (and determination of the residual impact)
- demonstration of acceptable level of impact or risk
- determination of residual risk rating (including controls aligned with decision type).

5.5.1 Decision context and assessment techniques

CGG applies the Oil and Gas UK (OGUK) (2014) Guidance on Risk Related Decision Making (Figure 5.2) to determine the assessment technique applied for each impact or risk. CGG has considered previous impact and risk assessments for similar activities, review of relevant published studies (peer reviewed and grey literature) and stakeholder consultation concerns/feedback. Wherever possible, site-specific and activity-specific data has been used in the impact/risk assessment; however, in order to address areas of uncertainty, a precautionary approach has been taken and a conservative or “worst case” approach has been applied where there is uncertainty in the level of harm.

The extent to which identified stakeholders have an interest in the decision depends upon the nature of the impact/risk (e.g. magnitude, complexity, uncertainty) and their perception of the impact/risk. The values, views, attitudes, perceptions and concerns of stakeholders consulted for the Gippsland MSS have been used in the determination of the decision context (Figure 5.2). Stakeholder concerns have been assessed for merit and adopted control measures (where relevant) are summarised in Section 9.

Once the decision context is established for the impact/risk this determines the assessment technique to use to identify appropriate control measures. The arrows in the Figure 5.2 show the assessment technique(s) likely to be needed to make the decision. Good practice forms the basis of the assessment for all decision contexts. Moving from decision context A to B to C increases the relevance for additional assessment techniques and the role these play in the identification of control measures and decision-making

- Good Practice: in accordance with recognised guidelines, standards and control measures that are used to manage well-understood impacts and risks arising from activities. This also includes control measures required to meet legislative requirements, codes and standards, including guiding principles such as the principles of ESD as defined in the EPBC Act.
- Engineering (or Environmental) Impact and Risk Assessment: this method may involve application of a range of techniques such as engineering analysis (e.g. underwater sound modelling), impact/risk assessment, cost benefit analysis, professional judgement.
- Precautionary Approach: this method requires uncertainty in the analysis to be addressed by using conservative assumptions that will result in a control measure being more likely to be adopted.

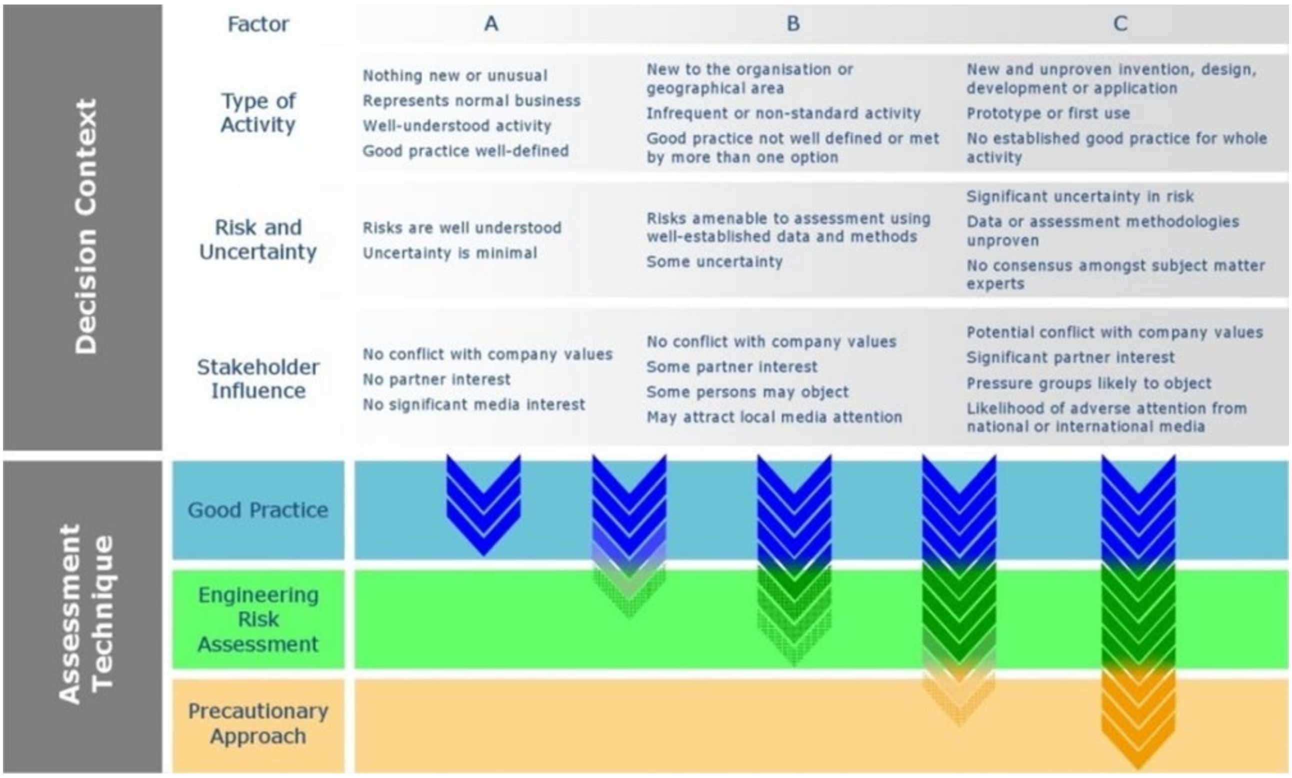

Figure 5.2 Risk related decision support framework (OGUK 2014)

5.5.2 Hierarchy of control measures

CGG has established a hierarchy of controls in accordance with their impact and risk management process as part of their HSE Management System (QHSE and SD Risk Management Guidance Note GRP_HSE_GEI_04E) (Table 5.6). Although commonly used in the evaluation of occupational health and safety hazard control, the hierarchy of controls philosophy is also a useful framework to evaluate potential environmental controls to ensure reasonable and practicable solutions have not been overlooked.

Table 5.6 Hierarchy of controls

Control type	Description
Eliminate	Selection of method based on appropriate design, elimination of methods with higher risks, e.g. eliminating seabed damage from anchors by using dynamically positioned vessels.
Substitute	Replace with a lower risk situation, e.g. use gel-filled streamers instead of fluid-filled streamers.
Reduce	Reduce the impact/ risk, e.g. soft-starts during operation of the seismic source to encourage marine fauna to move out of the area, thereby reducing exposure to elevated noise levels.
Engineering/Isolation	Engineer out the impact/risk, e.g. automatic flotation devices to aid in recovering lost streamers.
Administration	Provide instructions, procedures or training to reduce the risk, e.g. use of procedures for management of risks for refuelling at sea, waste management and marine fauna interactions, training of crew through environmental inductions.
Protective	Use appropriate protective equipment, (including emergency response and contingency planning), when other control measures are not practical or have not totally removed the hazard

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5.5.3 Demonstration of ALARP (Reg 13(5)(c))

Regulation 13(5)(c) of the OPGGS(E) Regulations require that where significant effects are identified, details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable (ALARP) and an “acceptable level”, must be included in the EP. Risk treatment involves a process of selecting additional control measures for reducing impact and risks that have not been demonstrated to be ALARP (Section 5.5.4) during the risk analysis and evaluation processes, and then establishing whether the residual impact/risk can be deemed acceptable (Section 5.5.5). In the case of higher order impacts or risks it is also expected that reasonable effort has been used to identify and evaluate alternative, additional, and improved control measures that may further reduce impacts and risks (NOPSEMA Guideline N-4750-GL1721).

Ideally, the control measures adopted during the assessment should bring the residual impact/risk to a low level and broadly acceptable region (as defined in CGG’s criteria in Table 5.5). All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 5.5). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable (i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

All identified impacts and risks associated with the activity were analysed and evaluated in accordance with the CGG modified risk matrix (Table 5.5). The coloured region signifies the tolerability of the risk criteria. Environmental impact and risks ranked as Low or Medium are considered generally ALARP and acceptable (i.e. acceptable providing that it can be shown that all practicable impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked as High are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual level of risk to ALARP and Acceptable.

However, if the residual impact/risk remains at the medium level, CGG must determine if the impact or risk has been reduced to ALARP. In the event that CGG identify additional control measures that can be implemented without the cost being grossly disproportionate to the benefit of impact or risk reduction, then these additional controls are adopted. If it is considered that the impact or risk is sufficiently low, ALARP has been reached and no further development of control measures is practicable, or if the costs of implementing further controls are grossly disproportionate to the environmental benefit, then the residual impact/risk is deemed to be acceptable (refer to Section 5.5.5 for a detailed description of CGG’s definition of acceptability).

In the event that a residual impact/risk is high or very high, then this is determined as an unacceptable impact or risk and requires additional control measures to reduce to ALARP. It is important to note that to maintain an impact or risk that is ALARP, ongoing action is required to ensure the integrity of control measures is maintained. Therefore, the emphasis on feedback and continuous improvement is a key feature of the management of impacts/risks to ALARP.

Additional control measures for the ALARP demonstration have been identified using the decision methods described below. Where the residual impact/risk is low, good industry practice (including recognised guidelines and standards) has been assessed to determine if additional control measures are appropriate. Where the residual impact/risk is medium, good practice and engineering (or environmental) assessment methods have been considered in introducing additional controls to reduce the impact/risk further. Where the residual impact/risk is high or very high, then additional control measures have been developed from a combination of good practice, assessment and a precautionary approach. The latter precautionary approach requires conservative assumptions to be made in the development of additional control measures where there is uncertainty in the process.

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Once additional control measures have been identified, each has been assessed on its merits of impact/risk reduction and the proportionality of the sacrifice associated with each measure. This assessment considers the practicality, effectiveness and the cost benefit of implementing the control measure, as described below.

5.5.3.1 Practicability

Additional control measures were assessed to demonstrate whether the impact or risk could be further reduced, or if the impact or risk level is ALARP. Treatments considered by CGG to be reasonably practicable have been implemented, while those considered to be not reasonably practicable have not been implemented, e.g. the cost, time and effort required to implement the measure is grossly disproportionate to the benefit gained.

5.5.3.2 Effectiveness

CGG's QHSE and SD Risk Management Guidance Note (GRP_HSE_GEI_04E) requires that the effectiveness of control measures must be assessed before they are implemented. Determination of effectiveness is subjective and thereby based on professional judgement, taking into account the following considerations

- Availability – will the control exist and be available when and where you need it?
- Reliability – will the control work as it was designed and intended?
- Impact – what will be the scale of effect if this control works perfectly?
- Duration – what will be the duration or time that the control will have its effect?

5.5.3.3 Cost benefit analysis

The estimated cost criterion consisted of a qualitative assessment by people familiar with the practicalities of implementing the control measures, to evaluate and rate the estimated cost impact of the additional control measure. Monetary values were not quantified; however, the cost was qualitatively ranked as follows

- High – Very significant cost associated with the implementation of this measure and the cost may be prohibitive or not warranted based on the potential benefit gained. The level of cost is likely to compromise the Gippsland MSS objectives and viability.
- Medium – Significant cost associated with implementation of this measure, however it is not considered prohibitive, when compared to the potential risk reduction benefit.
- Low – No significant cost associated with implementation of this measure.

The expected net benefit of the additional control measure in reducing either the likelihood or the consequence of the impact or risk, beyond that achieved by the previously identified control measures was evaluated on a qualitative basis. If a control measure reduced the potential impact or risk significantly, but did not change the residual risk ranking, it may still be considered as a net benefit and a contribution to reaching ALARP.

The potential for each additional control measure to generate negative environmental impacts, health and safety issues or operational risks was considered. Where effects were considered to negate the potential benefit partially or fully, the control measure was not considered for implementation, as it had no net benefit and contribution to reaching ALARP.

Where the benefit (i.e. reduction in impact or risk) of an additional control measure was considered grossly disproportionate to the cost of implementation or the effect on survey efficacy, the control measure was not accepted. As such, the control measures presented in the impact and risk assessment constitute only those that were deemed to result in a reasonable, practicable and effective reduction in the likelihood or consequence of an impact or risk becoming realised, and thereby demonstrating ALARP whilst achieving the objectives of the survey.

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5.5.4 Residual impact and risk ranking

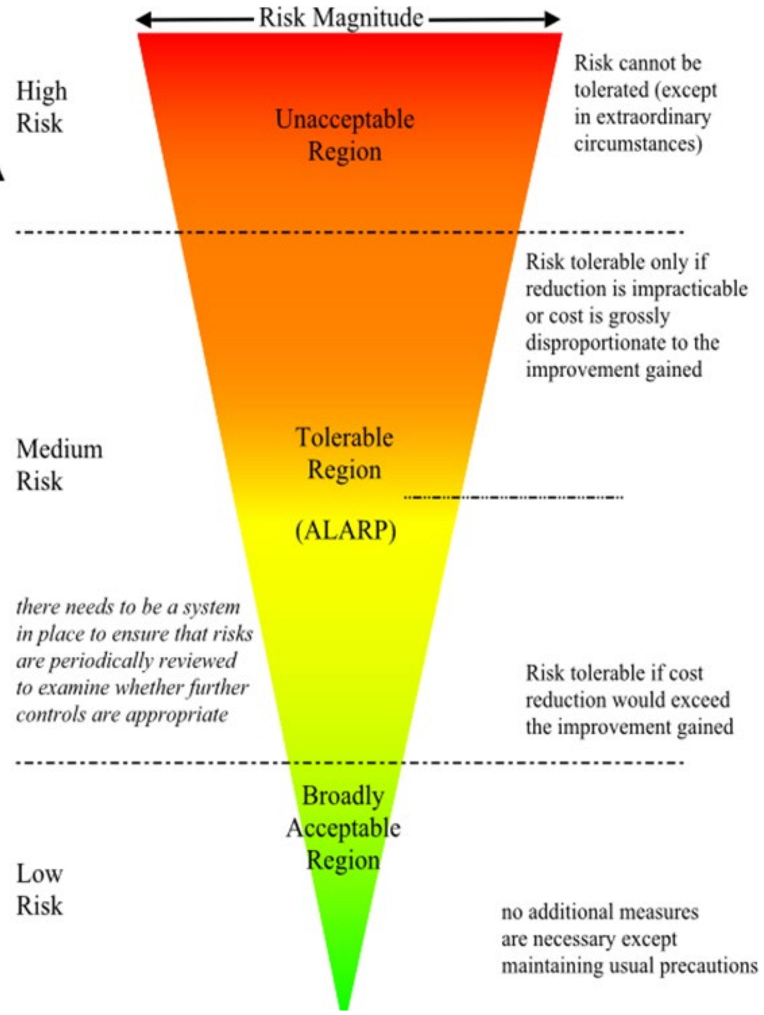
The residual impact and risk ranking process is undertaken to assess the effect of control measures in mitigating the inherent risk levels. It follows the identification of the decision context type, ALARP process and establishing appropriate control measures.

Residual risk rankings were based on re-assessment of the likelihood and consequence of the impacts with the mitigating controls in place. Residual risk was assigned using CGG's risk matrix in Table 5.5. All identified impacts and risks associated with the activity were analysed and evaluated in accordance with CGG risk matrix. The coloured region signifies the tolerability of the risk criteria Environmental impact and risks ranked as low or medium are generally considered ALARP and acceptable (provided that it can be shown that all practical impact and risk reduction measures have been taken and they will continue to be taken). Impacts and risks ranked high are undesirable or unacceptable and require additional control measures to be implemented to reduce the residual risk to ALARP and Acceptable.

5.5.5 Demonstration of Acceptability (Regulation 13(5)(c))

Regulation 13(5)(c) of the OPGGS(E) Regulations requires a demonstration that residual environmental impacts and risks are of an acceptable level. Acceptance is often represented as an inverted triangle (Figure 5.3), where the level of risk increases from a low risk or "broadly acceptable region" through a "tolerable region" (if impacts/risks are demonstrated to be higher, but ALARP) and then to an "unacceptable region". These principles have been adopted in CGG's definitions of acceptability

- Low: Good industry practice (including legislation and standards) has been applied and the impact/risk is acceptable without further reduction measures being required. Further effort towards impact/risk reduction is not reasonably practicable without sacrifices (costs, loss of opportunities, or loss of technical quality) grossly disproportionate to the impact/risk reduction benefit.
- Medium: Acceptable (acceptable / tolerable), providing that it can be shown that all practicable control measures have been implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, with continual review of these measures and any potential new ones.
- High (undesirable): CGG management decision required to accept impacts/risks and proceed. Additional control measures are required to be considered and implemented, if the sacrifices are not grossly disproportionate to the environmental benefit gained, to prevent or reduce the impact/risk to ALARP and be acceptable.
- Very high (unacceptable / intolerable): May require re-design of project and/or its parameters, additional control measures are required to be implemented (regardless of sacrifice) to prevent or reduce the impact/risk to ALARP and be acceptable.



(from: ISO 31010:2009 Risk management – risk assessment techniques)

Figure 5.3 Approach to demonstrating ALARP and acceptable levels (Reg 13(5)(c))

- CGG's model for demonstrating acceptable levels of impacts and risks for the Gippsland MSS is based upon the criteria described in Table 5.7. Using the appropriate criteria from Table 5.7, acceptable levels of impact were defined prior to conducting the evaluation of individual impacts and risks in Section 6 and Section 7. However, not all the criteria for acceptance in Table 5.7 will apply to defining levels of acceptability for all impacts and risks assessed within this EP. CGG has therefore distinguished between higher and lower order environmental impacts and risks.
- Higher order impacts/risks are generally more complex and include those where the environment or receptor affected is protected/threatened, vulnerable to the impact/risk, not widely distributed, or where there is uncertainty in the effectiveness of adopted control measures. Such impacts/risks relevant to the Gippsland MSS include underwater noise from seismic operations, accidental oil spill (vessel collision/grounding) and physical interaction with other marine users. It is expected that reasonable effort has been used to identify and evaluate alternative, additional, and improved control measures that may further reduce impacts and risks (NOPSEMA Guideline N-4750-GL1721). Lower order impacts include atmospheric emissions, routine discharges, light emissions, accidental loss of materials, introduced marine species and fuel spills.
- Following demonstration that all reasonable and practicable control measures have been adopted to reduce the impacts and risks to ALARP, the pre-defined acceptable levels of impact have been compared with the residual levels of impact and risk. If the residual impact levels lie within the boundaries of the pre-defined acceptable levels, the impact or risk is considered acceptable.

CGG's criteria for acceptance of residual risks following the demonstration of ALARP is based upon the criteria and associated considerations described in Section 5.5.5 and documented for each impact/risk in Sections 6 and 7.

Table 5.7 Criteria for defining acceptable levels of impact

Criteria for acceptance	Definition of criteria
CGG's Internal Context	• Alignment with CGG's Environment Policy and the environmental management system for the Gippsland MSS described in Section 8. • CGG impact/risk matrix defines 'low risk' as acceptable, 'medium risk' as acceptable providing ALARP has been demonstrated, 'high risk' as undesirable (i.e. requiring ALARP demonstration and decision to accept based on CGG management decision), and 'very high risk' as unacceptable (Table 5.5) • As such, have all reasonable and practical control measures been adopted to reduce the risk or impact without sacrifices being disproportionate to the benefit of the risk reduction?
Legislative Requirements	• The impact/risk is being managed in accordance with existing Australian or international legislation, conventions and/or standards, such as MARPOL 73/78, AMSA Marine Orders, and Marine Notices, Policy Statements (refer to Section 2) • Aligned with the principles of Ecological Sustainable Development (ESD), including application of the precautionary principle and/or how uncertainty has been reduced • The proposed management of the impact/risk is aligned with species-specific or protected area management plans/conservation advice actions or conservation objectives. • The proposed management of the impact/risk is aligned with the identified conservation values for the existing environment, as defined in the South-East Commonwealth Marine Reserves Network Management Plan (2013-2023).
Industry Good Practice	• The impact/risk is being managed in accordance with industry good practice (APPEA Code of Environmental Practice and IAGC guidelines), and national and international standards (ISO 31010:2009 Risk Management, Standards Australia / Standards New Zealand Risk Management Guidelines) APPEA Code of Environmental Practice and IAGC guidelines
Social Acceptance	• Concerns raised during stakeholder consultation have been assessed for their merits and control measures developed, if appropriate, to manage those concerns. • There are no outstanding merited concerns that have not been assessed.
Existing Environmental Context	• Is the effect on the environment or receptor localised, short-term and recoverable? • Have potential impacts to environmental values or sensitivities been assessed as local, regional (and if applicable global) level in terms of population level and long term effects? As such, are adopted controls appropriate and adequate in avoiding such effects and thereby reducing risks to ALARP.

5.6 Environmental performance outcomes and standards

Regulation 4 of the OPGGS(E) Regulations provides definitions for the following

- Environmental performance outcome: A measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level.
- Environmental performance standard: A statement of the performance required of a control measure.

Environmental performance outcomes, standards and measurement criteria for each aspect of the activity that has the potential to cause adverse environmental impacts or risks are detailed in the assessments presented in Section 6. Environmental performance will be measured and reported against these standards and measurement criteria, as part of CGG's commitment to continuous improvement of environmental, health and safety performance.

CGG will develop and maintain an Environmental Conformance Register for the activity, which details the environmental commitments, performance outcomes and criteria outlined in this EP. The Conformance Register is an audit tool to be used during the activity to demonstrate conformance of the activity with the environmental performance commitments made by CGG. This Conformance Register will be submitted to NOPSEMA as part of the Post-survey Environmental Performance Report (PEPR) within two months following the completion of the survey (Section 8.8.1).

5.7 Monitoring and review

Ongoing monitoring and review are essential to ensure the impact and risk assessments within this EP remain relevant. Introduction of new impacts/risks due to changes in the activity or context, changes in the consequence of impacts/risks, and maintaining effectiveness of adopted controls are addressed in CGG's Management of Change procedure described in Section 8.2.1.

RPS

6 Environmental impact assessment – planned events

This section of the EP presents the results of the impact assessment of planned events for the Gippsland MSS using the methodology described in Section 5.0. As required by Regulation 13(5) and 13(6) of the OPGGS(E) Regulations, this assessment demonstrates that the impacts associated with the activity will be reduced to ALARP and to an acceptable level. Potential impacts associated with transit of the survey vessel and support/escort vessels to and from the Operational Area, are considered outside the activity and therefore outside the scope of this EP and assessment.

6.1 Impact 1: Underwater sound – seismic operations

6.1.1 Identification of hazard and extent

Hazard	The activity is a typical 3D survey similar to the majority of seismic surveys conducted in Australian marine waters in terms of technical methods and procedures. No unique or unusual equipment or operations are proposed. The dominant source of underwater noise during the Gippsland MSS will be from the operation of the seismic source (airgun array), which is proposed to be in frequent operation for the duration of the survey. The airgun array will have a maximum volume of 3,000 in^3. During the proposed activity, the seismic survey vessel will traverse a series of pre-determined sail lines at 400 to 600 m apart, within the Acquisition Area at a speed of approximately 4.5 to 5 knots (8 to 9.3 km/hr). Seismic data will be acquired in water depths of 43 to 3,345 m. The seismic array is highly directional; focussing sound energy towards the seabed, but will also ensonify the surrounding water column to a lesser extent. The underwater sound generated by the array will be strongest at the source and rapidly decrease with distance from the source. Undershooting may occur around a maximum of ten offshore production platforms within the Acquisition Area (Section 3.4.3). During undershooting, a secondary vessel with a similar seismic source will be positioned parallel to the main survey vessel and for each platform, two passes will be made on each side of the platform, once with the secondary source vessel on the same side as the main vessel and a second pass where the secondary source will be on the opposite side of the platform. The two source vessels will be approximately 500-800 m apart. The primary vessel with cables has two sources and a second vessel also has two sources. Each source will fire every 50 m, alternating between the two source vessels, so there is still 12.5 m between shot points. Hence the amount of sound being produced in a given amount of time is the same as for conventional data acquisition. The vessels will be passing over the same ground twice either side of the platform, so four extra passes in total are required. The size of the undershoot area under each platform will be 25 km x 3 km, and the time required to acquire seismic data for each undershoot area will be 18 to 55 hours (likely average duration of 36 hours). During this maximum 55-hour period the total maximum duration of ensonification of this area will be 10 hours, which will include 45 hours when the airguns are not operational. Marine biota in the area of ensonification will be exposed to different received levels of sound energy, depending on their behaviour, physiology and where they are in relation to the source. However, actual near-field and far-field received sound levels are influenced by a number of factors including the overall size (capacity) of the acoustic source, the array configuration, water depths in the area, position in the water column, distance from the source and geoacoustic properties of the seabed.

Extent	The areas of ensonification for marine fauna groups are based on the largest area of effect predicted by the underwater sound modelling for the marine fauna thresholds (Section 6.1.3) applied to this assessment. These areas are defined by the following distances from the source:
	• Plankton – up to 2.2 km (<200 m water depth) to 6.4 km (>1,000 m depth) from the source (based on mortality recorded by McCauley et al. 2017)
	• Crustaceans (e.g. lobsters and prawns) – up to 100 m from the source in water depths up to 200 m (based on sub-lethal effects recorded by Day et al. 2016)
	• Bivalves (e.g. scallops) – up to 625 m from the source (based on sub-lethal effects recorded by Day et al. 2017)
	• Octopus and squid (these species do not occur >825 m depth)
	  ◦ up to 1.4 m from the source in shallow waters (< 200 m depth)
	  ◦ up to 2.2 km from the source in mid depth waters (200-1,000 m)

RPS

	• Fish (demersal species, including site-attached species) – up to 3 km from the source (based on TTS effects for accumulated 24 hour exposure scenario)
	• Fish (pelagic and demersal species)
	  • up to 500 m from the source in shallow waters (< 200 m depth)
	  • up to 1.1 km from the source in mid depth waters (200-1,000 m)
	  • up to 1.5 km from the source in deep waters (>1,000 m)
	• Marine turtles – up to 150 m (<200 m depth) to 232 m (>1,000 m depth) from the source (based on potential mortality and recoverable injury)
	• Cetaceans
	  • Low-frequency cetaceans (pygmy blue, southern right, humpback) – potentially up to 12.5 km from the source in the inshore direction and 35 km in the offshore and along-shore direction (based on TTS effects for accumulated 24-hour exposure)
	  • Mid-frequency cetaceans (sperm whales – *Physeter* sp.) – potentially up to 680 m (<200 m depth) to 1.3 km (>1,000 m depth) in all directions from the source (based on TTS effects for accumulated 24-hour exposure)
	• Pinnipeds – up to 1.4 km (<200 m depth) to 1.6 km (>1,000 m depth) from the source in all directions (based on TTS effects for accumulated 24-hour exposure).
	• Marine mammals (behavioural disturbance) – up to 1.2 km (<200 m depth) to 3.9 km (>1,000 m depth) in all directions from the source.

Duration	Continuous for the duration of survey – up to 6.5 months (mid Jan to end July)

6.1.2 Levels of acceptable impact

The impact on marine receptors caused by underwater sound from seismic operations will be acceptable when the levels of acceptability are met as described below.

Table 6.1 Levels of acceptable impact – underwater sound from seismic operations

Acceptability criteria	
Marine receptors (general)	• Seismic operations (including soft starts and ramping up) are limited to within the Operational Area. • Seismic discharge intensities are limited to the minimal levels at all times while performing operational objectives • Soft-start of airgun array will be used every time the array is first started • Zoning of acquisition area to reduce potential impacts on Biologically Important Areas and to avoid intense ensonification of any one area for more than a month
Plankton (incl. fish larvae, eggs)	• Minimise overlap of seismic acquisition with spawning activity in important areas for fish/invertebrates such as South East Reef. • Scheduling acquisition of the zones within the acquisition area to avoid ensonification of parts of the survey area for more than 24 hours; therefore impacts on key productivity events in areas of upwelling are unlikely. • Plankton communities only affected for a short time. • No lasting population or ecosystem level effects.
Fish (incl. spawning)	• Survey has negligible effects on the spawning output of commercially important species likely to be present within the Operational Area. • The BIA for great white shark overlaps the north-western boundary of the Operational Area. However, the Issues Paper (DSEWPaC, 2013b) for this species does not identify seismic survey as a threat to its recovery and the species also not known to be sensitive to underwater sounds. • No population or ecosystem level effects.
Invertebrates (incl. spawning)	• Survey has negligible effects on the spawning output of commercially important species likely to be present within the Operational Area. • No population or ecosystem level effects.

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Acceptability criteria

Marine turtles	• Predicted effects limited to behavioural disturbance of a small number of individuals. • No predicted impacts on breeding, migration or foraging of marine turtles. • No population or ecosystem level effects.

Cetaceans	• Application of measures defined in Part A of EPBC Act PS 2.1 and additional measures if necessary to align with conservation management plans and good practise
	• No displacement or exclusion of foraging, aggregating, calving/breeding, migrating cetaceans from BIAs.
	• Aligns with the relevant management actions from the Conservation Management Plan for the Blue Whale
	  ◦ conduct seismic surveys outside BIAs at biologically important times of the year
	  ◦ PBWs will continue to use the BIA without injury and are not displaced from the foraging area
	  ◦ apply the measures specified in the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales
	  ◦ behavioural impacts are to be considered when assessing the effect of anthropogenic noise on blue whales
	• Aligns with the relevant management actions from the Conservation Management Plan for the SRW by
	  ◦ minimising risk of injury to SRW from seismic surveys
	  ◦ maintaining connectivity of coastal habitat including between aggregation and calving areas
	  ◦ conduct seismic surveys outside BIAs at biologically important times of the year
	  ◦ apply the measures specified in the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales
	  ◦ assess and address seismic survey noise and time the seismic survey to avoid calving areas in SRW calving period
	• This EP aligns with the management actions of the HBW Conservation Advice by
	  ◦ performing site-specific underwater acoustic modelling to assess the impacts from noise on cetaceans
	  ◦ applying standard measures specified in the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales (DEWHA 2008)(because the seismic survey is not within known calving, resting, foraging or a confined migration pathway, additional measures for HBWs are not required)
	• Aligns with the management actions of the sei whale Conservation Advice and fin whale Conservation Advice for an assessment of noise impacts.
	• No population or ecosystem level effects.

Australian and New Zealand fur seals	• No disturbance to breeding colonies, known haul-out sites or known foraging areas. • No population or ecosystem level effects.
Fisheries	• Stakeholder concerns/objections received have been merit assessed and changes to survey activity have been adopted or control measures developed to address merited concerns/objections, where required. No outstanding merited concerns that are not being addressed. • No disruption to fishing activities (with the exception of octopus fishers with fixed equipment) beyond that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre. • No ongoing impact on catchability as fish predicted to recover soon after survey completion (see Section 6.3).
Protected areas	• No predicted impacts on the conservation values of East Gippsland and Beagle Commonwealth Marine Parks (Figure 4.4). • No predicted impacts on the values of the East of Eden Upwelling KEF • No predicted impacts on the values of the Big Horseshoe canyon KEF.

RPS

6.1.3 Underwater sound modelling

CGG engaged RPS in the UK to undertake underwater sound propagation modelling for the Gippsland MSS to determine the potential spatial extent of potential underwater sound impacts from seismic operations (Appendix D1). These sound sources represent the worst-case sound impacts from impulsive (seismic) sound, and the zones of effect encompass the zones of effect for other sound sources (i.e. vessel noise). While the airgun arrays are assumed and modelled as if they were point sources, they are not (DEWHA, 2008, NMFS, 2018) and therefore the modelling represents a worst case scenario.

Propagation modelling was carried out using an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The sound propagation model is based on a combination of theoretical considerations and extensive experimental data. The model has been validated by numerous field studies and benchmarked against a range of other models, with good agreement (e.g. Toso et al. 2014; Etter 2013; Schulkin and Mercer 1985 in Appendix D1). RPS also carried out additional benchmarking tests using the extended Rogers propagation model in comparison to other propagation models – refer to Appendix D1.

Seismic sound was modelled for a 3,000 in^3 airgun array with a source level of 261.4 dB re 1 µPa SPL (peak to peak (PK-PK). The Acquisition Area was divided into shallow (<200 m water depth), mid-depth (200 to 1,000 m depth) and deep waters (>1,000 m depth). Representative locations within each of these depth zones were modelled and the maximum range to the threshold/guideline sound level over all azimuths was reported. The predicted maximum received levels reported in this EP and Appendix D1 are therefore considered representative of the seabed type and bathymetric features across the full extent of the Gippsland Basin.

The underwater sound modelling for cumulative exposure of cetaceans was conducted in accordance with the recommendations of a 24-hour exposure (NMFS, 2018). In this case the scenario used was of a single animal remaining stationary at a distance from the seismic line as the seismic vessel traversed the line. In the case of the Gippsland MSS, the line is approximately 110 km long. The results provided minimum offset distances from the seismic line a cetacean could remain for 24 hours without suffering TTS. This can be difficult to extrapolate to the real world but the two ranges of cumulative exposure over a 24-hour period must be tempered by understanding that the majority of the energy an animal is exposed to occurs when the vessel and animal are closest. In the Gippsland Basin all cetaceans present are expected to be transiting or foraging and unlikely to remain stationary. Conversely, any response from the cetaceans are likely to be in the opposite direction to the seismic source and, due to the open seas of the area will not become constrained in their escape efforts. Furthermore, the seismic vessel will not traverse the same line twice and will instead skip lines and work within set zones for a month at a time. Therefore, during the planned seismic survey the ranges to potential cumulative injury would be substantially shorter than those presented in Appendix D1.

For the above reasons, fleeing-animal scenarios were also modelled assuming animals would move away from the source. These scenarios offer additional information about more realistic exposures and are alternatives suggested as alternative modelling methods in NMFS (2018). Of all cetacean species expected in the Operational Area, the PBW is considered to be the most sensitive due to the identification of the BIA for possible foraging. Therefore, the speed used for the fleeing animal model was 1.5 m^{-s} (5.4 km^{-hr}) which is slow for this species but a reasonable precautionary level as a response compared with speeds estimated from satellite tagging studies (Double et al. 2012; Owen et al. 2016).

6.1.3.1 Conservatism in model assumptions

Although there is considerable uncertainty in the relationship between noise levels and impacts on aquatic species, the science underlying noise modelling is well understood (Farcas et al. 2016). The process involves application of quantitative noise exposure thresholds/criteria for particular groups of receptors and modelling predicted noise levels over a particular area. The accuracy of model predictions depends both on employing an appropriate model and on the quality of the input data (Farcas et al. 2016). Noise propagation models require assumptions regarding the marine environment in which they are based.

Uncertainties quite often exist in terms of site-specific knowledge of physical oceanographic conditions and/or seabed type and composition, all of which are influencing factors on the propagation of sound in underwater environments. The level of influence that these physical environmental conditions have on acoustic propagation varies and where site-specific data are not available, a precautionary approach is taken, often basing assumptions on regional conditions. The site-specific geoacoustic sites modelled in the Gippsland MSS acquisition area e.g. seabed substrate type, sea surface roughness are described in Appendix D1 and demonstrate the conservatism that has been built into CGG's modelled received levels.

6.1.3.2 Sound source verification – measured sound levels

The complex behaviour of sound underwater is influenced by numerous variables as described above; modelling the behaviour of sound propagating underwater considers all the known variables, using the best available data for each input parameter, and conservatism where there is uncertainty. Even so, it is likely that actual sound levels vary from those modelled, due to small-scale variation and complex reflection, refraction, absorption, interference and reinforcement patterns. It is, therefore, ideal to verify the modelled sound levels using measurements of underwater sound levels from the survey area.

There have been more than 16 historical seismic surveys over the Gippsland Basin. CGG has analysed this historic seismic survey data within the Gippsland Basin, and more specifically within the proposed Gippsland MSS Acquisition Area. CGG has developed a method for calculating SPL and SEL levels from conventional streamer seismic data using streamer hydrophones and compared these data to the modelled data for the Gippsland MSS. The methods have been peer-reviewed and agreed by Dr Alexander Gavrilov from the Curtin University Centre for Marine Science and Technology (CMST) (see Appendix D2).

Seven historic surveys were selected for the analysis as their spatial extents covered seabed areas and water depths across the Gippsland MSS Acquisition Area (Figure 6.1). All surveys were acquired using a seismic array of ≥3,000 in^3. The seismic streamer data from selected sail lines considered representative of the Gippsland MSS acquisition area (Figure 6.1) were analysed to produce measured sound levels close to the surface (i.e. where the streamers are). For all surveys G01a, Tuskfish, Elver, Sue, Oscar, Bazzard and HGP, instantaneous SEL and peak SPL levels were calculated for along each selected sail line. Maximum and mean/medians and standard deviations for each survey and in each water depth banding (<200 m, 200 to 1,000 m and >1,000 m). The full results of the analysis are provided in Appendix D3.

Measured levels from all sail lines analysed within the Gippsland 3D MSS area are shown in Figure 6.2. The maximum level in water depths of 20 to 200 m is 211.5 dB SEL with a mean of 153 dB SEL (±7.01SD), in water depths 200 to 1,000 m it is 196 dB SEL with a mean of 154 dB SEL (±6.01SD), in 1,000 to 2,600 m it is 175 dB SEL with a mean of 154 dB SEL (±3.6SD). These maximum levels are only within close proximity from the source, which you can see in Figure 6.2 as the SEL ranges for each plot are shown on the right hand side of the plots. The maximum levels within a few hundred meters of the source for all surveys are generally less than 176 dB SEL. Measured levels directly over the South East Reef are also presented for peak SPLs (Figure 6.3) and show that the highest levels are within less than 500 m of the source and maximum levels to not exceed 200 dB SPLpk, which is below any of the fish and lobster injury thresholds (i.e. 207 to 213 dB SPLpk).

Comparison of the measured levels from seven previous seismic surveys of a similar or larger array size as planned for the Gippsland 3D MSS with the predicted sound levels from the underwater sound propagation modelling provides validation of these modelled levels. The measured levels were found to be significantly lower than those predicted by the modelling, which provides an additional level of conservatism and precaution in the impact assessment which is based on the predicted impact ranges based on the modelling.

Gippsland bathymetry with legacy survey overlay

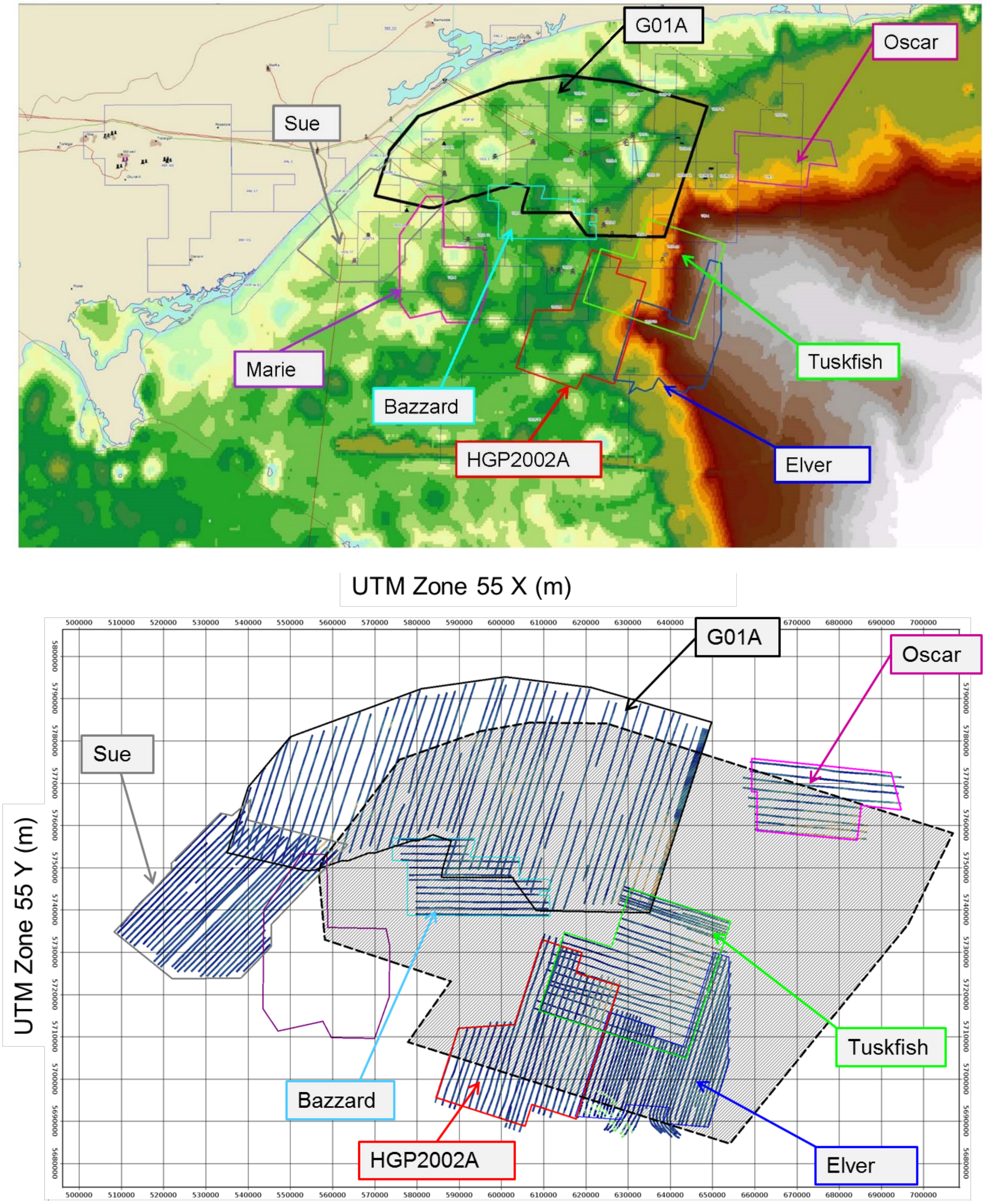

Figure 6.1 Spatial extent and overlap of previous marine seismic survey with the Gippsland 3D MSS

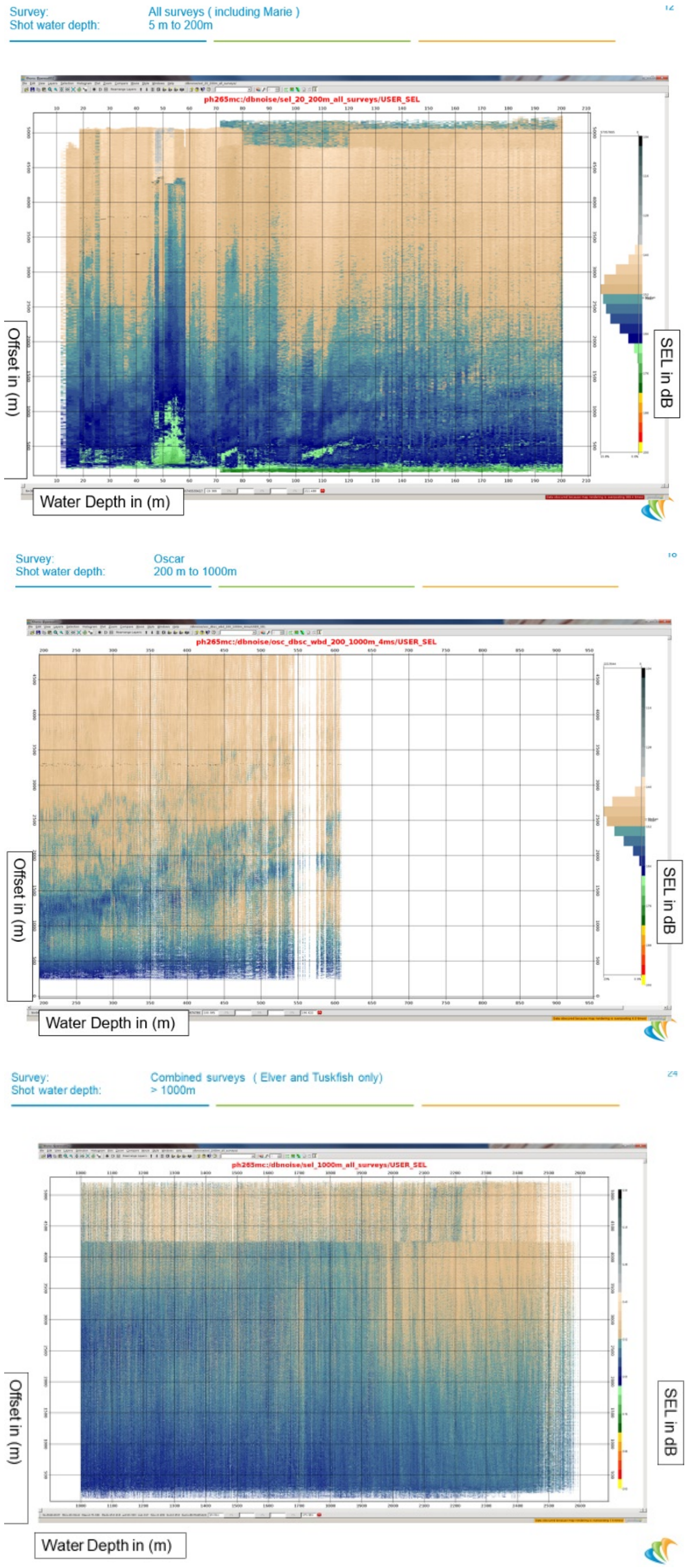

Figure 6.2 Measured sound levels from all previous surveys in 20 to 200 m water depth (top), from 200–1,000 m water depth (middle), and 1,000–2,600 m (bottom)

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South East Reef Area: Measured SPL

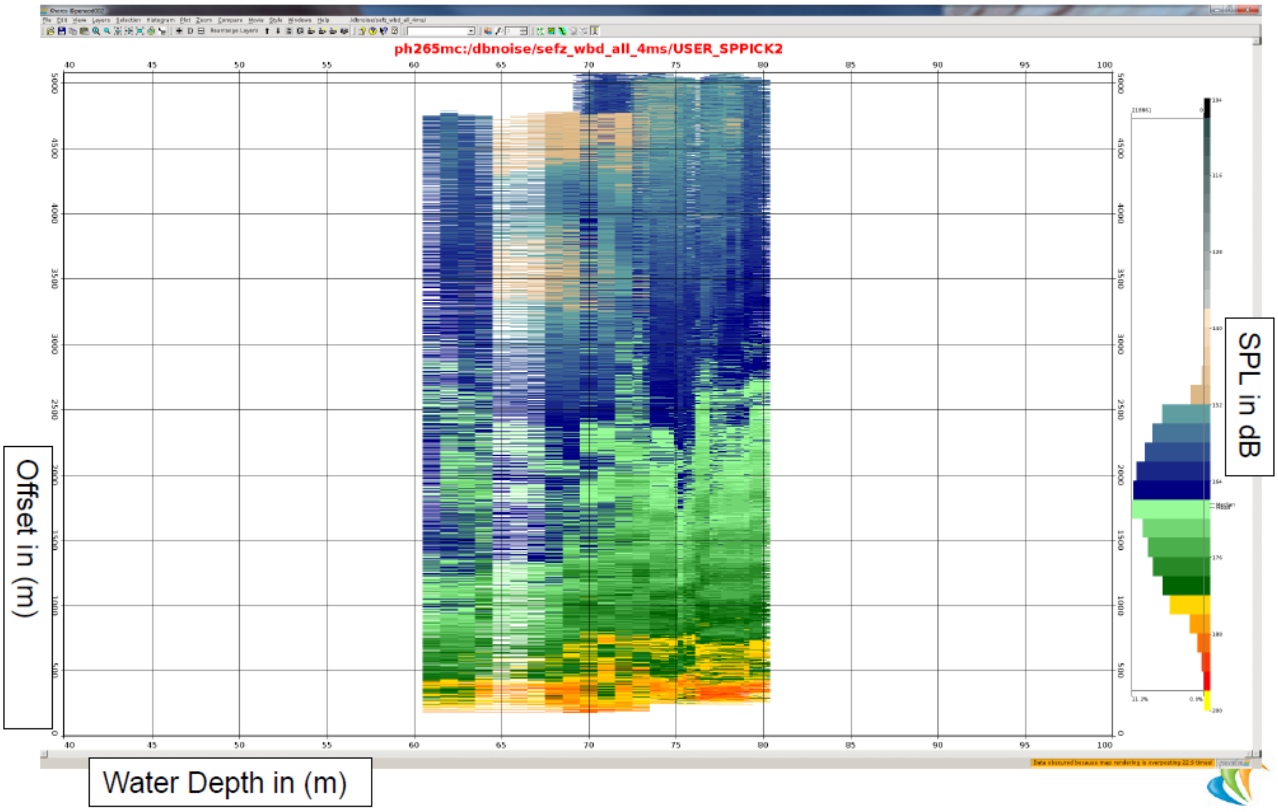

Figure 6.3 Measured sound levels from all previous surveys over South East Reef (<200 m water depth)

Figure 6.4 shows the modelled sound levels from CGG's Nucleus model in SPL (blue) and SEL (red) units overlaid on the corresponding Tuskfish and G01A streamer measurements. It confirms a high level of concordance between the modelled Nucleus and measured data out to 1,000 m from the source array. This means that the modelled data which is based upon the Nucleus source model can be confidently used for the impact assessment, due to the greater resolution than the measured data, making it more useful in determining distances to threshold isopleths.

At distances of >1,000 m it is not appropriate to solely use the outputs from the Nucleus model as this form of modelling is carried out independently of factors that affect the propagation of sound at longer ranges, such as the effect of surface scattering (i.e. reflections with the between the source and receiver/seabed), geoacoustic properties of the seabed and the sound speed gradient and the consideration of 'sound channels' (i.e. sound can propagate in a 'duct-like' manner within channels for large distances). CGG's sound propagation modelling carried out across the extent of the Gippsland MSS Acquisition Area has considered each of these factors (and more) in the predictions of received levels, which are discussed in detail in Appendix D1.

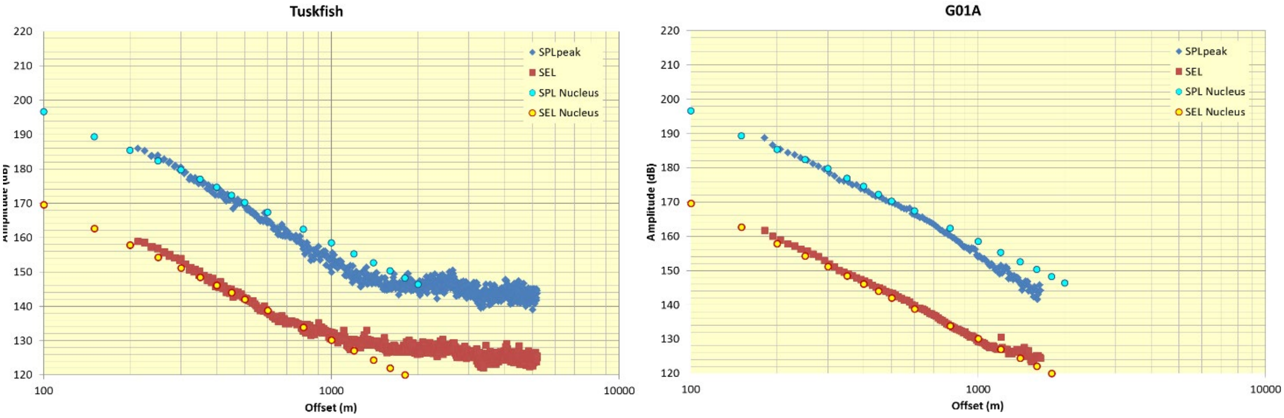

Figure 6.4 Gippsland historical measured vs nucleus modelled sound levels

The measured streamer data have also been compared to historical measurements from CMST's underwater sound loggers, as shown in Figure 6.5. The plots show high concordance between the streamer data (dark blue points) and logger data (magenta curves). The measured data aligns with the higher measurements from the CMST logger (magenta) data representing 3,000 – 4,000 in^3 arrays. This confirms that the CGG measured data is a good predictor of received sound levels out to the measured offset distance of 5 km to benchmark the sound levels predicted by the propagation modelling. This benchmarking of the modelled outputs gives confidence that the predicted modelled received levels are the best predictors of impact ranges for marine fauna groups.

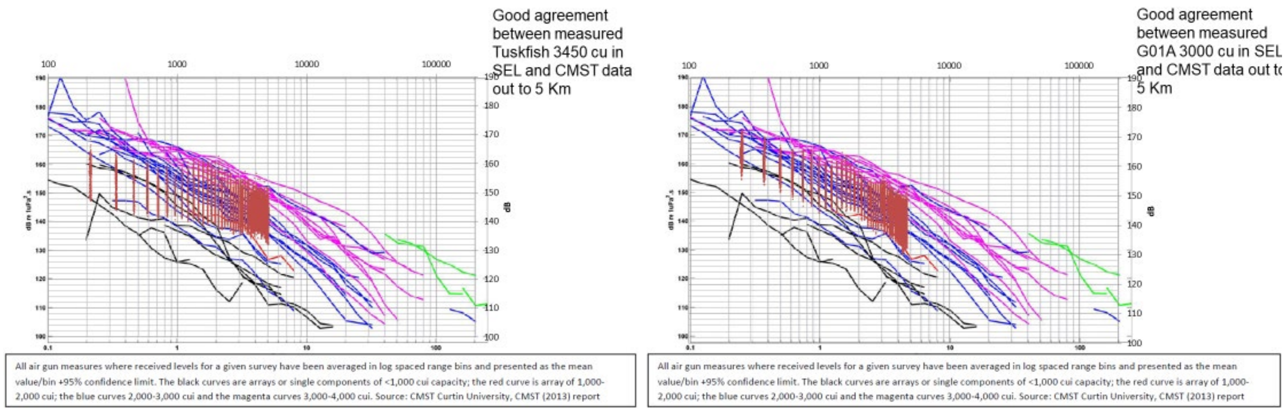

Figure 6.5 Gippsland Tuskfish (left) and G01A (right) measured hydrophone compared to CMST logger measurements (red vertical lines represent measured data)

The streamer hydrophone measurements for the Tuskfish and G01A MSS' are presented in Appendix D3 at various offsets from the source ranging from 250 m to 5 km, and at various water depths from approx. 200 m to 4,750 m, to examine the effect of depth on received sound levels. The measured data show that received sound levels are more variable with distance from source and this is more pronounced in water depths up to approx. 1,000 m in the nearfield (i.e. closer offsets 250 and 1,000 m) (Figure 6.5). Further there is a clear fall off in received sound levels with distance from the source, which is also represented in shallow waters of 50 m (Figure 6.6). The variation of sound levels with depth and at different offsets is most likely due to variation in water depth and seabed types; these two factors have been accounted for in the sound propagation modelling through conservativism in model assumptions, i.e. less reflective seabed type and modelling at across the range of water depths within the Gippsland MSS Acquisition Area.

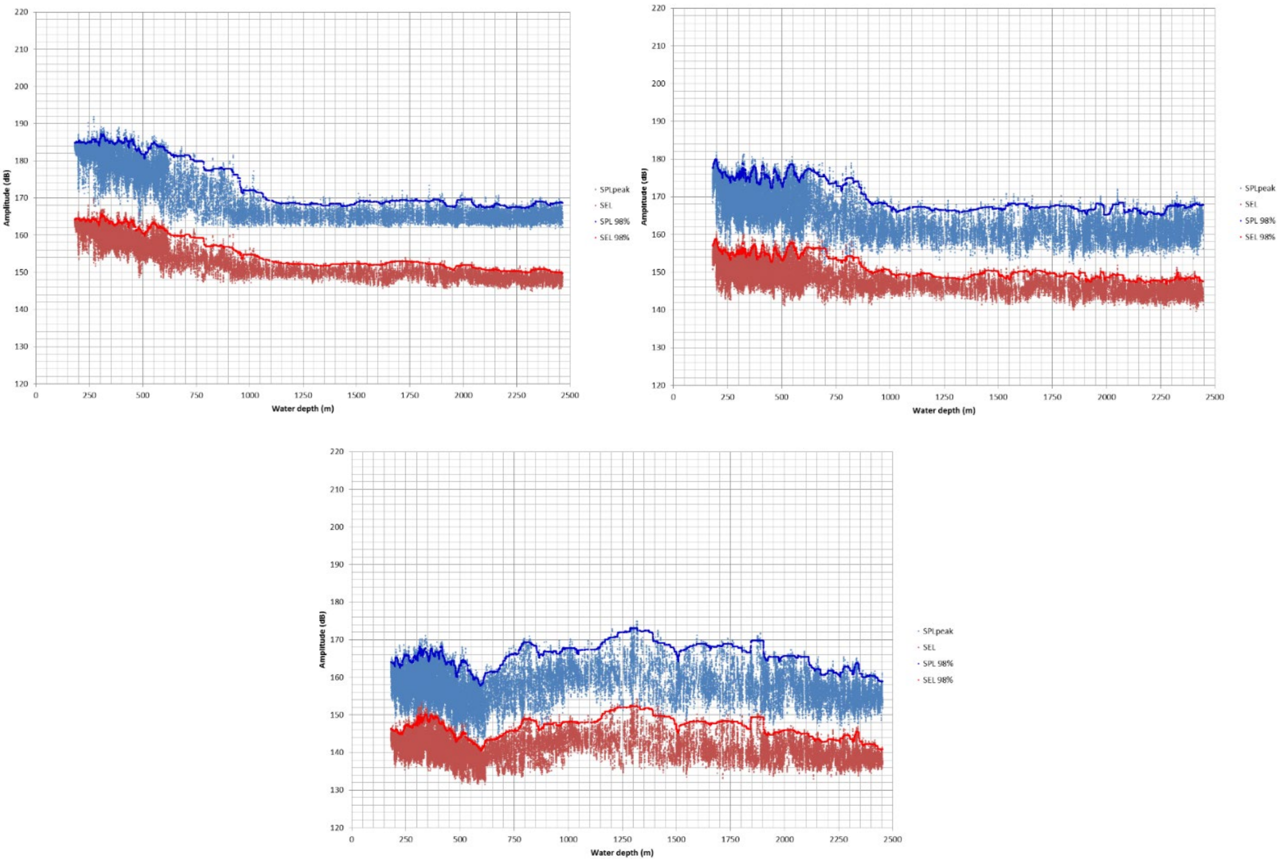

Figure 6.6 Tuskfish MSS measured sound levels at 250 m offset (above), 1,000 m (middle) and 4,750 m offset (below) from the source over water depth

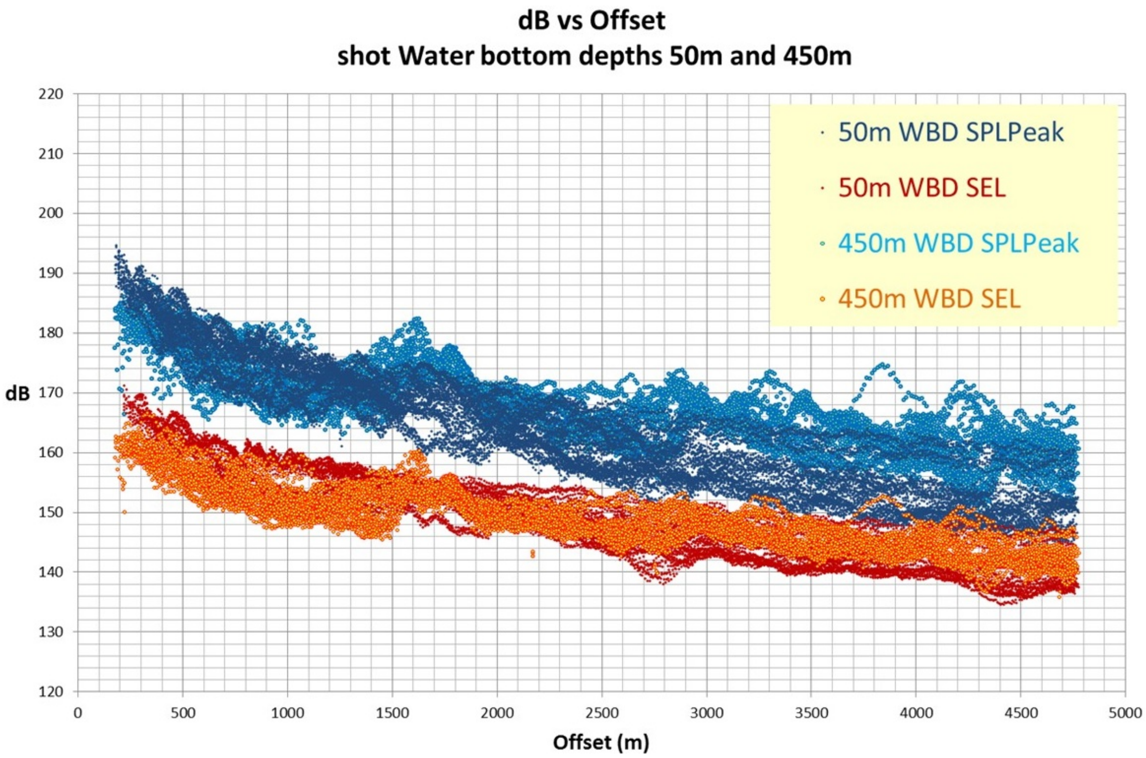

Figure 6.7 Tuskfish and G01A MSS combined measured sound levels in 50 m and 450 m water depths out to 5 km offset from the source

These measured data from previous seismic surveys in the Gippsland Basin demonstrate that the modelling of the single shot SPL and SEL levels for fauna that are sensitive to low frequency (LF) sounds are similar to actual sound propagation in the marine environment. Monitoring of the data in this way can be used during seismic survey to validate the modelling estimates for the LF components of the seismic discharges. Assuming the modelled LF components are comparable with the measured LF levels, the higher frequencies may also be assumed similar.

6.1.3.3 Marine fauna exposure criteria adopted

The underwater sound impact criteria that have been used to predict the impact ranges (distances from the source) for injury or disturbance to marine fauna, include peer-reviewed and accepted thresholds and guideline levels based on the best available science for received sound levels (RSLs). These criteria cover a range of effects from behavioural disturbance to injury or physiological damage. In the absence of peer-reviewed or recognised criteria, such as for plankton and some invertebrates, the modelling has used reported effects levels from recent publications. In the absence of directly relevant criteria for some taxa, conservative criteria have been adopted on the basis of international convention and from pile-driving impact studies, which are based on extended exposure to high intensity sound pulses and make no allowance for the receptor to leave the area if the sound level becomes uncomfortable.

6.1.3.3.1 Plankton, fish larvae and eggs

Guideline thresholds for mortality to eggs and larvae have been proposed based on the sound exposure guidelines by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014). These guidelines represent the Working Group’s efforts to establish broadly applicable guidelines for ichthyoplankton (fish eggs and larvae). The criteria that Popper et al. (2014) suggest for mortality in eggs and larvae are based on levels measured in the study by Bolle et al. (2012) that indicated no damage was caused by simulated repeated pile driving at 207 dB re 1 µPa SPL_{peak} or 210 dB re 1 µPa SEL_{cum}.

McCauley et al. (2017) reported zooplankton mortality rates at received levels of 178 dB re 1 µPa (Lpk-pk) up to 1.2 km from an airgun, however modelled impacts are considered to have been over-estimated based on the limitations of the survey methodology. Richardson et al. (2017) agreed that McCauley et al. (2017) found evidence of some local-scale impact of seismic activity on zooplankton but also noted that their modelled impacts may have been over-estimated due to diel vertical migration which was not included in the McCauley et al. (2017) model. Notwithstanding, Richardson et al. (2017) predicted recovery of the zooplankton community within three days after the end of the seismic survey. The level reported in the McCauley et al. (2017) is therefore deemed inappropriate as a threshold for assessment within this EP.

6.1.3.3.2 Invertebrates

Lobsters and scallops

There are no peer-reviewed or recognised sound exposure criteria for invertebrates. Research on the impacts of low frequency sound to marine invertebrates is limited (Caroll *et al.* 2016). Day et al. (2016) assessed the impact of seismic sound on rock lobsters and their larvae, and scallops. Day et al. (2016) concluded in their paper that the results of their study were broadly applicable to lobster and scallop fisheries throughout the world, and to crustaceans and bivalves in general. The exposure levels from that study have been compared with predicted modelled received levels for benthic invertebrates.

Exposure to the maximum measured SPL of 209 to 212 dB re 1µPa (pk-pk) did not result in mortality of any adult lobsters or a reduction in the quantity or quality of larvae; however, a range of sub-lethal effects to adults were observed (Day et al. 2016). Exposure to air gun signals did not result in any mortality in any of the experiments on lobster conducted in the Day et al. (2016) study; lobsters and other crustacean species are not expected to be killed at these sound levels.

RPS

Exposure to the maximum measured SPL of 191 to 213 dB re 1µPa (pk-pk) did not result in immediate mass mortality in adult scallops; however, increases in the level of exposure (i.e. repeated exposure to air gun passes) were found to significantly increase mortality. Overall mortality rates in the exposed scallops were at the low end of the range of naturally occurring mortality rates documented in the wild, with control scallops having a total mortality rate of ≤5% and exposed scallops showing a mortality rate of 9-11% (Day et al. 2017).

Cephalopods – squid and octopus

There is a scarcity of peer-reviewed literature reporting experimental studies about the effects of underwater anthropogenic noise on cephalopod species. As a result there are no peer-reviewed or recognised sound exposure criteria for cephalopods. Evidence from studies exposing cephalopods (squid, octopus and cuttlefish species) to near-field low-frequency sound have shown received peak levels may cause anatomical damage (e.g. André et al. 2011, Solé et al. 2013), however research is limited to experiments in artificial tanks, rather than in the wild, and researchers have cautioned extrapolation of the conclusions of these results especially where there are no options for escape (Goodall et al. 1990; Popper et al. 2001; Montgomery 2006; Gray et al. 2016; Carroll et al. 2017). There have been no observed cephalopod mortalities directly associated with seismic surveys.

Solé et al. (2013) exposed two species of squid, one species of octopus and a cuttlefish species to received peak levels of 175 dB re 1 µPa which resulted in permanent and substantial alterations of the sensory hair cells of the statocysts in all four species. Lesions were evident from 0 to 96 hours following exposure with no clear evidence of recovery, however the authors observed scarring processes in some specimens at 48 h, suggesting some level of recovery is possible. Although the concluded on a common cause-to-effect relationship between sound and trauma in all exposed individuals, they did not propose or consider the pressure (received) levels reported in their paper could or should be taken as reference values for the injury trigger (lesions) due to the lack of particle motion measurements and acoustic mapping in the experimental tank. CGG has therefore not adopted the peak received level of 175 dB re 1 µPa as an assessment threshold, but acknowledges in the assessment for squid and octopus that injury as a result of exposure of these species to low frequency seismic sound during the survey. In recognition of the scarcity of data and scientific studies on the effects of low-frequency sound on squid and octopus, CGG is proposing to undertake a field and laboratory-based study of the impacts of underwater sound from the Gippsland MSS seismic operations on octopus (Section 8.3.2.2).

McCauley et al. (2000) studied captive squid (*Sepioteuthis australis*) responses during a seismic survey, where squid showed a startle response to nearby airgun start up and evidence that they would significantly alter their initial behaviour at an estimated 2 to 5 km from a source. Fewtrell and McCauley (2012) identified that as levels increased above 147 dB re 1µPa^2.s (SEL) squid would elicit avoidance behaviour and sudden levels of 162 dB re 1µPa^2.s (SEL) or more induced an “inking” response. The authors concluded that squid are likely to move away or exhibit strong responses from a new source but are less likely to respond if the noise levels are gradually increased e.g. either through a soft-start or if the individuals have been exposed to the source before (habituation). They also identified that the individual squid used in their trials responded to the same stimuli after several exposure experiments suggesting that the physical injury and impairment to the hearing structures didn’t occur. For the purposes of the impact assessment on squid, the value of 162 dB re 1 µPa^2.s (SEL) can be used as a threshold since a soft-start will always be used where the sound levels are gradually ramped up to full power and low level responses are considered to not be biologically significant. CGG has also applied this exposure threshold for strong behavioural disturbance to octopus in this assessment.

6.1.3.3.3 Fish

The thresholds for harm to fish species have been based on the sound exposure guidelines for fish proposed by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014). The guidelines represent the Working Group’s consensus efforts to establish broadly applicable guidelines for fish, with specific criteria relating to mortality and potential mortal injury, recoverable injury and TTS (Table 6.2). The Working Group defines the criteria for injury and TTS as follows:

RPS

- mortality and potential mortal injury – immediate or delayed death
- impairment
  - recoverable injury – injuries, including hair cell damage, minor internal or external haematoma, etc (none of these injuries is likely to result in mortality)
  - TTS – short or long-term changes in hearing sensitivity that may or may not reduce fitness (defined as any persistent change in hearing of 6 dB or greater).

Table 6.2 Summary of fish injury exposure guidelines for seismic airguns (Popper et al. 2014)

Type of fish	Mortality and potential mortal injury (dB re1 µPa)	Impairment (dB re1 uPa)	
		Recoverable injury	TTS
Fish: no swim bladder (particle motion detection)	>213 dB peak	>213 dB peak	>186 dB SEL_{cum}
Fish: swim bladder is not involved in hearing (particle motion detection)	>207 dB peak	>207 dB peak	>186 dB SEL_{cum}
Fish: swim bladder involved in hearing (primarily pressure detection)	>207 dB peak	>207 dB peak	186 dB SEL_{cum}

Source: Popper et al. (2014)

Injury

The guideline levels for each of the criteria above have been derived from a number of sources. The mortality and recoverable injury guidelines are based on predictions derived from effects of impulsive sounds from piling (Halvorsen et al. 2011), since there are no quantified data for acoustic sources. Halvorsen et al. (2011, 2012) measured the ‘response severity index (RSI)’ of fish species exposed to pile driving. From this study, the authors identified that an RSI of 2 would be an acceptable level of physiological injury for the fish exposed to pile driving, which corresponded to a peak SPL level of 207 dB re 1 µPa. It should be noted that the RSI ranking of 2 relates to ‘mild’ and ‘non-life threatening’ injuries.

There are few data on the physical effects of seismic airguns (e.g. mortality, barotrauma) on fish, and of these none have shown mortality (Popper et al. 2014; Carroll et al. 2017). Popper et al. (2014) cite studies on seismic sound effects on fish and state that no studies have linked mortality of fish, with or without swim bladders, to seismic sound from airguns or in experimental studies replicating seismic sound fields (Popper et al. 2005; Boeger et al. 2006; Popper et al. 2007; Hastings et al. 2008; Halvorsen et al. 2011, 2012; Casper et al. 2012; McCauley and Kent 2012; Miller and Cripps 2013; and Popper et al. 2015). Empirical evidence comes from a study by Wagner et al. (2015) which exposed gobies to seismic sound at a level greater than the mortality and potential mortality threshold proposed by the Popper et al. (2014). The fish were exposed to six discharges at an average peak SPL of 229 dB re 1 µPa. Fish were monitored for 60 hours post exposure and no mortality or significant physiological damage (hair cell loss or otolith damage) were observed.

Casper et al. (2012) further investigated the RSI for several fish species; representative of the three fish groups identified by Popper et al. (2014):

- Group1: fish without swim bladders (sharks, rays, flatfish)
- Group 2: fish with swim bladders not involved in hearing (salmonids, sturgeons, jewfish, snapper)
- Group 3: fish with swim bladders involved in hearing and structurally connected to the inner ear, (herring, perch, bass, rockfish).

The study did not identify any mortal or potentially mortal injuries in the four fish species exposed to piling sound levels above an SEL of 177 dB re 1 µPa^2.s (or 207 dB re 1 µPa SPL peak). This level was concluded by the authors as being the potential onset of physiologically significant injuries (Casper et al. 2012) rather than mortality, highlighting the highly conservative and precautionary nature of the guideline levels proposed by Popper et al. (2014). It is, however, important to note that the intent of authors in proposing these thresholds was as “a first step in setting guidelines that may lead to the establishment of exposure standards for fish (and sea turtles)” (Popper et al. 2014).

The actual impacts associated with sound levels for the tentative thresholds for mortality/potential mortal injury and recoverable injury proposed by Popper et al. (2014) are therefore deemed to represent the level at which physiological damage may start to occur, as evidenced in the studies by Halvorsen et al. (2011, 2012) and Casper et al. (2012). They do not represent a likely mortal impact zone and empirical field data indicates mortality will not occur at these levels.

Impairment

The TTS thresholds for fish are proposed by Popper et al. (2014) and are based on data from Popper et al. (2005) for exposure of fish to a seismic airgun array. The fish were exposed to a sound level of 186 dB re 1µPa^2.s (SEL_{cum}), accumulated over five seismic pulses, and provide the most relevant cumulative exposure guideline specific to a seismic study. In the Popper et al. (2005) study, the experimental design was based on five exposures to the airgun at 40 second intervals so that the fish were exposed to a steady sound level. The authors note that in contrast, a normal seismic survey might present signals as often as every 10 seconds; however several contributing factors are described in the paper that lead the study authors to conclude that, although these factors do not compensate for the more frequent exposure in an actual seismic survey, their experiments exposed fish with an approximate “worst case” with regard to seismic stimulation (Popper et al. 2005). These factors include that as the survey vessel is moving, a stationary fish subject would be exposed to the maximum level only once in a sequence of exposures. Further, that the majority of exposed fishes during a seismic survey are likely to be at greater distances from the source than those in the Popper et al. (2005) study (i.e. 13 and 17 m) and would therefore receive a lower sound level. The guideline level for TTS proposed by Popper et al. (2014) derived from the results of the experiments conducted by Popper et al. (2005) are based on TTS responses from a hearing specialist fish species (i.e. those with the highest sensitivity to sound). This guideline level can also be considered worst case in this respect for the fish species assessed within this EP.

An independent peer review was conducted by Popper (2018) for the Bethany MSS EP (https://www.nopsema.gov.au/assets/epdocuments/A601445-EP-Summary-redacted.pdf). Popper (2018) explained in his review that the effects of TTS are unlikely to show up in fishes until the intensity of the sound is well above the fish’s hearing threshold. He went on to state that for fish species that are free swimming (which include key commercially targeted species) it is likely that there would be no TTS effect whatsoever since fish will likely move away from the sound source. The review concluded that if TTS is experienced, the level would be low and recovery would start as soon as the most intense sound ends and would be within 24 hours. Popper (2018) concluded that the time over which energy should be accumulated in each individual fish in the seismic survey area should be limited to the time over which fishes get maximum exposure, and that a period of 24 hours was considered likely far too long a period for calculation of accumulation of energy in determining potential harm (e.g. damage or TTS). Based on Popper’s (2018) conclusions, the most likely effect (if any) to fishes resulting from cumulative sound exposure is temporary threshold shift (TTS), and that the cumulative SEL 24 hour threshold is considered.

CGG has adopted cumulative SEL as the TTS threshold for exposure in fish, which based on the Popper’s (2018) expert review, is considered highly unrealistic, and therefore highly precautionary, with any TTS effects in fish being temporary and recovery expected within 24 hours.

Behaviour

There are no peer reviewed published thresholds for comparison of behavioural disturbance effects in fish as a result of exposure to seismic or continuous sound sources. Popper et al. (2014) did not propose specific behavioural guideline values for exposure to sound due to the limited experimental data supporting previously proposed guidelines, and the specific nature of behavioural responses amongst fish species, i.e. one guideline or criteria does not fit all. Instead Popper et al. (2014) recommends a qualitative relative risk of behavioural effects at three distances from the source – near (tens of metres), intermediate (hundreds of metres) and far (thousands of metres). For seismic sources, a high risk of behavioural effects were agreed for all fish groups (with / without swim bladders) within tens of metres from the source (near) and low risk agreed for all fish groups more than thousands of metres (far).

CGG has adopted the qualitative relative risk approach proposed by Popper et al. (2014) for the assessment of potential behavioural disturbance to fish as a result of the activity, and has further supported the assessment with conclusions and outcomes of various peer reviewed studies that have reported behavioural effects to fish exposed to seismic sources.

6.1.3.3.4 Marine turtles

Popper et al. (2014) proposed a guideline for mortality and potential mortal injury for marine turtles of 207 dB re 1 µPa peak based upon piling studies. There have been no studies conducted on hearing loss or the effects of exposure to intense sounds on hearing in any turtles, therefore Popper et al. (2014) have extrapolated from fish, based on the rationale that the hearing range for turtles much more approximates to that of fishes than of any marine mammal. There are no specific guideline values proposed by the Working Group for behaviour due to the limitations described above for fish (Popper et al. 2014).

6.1.3.3.5 Marine mammals

Based on current knowledge of functional hearing in marine mammals, NMFS (2016) identify three distinct, functional groups of cetaceans, based on the frequency range at which their hearing is most sensitive: a) low frequency (LF) cetaceans (7 hertz – 35 kilohertz); b) mid-frequency (MF) cetaceans (150 hertz – 160 kilohertz); c) high frequency (HF) cetaceans (275 hertz to 160 kilohertz).

NMFS (2016) recommend dual marine mammal criteria for the prediction of PTS and TTS from underwater sound modelling – peak SPL 'unweighted' criteria and cumulative exposure weighted criteria (Table 6.3). CGG have applied both sets of criteria in the assessment for marine mammals within this EP.

NMFS' (2016) revised acoustic thresholds did not suggest a revised approach to Southall et al.'s (2007) suggested criteria for behavioural disturbance. The NMFS (2013) sound level criterion for potential disturbance to marine mammals (pinnipeds and cetaceans) is 160 dB re 1 µPa SPL for impulsive sounds, which is peer reviewed and accepted by the scientific community, and has therefore used for the assessments in this EP.

In addition, EPBC Act Policy Statement 2.1 determines suitable exclusion zones with an unweighted single shot SEL threshold of 160 dB re 1 µPa^2·s (DEWHA 2008). The policy statement is only relevant for baleen and large toothed whales and does not apply to smaller dolphins and porpoises (DEWHA 2008). This threshold has also been applied to the assessment in this EP.

Table 6.3 Summary of relevant injury and behavioural criteria for marine mammals

Marine mammal hearing group	DEWHA (2008)	NMFS (2013)	NMFS (2016)			
	Unweighted per-pulse SEL (dB re 1 uPa^2-s)	Behaviour (all other marine mammals)	Injury (PTS)		TTS	
		SPL (dB re uPa)	Weighted SEL24h (dB re 1 uPa^2·s)	PK (dB re 1 uPa)	Weighted SEL24h (dB re 1 uPa^2·s)	PK (dB re 1 uPa)
Low frequency cetaceans	160 (baleen and large toothed whales)	160 (all marine mammal groups)	183	219	168	213
Mid-frequency cetaceans			185	230	170	224
High-frequency cetaceans			155	202	140	196
Phocid pinnipeds in water	NA		185	218	170	212
Otarid pinnipeds in water	NA		203	232	188	226

RPS

6.1.3.3.6 Divers

Human divers exposed to sound levels above 154 dB re 1 µPa (SPL) in the frequency range 0.6 to 2.5 kHz reported changes in their heart rate or breathing frequency (Fothergill et al. 2001). Parvin et al. (2002) went on to propose a maximum threshold level for recreational divers and swimmers of 155 dB re 1 µPa (SPL). CGG has adopted the level by Parvin et al. (2002) as the threshold for commercial and recreational divers in this assessment.

6.1.4 Impact analysis and evaluation

This section describes the impacts that may occur on significant marine environmental receptors identified in Section 4 that are known to be sensitive to underwater sound discharges from seismic airgun arrays. This part of the impact assessment method is described in Section 5.4.1. Each of the subsequent sections then undertake the impact analysis as defined in Section 5.4.2.

Sensitive receptors/ values	Review of the environmental resources described in Section 4, indicates that discharge of the acoustic source in the Gippsland MSS Acquisition Area has the potential to affect adversely the following environmental receptors, values and sensitivities, to varying degrees: • plankton (including commercially important fish and invertebrate larvae/eggs) • fish and invertebrates (including commercially fished species e.g. southern rock lobster, scallops, octopus, squid, trawled demersal species, sharks) • foraging PBWs (Acquisition Area overlaps possible foraging BIA and known distribution area) • resting and migrating SRWs (Acquisition Area lies adjacent to their coastal resting and migration BIA) • migrating HBWs (northern migration from Southern Ocean to NSW coast from May on) • transient / opportunistically feeding cetacean species (e.g. Antarctic minke, sei, fin and sperm whales) • Australian and New Zealand fur seals (may forage in the Operational Area) • transient marine turtles.
Potential impacts	Potential environmental impacts to these environmental receptors include: • physical injury to auditory tissues or other air-filled organs • hearing loss; either temporary threshold shift (TTS) or permanent threshold shift (PTS) • direct behavioural effects through disturbance or displacement and consequent disruption of natural behaviours or processes, e.g. migration, feeding, resting, calving • indirect behavioural effects by impairing/masking the ability to navigate, find food or communicate or by affecting the distribution or abundance of prey species • indirect effects on the catchability of commercial fish stocks. The potential for impact on individual animals depends on a number of factors, including the presence of the animal during the survey period, its proximity to the noise source, its ability to avoid the sound field generated by the airgun array, its specific physiological tolerance and the overlap between its hearing range and the seismic frequency range. Most of the sound energy of the seismic airgun pulses is in the low frequency range of 10 to 200 Hz (McCauley 1994; OGP 2011). The marine species most at risk from the low frequency acoustic emissions from seismic operations within the operational area are cetaceans, particularly baleen whale species that hear and communicate in a similar low frequency range.

6.1.4.1 Impacts on plankton (incl. fish larvae and eggs)

Planktonic organisms are, by definition, transported by prevailing wind- and tide-driven currents; becoming very widely dispersed and they cannot take effective evasive behaviour to avoid anthropogenic sound sources. Some forms of phytoplankton and zooplankton are capable of independent movement and can migrate vertically in the water column, but their horizontal position is largely determined by water movement and currents. Zooplankton typically exhibit diel vertical migration whereby they migrate to the water surface at night to feed and return to deeper waters during the day to avoid predation (Berge et al., 2009). Certain species (e.g. the copepod *Neocalanus plumchrus*) will also migrate to different depths at different stages of their life cycle (Kobari and Ikeda 2001). Phytoplankton, particularly diatoms and dinoflagellates, also show diel vertical migration (e.g. Cullen and Horrigan 1981, Hajdu et al. 2007), triggered by environmental conditions such as irradiance in the photosynthetically active radiation range (400 to 700 nm wavelengths) (Gerbersdorf and Schubert 2011).

Spatially, phytoplankton will vary according to nutrient concentrations and light availability. Temporally, phytoplankton populations in subtropical oceans drop off in summer as the buoyant warmer water becomes nutrient depleted. Zooplankton growth rates are highly variable among species. Spatially, the abundance and diversity of zooplankton varies significantly at all scales, driven by environmental conditions such as water temperature, depth, season, the availability of food resources and predation.

There have been few studies into the effects of marine seismic surveys on plankton. Up until recently, studies on the effects of sound from airguns on zooplankton have indicated that any effect is likely to be highly localised (<10 m from the source and typically within 0.5 to 5 m) (Table 6.4) (Kostyuchenko 1973; Matishov 1992; Booman et al. 1996; Payne 2009). These studies indicated that impacts would be insignificant compared with the naturally high turnover rates of zooplankton.

Table 6.4 Observed seismic noise pathological effects on zooplankton

Species	Source	Source level (dB re 1 μPa)	Distance from source	Exposure level (dB re 1 μPa SPL)	Observed effect	Source
Cod (larvae 5 days)	Single airgun	250	1 m	250	Delamination of the retina	Matishov (1992)
Cod (larvae 2–10 days)	Single airgun	222	1 m	222	No injuries detected	Dalen and Knutsen (1987)
			10 m	202	No injuries detected	
Fish eggs (anchovy)	Single airgun	230 (estimated)	1 m	230	7.8% of eggs injured relative to control	Kostyvchenko (1973)
			10 m	210	No injuries detected	
Fish eggs (red mullet)			1 m	230	No injuries detected	
			10 m	210	No injuries detected	
Dungeness crab (larvae)	Seven airgun array	244 (estimated)	1 m	233.5	No significant difference in survival rate relative to controls	Pearson et al. (1994)
			3 m	230.9		
			10 m	222.5		
Snow crab (eggs)	Single airgun	216	2 m	216	1.6% mortality; 26% delay in development	Christian et al. 2004
Spiny lobsters (embryos)	Single airgun	223 (estimated)	Run over the pots	200	No differences in the quantity or quality of hatched larvae	Day et al (2016)
		224 (estimated)		203		
		227 (estimated)		205		
Zooplankton (incl. krill)	Single airgun (150 in^3)	205 (estimated)	1.2 km	178 dB re 1 μPa (pk-pk)	Decreased abundance and increased mortality rate from 19% to 45%	McCauley et al. (2017)

Day et al. (2016) exposed egg-bearing female spiny lobsters (*Jasus edwardsii*) to sound from three air gun configurations, all of which exceeded levels of 209 dB re 1 μPa (pk-pk) (Day et al. 2016). Overall there were no differences in the quantity or quality of hatched larvae, indicating that the condition and development of spiny lobster embryos were not adversely affected by air gun exposure (Day et al. 2016). Although no apparent morphological abnormalities were observed, exposed larvae from the 45 in^3 experiment were found to be significantly longer than control larvae. However, the size of larvae in this study fell well within the range of natural variation, indicating natural variation in larvae is much greater that the differences observed between treatments in this study. Day et al. (2016) concluded no effects on embryos early in development within 1 to 1.5 km of the seismic source.

McCauley et al. (2017) reported zooplankton mortality rates more than two orders of magnitude higher than recorded in earlier studies. They found that exposure to a 150 in^3 airgun shot significantly decreased zooplankton abundance and that the mortality rate increased from a natural rate of 19% per day to 45% per day (McCauley et al. 2017). Impacts were detected out to edge of the study area, at 1.2 km from the airgun in waters 34 to 36 m deep (McCauley et al. 2017); these water depths are considerably shallower than the majority of seismic surveys in Australia.

In response to the McCauley et al. (2017) study, CSIRO modelled the impacts on zooplankton from a 35-day seismic survey in 300 to 800 m deep water in an 80 km x 36 km survey area (Richardson et al. 2017). Within the survey area, the model predicted a 22% reduction in zooplankton biomass, which declined to 14% within 15 km of the survey area (Richardson et al. 2017). They modelled the recovery of the plankton population and found it returned to 95% of the original biomass level within three days after the end of the survey. The rapid recovery was attributed to the fast growth rates of zooplankton and the dispersal and mixing of zooplankton from inside and outside the impacted area (Richardson et al. 2017).

The potential impacts of seismic surveys on plankton will depend on the species in question, the life history stages, the specifications of the airgun array, the distance between the airgun discharge and the plankton, the number of discharges, the water depth and the seabed features. Proximity to the source (i.e. airgun array) will also be variable due to diel migration of plankton (including fish larvae) between surface and deep waters. Consequently, predicting impacts is difficult due not only to the diversity of organism in the plankton but to the variation in environmental and physical parameters.

The upwelling East of Eden KEF is an area of high primary productivity (Figure 6.7) and overlaps the Gippsland Operational Area in its northwestern extent (Figure 4.11). The timing of the upwelling events are not well known, however it is possible that they are linked with the Bass Strait and Bonney Upwelling events. The Acquisition Area has been reduced in the northwestern area to minimise the overlap with this KEF. Productivity is generally low in much of the Acquisition Area, with higher productivity off the continental slope and in the shallow waters along the coast. Predicted received sound levels from the modelling were compared with the peer reviewed and accepted threshold for mortality recommended by Popper et al. (2014) of 207 dB re 1µPa SPLpk. The modelling predicted that this sound level could be reached up to 150 m from the source in water depths <200 m and up to 235 m in water depths >1,000 m within the Acquisition Area (refer to Appendix D1).

Based on the research to date, there is not enough data to confidently define zones of impact for planktonic organisms, including the eggs and larvae of fish. Although the recent work by McCauley et al. (2017) and Richardson et al. (2017) suggests that the zone of impact for zooplankton may be higher than previously thought, there is still evidence that for certain components of the plankton effects are likely to be limited to much less than this. Further, for many components of the zooplankton and phytoplankton, recovery is expected to be rapid (in the order of days), so the effects expected to be limited and to be within the range of natural variability.

Richardson et al. (2017) showed that zooplankton communities can begin to recover during the survey period during periods of good oceanic circulation (and periods of upwelling), and therefore a continuous decline in zooplankton throughout the survey period is not anticipated and would progressively recover during the survey as the vessel moves to each successive shot-line and each of the five acquisition zones. It is unlikely there would be localised patches of reduced food availability for plankton feeders over the period of the survey and during the 3-day recovery period (as modelled by Richardson et al. (2017)). No population level effects are expected in commercially caught finfish species, or to their catch rates as a result of impacts on eggs/larvae.

The predicted consequence for plankton is **Minor** with very limited impacts on plankton populations and the regional Gippsland Basin primary productivity.

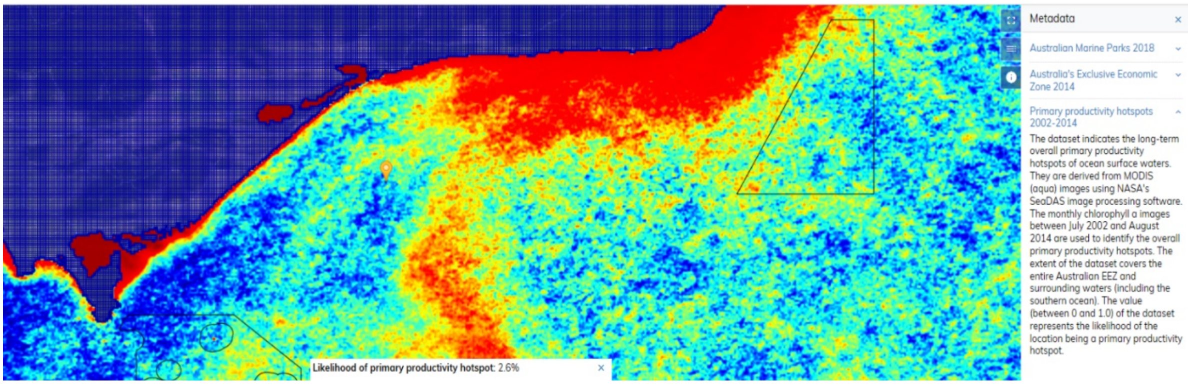

Figure 6.8 Primary productivity in the Gippsland marine region (using CSIRO data from 2002-2014)[1]

6.1.4.1.1 Impacts on spawning

Commercially important fish species that occur within the area that might be affected by the seismic activity are predominantly broadcast spawners (species that release vast numbers of sperm and eggs into the water column, or in some cases scatter them on the substratum, such as octopus), with several species forming spawning aggregations on the continental shelf, shelf break and slope. The commercially important crustacean species fished in the vicinity of the survey area (e.g. southern rock lobster) also spawn eggs but hold them under their abdomen where they incubate until hatching. Spawning species may aggregate at locations and spawn all their eggs and sperm at a specific time within a certain period (e.g. on a lunar cycle for blue grenadier), batch spawn across a region multiple times during certain seasons (e.g. pink ling) or spawn continuously throughout the year (e.g. Gould's squid). Significant spawning aggregation areas are not known to occur in the vicinity of the survey area, although information regarding fish spawning is generally not well documented.

Spawning periods for key species of Commonwealth and State-managed fisheries expected to be active within area that might be affected by the seismic activity are shown in Table 6.5. These species are likely to spawn on or around reefs such as South East Reef, for example, blue warehou were historically captured in large numbers from South East Reef (Section 4.4.4.3). Because of variability in spawning by different species there is typically some overlap between the survey and fish spawning periods. However, as described in Section 4.10 this overlap is not complete, and/or for many species the main spawning grounds are located outside of the survey area (e.g. blue grenadier, pink ling, snapper and blue-eyed trevalla). In the case of invertebrate species, the survey period does not overlap the spawning period of scallops, avoids part of the spawning period and all of the hatching period for rock lobster, and only partially overlaps the year-round spawning period of octopus and squid (Section 4.10). Note also that Table 6.5 does not include information for species that do not spawn at all within the south-east marine region (e.g. tuna, billfish, gemfish west, John and mirror dory, and school and king prawns). The months of March and April were identified as the months with the lowest sensitivity for spawning (Table 6.5). As such, and in recognition of the importance this reef has to fishers (Table 9.1), CGG has committed to acquiring seismic data within the zone (Zone 4) that encompasses South East Reef from March to April.

Fish larvae and eggs could be affected up to 150 to 235 m from the source in all water depths modelled (Appendix D1), however as discussed above recovery is expected to be rapid (in the order of days), and effects are expected to be limited and to be within the range of natural variability. However, over South East Reef a smaller array will be used of 150 in^3 (see Section 3). Received levels at offset distances for a 150 in^3

[1] https://atlas.parksaustralia.gov.au/amps/key-maps/chlorophyll-a-and-ocean-productivity?rsid=27184&featureId=AMP_SE_BEA

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array source were modelled by CGG (Table 6.9), which demonstrates that fish larvae/egg mortality (207 dB SPLpk threshold) could occur within 20 m of the source, but would not reach the top of South East Reef (i.e. this threshold is exceeded up to 25 m water depth). Species spawning at or near the seabed (e.g. lobster) would therefore not be exposed to injurious levels, and any fish larvae/eggs released would only be affected in a very small range of 20 m either side of the 150 in^3 array.

In terms of indirect impacts, the potential mortality of larval fish that rely on zooplankton for food is difficult to predict but is not expected to affect a significant proportion of larvae based on the assumptions that not all zooplankton are killed by exposure to airguns (Richardson et al. 2017) and only a very small proportion of the plankton would be exposed at any one time. Furthermore, zooplankton populations are likely to recover rapidly following completion of a seismic survey due to fast growth rates and mixing of zooplankton from both within and without the area of effect.

The predicted consequence for plankton is **Minor** with very limited impacts on plankton populations and the regional Gippsland Basin primary productivity.

Table 6.5 Spawning times for key commercially fished species

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blue grenadier					■	■	■	■	■	■		
Tiger flathead	■	■										■
Rock lobster						■	■	■	■	■	■	
Pink ling			■	■	■	■	■	■	■	■		
Blue warehou						■	■	■	■			
Eastern school whiting	■	■	■							■	■	■
King George whiting					■	■	■					
Snapper	■										■	■
Gummy shark	■	■										■
School shark	■											■
Scallop								■	■	■	■	
Pale/Maori octopus	■	■	■	■	■	■	■	■	■	■	■	■

Dark blue cells indicate spawning period.
Green cells indicate months of lowest sensitivity.

6.1.4.2 Impacts on invertebrates and fisheries

Until recently, effects on marine invertebrates were expected to be limited in spatial extent (<10 m as reported in a study of the effect of seismic explosions on pearl oysters by Le Provost et al. (1986)), as they are considered less sensitive to noise than hearing-specialist fish species, due to the lack of air-filled organs. La Bella et al. (1996) examined biochemical indicators of stress in bivalves exposed to seismic airgun noise. In this study, they found that hydrocortisone, glucose and lactate levels between test and control animals were significantly different in the venerid clam *Paphia aurea*, showing an evidence of stress caused by acoustic noise. This was measured at an exposure distance of 7.5 m between the test animals and source. Following on from this, a study by Hirst and Rodhouse (2000) suggested that most invertebrates would only detect seismic shots within about 20 m, and that catch levels of shrimp and lobster in areas surveyed with airguns reported no change during the surveys (Hirst and Rodhouse 2000). A study conducted in 2002 examined a number of health, behavioural, and reproductive variables before, during, and after, seismic discharge exposure on snow crabs (*Chionoecetes opilio*). Experimental animals were exposed to peak received broadband sound levels of 201 to 237 dB re 1 µPa. The results of the study suggested no obvious effects on crab behaviour, health or catch rates (Christian et al. 2004).

A study conducted by the Tasmanian Aquaculture and Fisheries Institute (TAFI) assessed the immediate impact of seismic surveys on adult commercial scallops (*P. fumatus*) in the Bass Strait in 2010 (Harrington et al. 2010). Participants in the Bass Strait Central Zone Scallop Fishery (BSCZSF) were concerned that the seismic survey may have a negative impact on the commercially important adult scallops within the region. The TAFI study concluded that no short-term (<2 months) impacts on the survival or health of adult commercial scallops were detected after the seismic survey (Harrington et al. 2010). There had been no change in the abundance of live scallops (or related change in dead scallop categories) or macroscopic gonad and meat condition after seismic surveying within either the control, impacted or semi-impacted strata. There was also no observable change in the size frequency distribution of scallops in the impacted and semi-impacted strata following the survey.

In response to the lack of discernible results from the 2010 before and after study by TAFI discussed above and the concerns from fisheries groups that seismic operations negatively affect catch rates, the Gippsland Marine Environmental Monitoring (GMEM) project was developed (Przeslawski et al. 2016). This study aimed at modelling and measuring sound at various depths before and during a seismic survey in 2015 to quantify potential impacts of seismic surveys on scallops and other benthic organisms. The underwater sound model predicted SELs of 170 dB re 1µPa^2.s within 250 m of the source and sound levels exceeding 150 dB re 1µPa^2.s out to 4 km from the source. However, the highest SEL measured by hydrophones during the survey was 146 dB re 1µPa^2.s at 51 m depth when the airguns were operating 1.4 km away. As such, the model was shown to be highly conservative, with actual noise levels falling to under 150 dB re 1µPa^2.s much closer to the seismic source than predicted. There was no evidence of increased scallop mortality, or effects on scallop shell size, adductor muscle diameter, gonad size, or gonad stage due to the seismic sound (Przeslawski et al. 2016). The authors concluded that the GMEM study provided no clear evidence of adverse effects on scallops, fish, or commercial catch rates due to the 2015 seismic survey undertaken in the Gippsland Basin. Przeslawski et al. (2016) further concluded that the GMEM study provides a robust and evidence-based assessment of the potential effects of a seismic survey on some fish and scallops.

The Day et al. (2016) study is the most recent that has recorded negative effects on commercially important shellfish species from seismic sound. The study investigated the effects of seismic sound on southern rock lobsters (*Jasus edwardsii*) and the Australian scallops (*Pecten fumatus*) located from 30 to 250 m from a seismic airgun source. Rock lobster experiments consisted of four sampling times between days 0 and 120 post-exposure, as well as over the longer term of 365 days post-exposure. Each lobster experiment comprised two treatments; a control pass of the airgun where it was deployed but not operated, and an active pass of the airgun (Day et al. 2016). Following exposure, a total of 302 lobsters, were sampled and assessed for mortality, two behavioural reflex tests, statocyst damage (balance and gravity sensing organ), condition, haemolymph biochemistry, the number of circulating haemocytes and embryonic development (see Section 6.2.4.1.1 for a description of results on lobster larvae). The maximum measured exposures were 209 to 212 dB re 1 µPa pk-pk. The maximum cumulative SEL received from multiple shots was between 192 and 199 dB re 1 µPa^2.s (Day et al. 2016). The study found that exposure to seismic sound levels up to a maximum SEL of 209 to 212 dB re 1 µPa pk-pk did not result in mortality of any adult lobsters, even at close proximity. However, sub-lethal effects, relating to impairment of reflexes, damage to the statocysts and reduction in numbers of haemocytes (possibly indicative of decreased immune response function), were observed after exposure (Day et al. 2016).

Although, the Day et al. (2016) study did not investigate the ecological impacts of the sub-lethal effects, of note however, is that the lobsters used for the July 2014 standard pressure experiment were collected from a scientific reserve in an area of high ambient levels of anthropogenic noise. These animals were found to have a high level of pre-existing damage to statocysts similar to that induced by the airgun experiments. These lobsters when exposed to the seismic airgun did not exhibit a significant increase in statocyst damage. The study authors suggested that this indicated that lobsters can adapt to statocyst damage, as these control lobsters with damaged statocysts did not display impaired righting reflexes.

Scallop experiments comprised four treatments, a control pass of the airgun deployed but not operated, one pass of the airgun, two passes of the airgun or four passes of the airgun with all passes being from the same range to the animals. Seismic sound exposure did not cause mass mortality of scallops during the experiment; however, repeated exposure (i.e. more than one pass of the airgun) where maximum exposure levels were in the range of 199 to 213 dB re 1μPa pk-pk was considered to possibly increase the risk of mortality (Day et al. 2017). Scallops exposed to repeated seismic sound suffered physiological damage with no signs of recovery over the four-month period; suggesting potentially reduced tolerance to subsequent stressors. In addition, changes in behaviour and reflexes during and following seismic exposure were observed. Day et al. (2017). Day et al. (2017) concluded that the results of their study were broadly applicable to spiny lobster and scallop fisheries throughout the world and crustaceans and bivalves in general.

Morris et al. (2018) investigated the effects of seismic on the snow crab fishery along the continental slope in Canada in a before and after control impact (BACI) study over a period of two years. Crabs were exposed to received levels of 187 dB re 1μPa^2.s (single shot) and 200 dB re 1μPa^2.s (cumulative over 24 hours). There was no negative effects on the catch rates in the shorter term (days) or longer term (weeks), and the authors concluded that seismic effects on snow crab harvest (if they do exist) would be smaller than changes related to natural spatial and temporal variation.

The relevance and implications of the above research has therefore been considered in the context of southern rock lobster and stocks in the Gippsland MSS Acquisition Area.

The areas of ensonification predicted by the underwater sound modelling for invertebrates were based on the largest area of effect within the Acquisition Area. For invertebrate species, the largest area of ensonification was based on the potential for a range of sub-lethal effects to occur as reported by Day et al. (2017), ranging from physiological to behavioural disturbance effects. These areas are defined in Table 6.6 by the following distances from the source:

- lobsters and prawns – up to 100 m from the source in water depths up to 200 m (these species do not occur >200 m depth)
- scallops – up to 625 from the source (this species does not occur >120 m depth)
- octopus and squid (these species do not occur >825 m depth)
  - up to 1.4 m from the source in shallow waters (<200 m depth)
  - up to 2.2 km from the source in mid depth waters (200–1,000 m).

Table 6.6 Summary of modelled impact ranges at the seabed for invertebrates based on Day et al. (2016) received levels

Invertebrate group	Species	Exposure level	Predicted maximum impact distance (m)	
			Shallow water (<200 m)	Midwater (200–1,000 m)
Crustaceans	Rock lobster, prawns	209 dB re 1μPa (pk-pk) Day et al. (2016)	92 m	160 m
Bivalves	Scallops	191 dB re 1μPa (pk-pk) Day et al. (2016)	624 m	Species does not occur
Cephalopods	Squid, octopus	162 dB re 1μPa^2.s (SEL) Strong behavioural responses Fewtrell and McCauley (2012)	1.4 km	2.2 km

6.1.4.2.1 Impacts on lobsters and scallops

Impacts of the Gippsland MSS on southern rock lobster and prawns are expected to be minor. For benthic adults potential effects will be limited to small areas (<100 m) directly under the source in VIC waters associated with reefs or outcroppings, where depths are less than the maximum depth limit of 200 m for these species.

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Impacts of the proposed survey on scallops are also expected to be minor and limited to within 625 m of the seismic source. Commercial scallops are mainly found at depths of 10-20 m but may also occur down to 60 m, which is in the shallowest waters of the Gippsland MSS Acquisition Area (minimum depth 42 m). Koopman et al. (2018) identified an area with increased scallop biomass which initially overlapped the Acquisition Area. However, in consideration of stakeholder concerns CGG has adjusted the Acquisition Area so that the area ensonified by seismic sound at levels predicted to impact scallops lies a minimum of 3.7 km from this scallop bed (Section 4.11.5.2). Otherwise, there is a very low level of commercial fishing effort for scallops within the Gippsland Basin.

Although there has been minimal fishing for scallops in the past few years, the results of the 2017/18 scallop survey by Koopman et al. (2018) highlighted the presence of a scallop bed inshore of the MSS area (shown in Figure 4.25). Feedback from fishers during the previous consultation meeting at Lakes Entrance has also confirmed the importance of this scallop bed. The impacts of seismic sound on scallops is a contentious issue in southeast Australia where seismic surveys have been blamed for devastating scallop beds, although the variable recruitment rates of scallops confound the ability to distinguish natural from human-induced impacts (seismic or fishing) on scallop populations. Other natural events such as spikes in water temperature have also been linked to major mortality events in southeast Australia during 2010 (Przeslawski et al. 2018). Nevertheless, CGG appreciates that the scallop bed identified inshore of the MSS area is, through the lack of similar beds found elsewhere in the area, important to fishers. CGG has therefore refined the survey area to ensure that no seismic acquisition will occur over the scallop bed defined by Koopman et al. (2018).

No mortality of scallops or lobsters are predicted as a result of seismic sound exposure. Day et al. (2017) observed that repeated seismic exposure could cause physiological damage to scallops which may lead to mortality. CGG has addressed this by committing to survey lines that are approximately 7,000 m apart from the preceding line rather than adjacent lines. This will give a minimum of 36 hours between corresponding points on adjacent seismic lines to allow fauna time to recover. CGG has also revised survey plans to avoid intensive undershooting activities in the vicinity of South East Reef, which is expected to be important lobster habitat.

6.1.4.2.2 Impacts on squid and octopus

Impacts on squid and octopus are predicted to be limited to behavioural disturbance only when airgun activity begins up to 1.4 km (in <200 m water depth) and up to 2.2 km (in 200 to 1,000 m depth) from the seismic source. Squid and octopus within the Acquisition Area are expected to be predominantly found in depths of <200 m, however can occur down to 725 to 825 m. In the area ensonified to these levels, at any one time during the seismic survey, squid are expected to move away as an avoidance response similar to that shown by Fewtrell and McCauley (2012). Furthermore, squid have been found to habituate to airgun sources without any apparent impairment of their hearing or responses over repeated exposure trials (Fewtrell and McCauley, 2012).

Given the similarities in physiology between squid and octopus, octopus are not thought to be at risk of physical injury even if individuals are exposed to several passes as noted by Fewtrell and McCauley (2012). There is limited information on the hearing sensitivity of octopus to sound stimuli. Kaifu (2008) studied *Octopus ocellatus* and concluded that the statocyst was responsible for the observed responses kinetic sound energy (particle motion). It is unknown how octopuses will respond behaviourally, but since they are benthic and territorial it is thought more likely that they will retreat into their lair as they normally do to perceived threats. They may also freeze and camouflage themselves if out in the open. Octopus are not expected to move very far from their territory and therefore will not be exposed to repeat close passes in short period of time since subsequent survey lines are about 7 km apart. If they remain in the same area they may be exposed to sounds shown to elicit strong responses two to three times throughout the survey period and these events will be several days apart allowing the individual animals to recover. Therefore, there is no reason to suspect that octopus will be adversely affected by the Gippsland MSS.

In response to stakeholder concerns over fisheries and the octopus fishery in particular, CGG has divided the Acquisition Area into five zones and will not survey over South East Reef or the Horseshoe Canyon KEF. Ongoing stakeholder communication will provide notification of where the seismic activity is at any one time and projected future activities.

The vessel will traverse all sail lines in each zone before moving onto the next zone. Each zone will take up to one month to complete, and there will be no seismic acquisition along adjacent sail lines in a period of less than 48 hours (except in the limited areas of platform undershoots as described above). Zone 4 is scheduled to occur in March or April while the other five zones will be surveyed around this fixture. All commercial invertebrates exposed to received sound levels eliciting a behavioural response will therefore recover between sail lines.

For invertebrate planktonic stages, potential spatial and temporal overlap larval phases may occur within the Acquisition Area, although the amount of biomass exposed to seismic activity would vary considerably as a consequence of oceanographical processes. Nevertheless, relative to the large area of southern Australian waters where these planktonic stages will occur the impacts on their biomass is expected to be very localised and short-term, with negligible population level effects compared to the natural high rates of planktonic turnover (see Section 6.1.5.1).

6.1.4.3 Impacts on finfish and fisheries

The effects of underwater noise on fish within the vicinity of the Gippsland MSS will vary depending on the size, age, sex and condition of the receptor among other physiological aspects, and the topography of the benthos, water depth, sound intensity and duration. The effect of noise on a receptor may be either physiological (e.g. injury or mortality) or behavioural. Behavioural changes are expected to be localised and temporary, with displacement of pelagic or migratory fish likely to have insignificant repercussions at a population level.

The ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014) gathered relevant scientific experts and regulators to define acoustic impact guidelines for fish. Popper et al. (2014) cite studies on seismic sound effects on fish and state that no studies have linked mortality of fish, with or without swim bladders, to seismic noise from airguns or in experimental studies replicating seismic sound fields (Popper et al. 2005; Boeger et al. 2006; Popper et al. 2007; Hastings et al. 2008; Halvorsen et al. 2011, 2012; Casper et al. 2012; McCauley and Kent 2012; Miller and Cripps 2013; and Popper et al. 2015). Empirical evidence comes from a study by Wagner et al. (2015) which exposed gobies to seismic sound at a level greater than the mortality and potential mortality threshold proposed by the Popper et al. (2014). The fish were exposed to six discharges at an average peak SPL of 229 dB re 1 µPa. Fish were monitored for 60 hours post exposure and no mortality or significant physiological damage (hair cell loss or otolith damage) were observed. In another study, individuals of four fish species were exposed to piling noise levels above a peak SPL of 207 dB re 1 µPa, but did not suffer any mortal or potentially mortal injuries (Casper et al. 2012).

A range of responses have been observed when studying the behaviour of wild fish species in the presence of anthropogenic sounds. Some fishes have shown changes in swimming behaviour and orientation, including startle reactions (Pearson et al. 1992; Wardle et al. 2001; Hassel et al. 2004). Sound can also cause changes in schooling patterns and distribution (Pearson et al. 1992). However, researchers have observed that once acoustic disturbances are removed, fish return to normal behaviour within about an hour (Pearson et al. 1992; McCauley et al. 2000; Wardle et al. 2001).

Potential recovery in European seabass and European eel exposed to seismic sound was investigated by Bruintjes et al. 2016 and Radford et al. 2016. European seabass experienced 12 weeks of impulsive noise showed no differences in stress, growth or mortality compared to those reared with exposure to ambient-noise playback (Radford et al. 2016). Anthropogenic noise-induced effects quickly dissipated and European eel and European seabass fish showed rapid recovery of startle responses and startle latency within two minutes after noise cessation (Bruintjes et al. 2016). Seabass also showed complete recovery of ventilation rate when exposed to peak SPLs of 200.1, 200.7 and 201.5 dB re 1 µPa; whereas eels showed rapid albeit incomplete recovery compared with ambient conditions.

The areas of ensonification predicted by the underwater sound modelling for fish were based on the largest area of effect within the survey area. The largest predicted area of ensonification for fish was based on the potential for temporary threshold shift (TTS) effects, i.e. effects that are temporary but recoverable. These areas are defined in Table 6.7.

Table 6.7 Summary of modelled impact ranges for fish (including sharks)

Fish group	Popper et al. (2014) exposure level	Predicted maximum impact distance (m)		
		Shallow water (<200 m)	Midwater (200-1,000 m)	Deep water (>1,000 m)
Fish: No swim bladder (also applied to sharks)	213 dB re 1µPa (pk-pk) Mortality and potential mortal injury / recoverable injury	80 m	115 m	120 m
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish Eggs and Larvae	207 dB re 1µPa (pk-pk) Mortality and potential mortal injury / recoverable injury	145 m	210 m	232 m
Fish: No swim bladder (also applied to sharks), Swim bladder not involved in hearing, Swim bladder involved in hearing	186 dB re 1µPa^2.s (SEL_{24h}) TTS	500 m	1.1 km	1.5 km

Although potential injury could occur directly below the source and within a few hundred metres (Table 6.7), this is a conservative approach because in reality there would be a range of effects within these impact ranges, including recoverably injury (Popper et al. 2014). Furthermore, these mobile species are likely to avoid the approaching airgun well before the noise reaches injurious levels, highlighting the fact that behavioural effects are more likely than physical and physiological effects at lower sound levels (Carroll et al. 2017), and are the most ecologically realistic consideration when assessing the impacts of seismic surveys (Bruce et al. 2018). Based on the expert review carried out by Popper (2018), it is highly unlikely that there would be physical damage to fishes as a result of a seismic survey unless the animals are very close to the source (perhaps within a few metres), with TTS being the most likely (if any) level of effect.

Popper (2018) further concludes that if TTS does take place, the duration of exposure to the most intense sounds that could result in TTS will be over just a few hours, and therefore, accumulation of energy over longer periods than a few hours is probably not appropriate. If TTS takes place, Popper (2018) concludes that it is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity, with recovery within 24 hours. Any fish species that occurs with 500 m to 1.5 km of the seismic source could experience TTS, however effects are recoverable once the seismic vessel has passed overhead. Potential impacts on less-sensitive fish such as sharks are likely to occur at significantly shorter ranges and will therefore be less of an impact than the more sensitive species.

This also applies to the great white shark whose BIA abuts the north-west boundary of the Operational Area. If any individuals are present in this area when the seismic survey is near, they are likely to move away but any behaviours including breeding and foraging is very unlikely to be significantly impacted. The recovery plan for great white sharks (DSEWPaC, 2013b) does not identify seismic survey as a threat. The BIA for grey-nurse shark is more than 100 km to the north east and unlikely to receive sounds from the seismic survey that would disturb sharks.

For the undershoot areas, as the seismic vessels will acquire adjacent sail lines between 500 and 1,000 m from the preceeding sail line less than 24 hours apart, recovery is still expected to occur as soon as the loudest sound passes overhead. CGG has modelled accumulated sound levels for TTS over periods of 24 hours to determine if there may be potential effects from sound received from shots received over a 24 hour period. Modelling received sound levels over 24 hours or longer assumes that very distant single shot SELs will be audible to fish and contribute to hearing fatigue that may eventually result in TTS. An independent review carried out by Popper in 2018 on cumulative TTS levels stated that in reality, fish will not hear sound over these distances, hence including the accumulated sound energy from distant shots over a full 24-hour period SELcum is considered to be conservative. Popper (2018) highlighted that it is important to consider how much of the sound is received (heard) by individual fish in a population. Fish will only hear and be exposed to relatively “loud” sounds for a relatively short period of time, relatively close to the sound source.

Popper (2018) further explains within his report that the effects of TTS are unlikely to show up in fishes until the intensity of the sound is well above the fish's hearing threshold. For fish species that are free swimming (which include key commercially targeted species) it is likely that there would be no TTS effect whatsoever since fish will likely move away from the sound source as the vessel passes overhead.

It is possible that there may be a high risk of behavioural disturbance within tens of metres of the operations and the potential for some moderate level effects within hundreds of metres, with a low risk of disturbance >1,000 m (Popper et al. 2014). Behavioural effects include changes in schooling and feeding behaviour, decreased predatory avoidance (although predators are also likely to be similarly impacted), and disruption to spawning. However, such behavioural changes are expected to be temporary as the seismic vessel traverses each survey line, localised in spatial extent, and most relevant to continental slope habitat which comprises only a small part of the overall survey area. Further, any effects are expected to be short-term and limited to duration that the fish is exposed to the source, which for a pelagic (free swimming) species would be limited to the time taken for the fish to swim away from the source.

For fish planktonic stages, the potential impacts of seismic sound will be similar to those described above for the planktonic stages of invertebrates, and relative to the large area of southern Australian waters where these planktonic stages will occur the impacts on their biomass is expected to be very localised and short-term, with negligible population level effects compared to the natural high rates of planktonic turnover (see Section 6.1.5.1). No medium or long-term effects are therefore predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species.

6.1.4.3.1 Impacts on fisheries

Some fishers believe there is a longer-term effect on fish catchability or presence in fished areas (e.g. Table 9.1); however, it is not possible to isolate possible seismic survey effects from confounding factors such as fishing pressure, climatic changes and variation in natural population dynamics. A series of studies have been undertaken to determine the effects of seismic surveys on fish catches and distribution, primarily in the United States and Europe (e.g. California: Greene 1985, Pearson et al. 1992; Norway: Dalen and Knutsen 1987, Lokkeborg and Soldal 1993) and UK (Pickett et al. 1994). While the conclusions from these studies are largely ambiguous, due to the inherently high levels of variability in catch statistics, one study noted that pelagic species appear to disperse, resulting in a decrease in reported catches during the surveys (Dalen and Knutsen 1987).

Engås et al. (1996) and Engås and Løkkeborg (2002) looked at the effects of a seismic exploration on fishing success for haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*). They found that, compared to pre-seismic catches, there was a significant decline in the long-line catch rate during and after the seismic study. The catch rate did not return to normal for five days after the end of the seismic study, although evidence of this decline being related solely to the survey is inconclusive. More recently, the same group used sonar to observe the behaviour of blue whiting and Norwegian spring spawning herring during a seismic operation and observed that fish would dive from the seismic source and not return until after the activity had stopped (Slotte et al. 2004).

A study undertaken by the CSIRO and Geoscience Australia (Thomson et al. 2014) examined fisheries catches (10 species of interest) and catch rates for potential effects from 183 seismic surveys undertaken in the Gippsland Basin (Bass Strait). This study found no clear or consistent relationships between seismic surveys and subsequent fisheries catch rates (Thomson et al. 2014).

In natural situations, the majority of fish are expected to be able to avoid the approaching noise source before it reaches injurious or potentially lethal levels through horizontal or vertical movements. Evidence that fish can actively avoid the source comes from studies of caged fish actively swimming away from the approaching noise source and temporarily reduced catchability in commercial fisheries. Wardle et al. (2001) conducted a field study, using a video camera to document the behaviour of fish in response to noise levels equivalent or greater than those in the proposed survey. This study showed that the resident fish on the site did not evade the active source until it was within a few metres. No direct mortality was observed at sound levels of up to 218 dB (SPLpk).

Thomson et al. (2014) carried out a desktop analysis of commercial log book fisheries catch data, environmental variables and past seismic surveys in the Gippsland marine basin to investigate whether there was a direct negative impact of seismic surveys on catch rates. The authors found that there were no clear or consistent relationships between seismic surveys and subsequent fisheries catch rates in their study. However, they cautioned that the results did not imply that such impacts do not exist, but that data was lacking. In terms of duration since a seismic survey occurred, significant positive and negative effects were found but could not be distinguished from inter-annual changes in stock size or availability to fishing gear resulting from other dynamics (Thomson et al. 2014).

More recently, the potential impact on the catchability of commercially important fish species was investigated using a 2D seismic survey in the Gippsland Basin, Bass Strait, in April 2015 to quantify fish behaviour and commercial fisheries catch across the region before and after airgun operations (Bruce et al. 2018). This study monitored acoustically tagged species (gummy shark, swell shark, tiger flathead) before, during and after the seismic survey and found little evidence of consistent behavioural responses, except for flathead, which increased their swimming speed during the seismic survey period and changed their diel movement patterns after the survey (Bruce et al. 2018). Modelling of logbook data for 15 commercially fished species and two gear types (Danish seine, gillnet) showed that catch rates following the seismic survey were significantly different than predicted in 9 out of the 15 species, with six species (tiger flathead, goatfish, elephantfish, boarfish, broadnose shark and school shark) showing increases in catch following the seismic survey, and three species (gummy shark, red gurnard, and sawshark) showing some reductions (Bruce et al. 2018). Similarly, Przeslawski et al. (2016) compared catch rates from 15 commercial fish species before and after seismic survey had taken place in the Gippsland Basin and concluded after relevant environmental variables were considered that no clear evidence that catch rates was found.

Haddon (2017) further investigated the effect of the 2015 seismic survey in the Gippsland Basin on deepwater flathead catches and concluded that the significant drop in catch per unit effort (CPUE) was very likely negatively influenced by the seismic survey. However, Haddon (2017) went on to add that the seismic survey did not appear to have had a lasting impact on deepwater flathead CPUE, which returned to typical values in the first month following the seismic survey.

The results of the seismic study on fish catch rates in the Gippsland Basin in 2015 are directly relevant to CGG's proposed Gippsland MSS. Commercially fished species and catch rates for commercially important fish and invertebrate species will therefore not be affected by underwater sound from seismic operations, and fish/invertebrates species are expected to recover within 24 hours, with recovery beginning as soon as the loudest (most intense) sound passes overhead.

The evaluation of impacts on fisheries from underwater sound is now supported by assessment of specific fishing activity (Table 6.8). For Commonwealth fisheries this is based on the most recent analysis of AFMA log book data by CSIRO on fishing effort distribution (number of operations) within the Australian EEZ (https://data.gov.au/dataset/summaries-of-afma-log-book-data-on-effort-distribution-for-commonwealth-fisheries-in-the-austra; accessed 21 Nov 2018). The data has been aggregated to produce summaries of total effort by gear type, over 5 year periods and at a 0.1 degree resolution where five boats or more operate. The most recent reporting period (2011-2014) is a four year period. The data is shown in Figures 4.23 and 4.24 for the Commonwealth trawl, Danish seine and shark gillnet sectors. It enables detailed review of the actively fished area and range of each fishery, and accurate assessment of the spatial overlap of fishing effort with the Gippsland Acquisition Area plus predicted maximum TTS impact range of 1.5 km. This effort data is considered to be more relevant for this analysis than other data such as modelled biomass estimates, which are inherently less accurate and precise, and unavailable in a format that enables direct comparison of the broader actively fished area and the MSS area of overlap. A study by SETFIA (on advice of the Scientific Advisory Committee) of temporal patterns in catch and effort data by these Commonwealth fisheries from within the MSS area is also underway to inform the order in which survey zones may be completed to minimise impacts to fishers. For state fisheries, the assessment of specific fishing activity is based on known fishing depths, fishing distance from shore, stakeholder feedback (e.g. for the octopus fishers), literature information (e.g. for the scallop fishery), and seasonal catch/effort data (e.g. the rock lobster fishery).

RPS

Table 6.8 Details of fisheries potentially occurring within the area impacted by seismic noise

Fishery	Actively fished depth range	Target species/ depth range	Percentage overlap with acquisition area plus maximum TTS buffer (1.5 km)	Potential impact?
Southern and Eastern Scalefish and Shark Fishery – Commonwealth Trawl Sector	Demersal otter trawl and Danish seine nets: ≤700 m	Blue grenadier: 200–700 m Tiger flathead: 10–400 m Silver warehou: 50 – 600 m Pink ling: 40–700 m	Actively fished area: 7,839 km^2 or 4% of actively fished area ensonified. Using CSIRO effort (number of operations) data from 2011-2014[2]: overlap of 7% of total trawl effort and 63% of total Danish seine effort (Figure 4.23).	Possible (trawl) – small area (4% of fished area), however significant overlap with Danish seine actively fished area. Possible (Danish seine) – overlap with large area (63%) of actively fished area evident from overlap with CSIRO effort data. Effort within Acquisition Zones 1, 2 and 3 is high at 19, 20 and 22 operations, and only slightly lower in Zones 4, 5 and 6 (16, 14 and 10 operations, respectively). Based on research on the effects of catch rates of fish in the Gippsland, it is possible there could be some movement of fish out of the immediate area of the seismic vessel (source), however it is expected that fish will return to the area once the seismic vessel has moved on and the area is no longer ensonified.
Southern and Eastern Scalefish and Shark Fishery – Shark Gillnet and Shark Hook Sectors	Gillnet fishing: <183 m Longline fishing: 183-1,500 m	Gummy shark: 80 – 350 m School shark: 0 – 550 m Australasian snapper: 0–220 m	6,066 km^2 or 2% of actively fished area ensonified. Using CSIRO effort (number of operations) data from 2011-2014: overlap of 7% of total gillnet effort (Figure 4.23).	Possible – 7% of effort lies within the Acquistion Area plus ensonification buffer. Based on research on the effects of catch rates of fish in the Gippsland, it is possible there could be some movement of fish out of the immediate area of the seismic vessel (source), however it is expected that fish will return to the area once the seismic vessel has moved on and the area is no longer ensonified.
Southern and Eastern Scalefish and Shark Fishery – Scalefish Hook Sector	183-800 m	Blue-eye trevalla: 40–1500 m Pink ling: 40–700 m Blue grenadier: 200–700 m Tiger flathead: 10–400 m Silver warehou: 27–650 m	1,950 km^2 or 5% of actively fished area ensonified.	Possible – 5% of effort lies within the Acquistion Area plus ensonification buffer. Based on research on the effects of catch rates of fish in the Gippsland, it is possible there could be some movement of fish out of the immediate area of the seismic vessel (source), however it is expected that fish will return to the area once the seismic vessel has moved on and the area is no longer ensonified. Fishery operates year round, catch rates unlikely to be impacted.
Southern Squid Jig	≤700 m	Gould's Squid: 0–700 m	7,839 km^2 or 2% of actively fished area ensonified.	Unlikely – small overlap with ensonified area. Reduction in the northern extent of the survey area has reduced much of the overlap with the upwelling area/KEF and also the area of higher intensity trawling for squid. There has been a reduction in effort in the squid jig fishery in the Gippsland, however squid are still caught by the Commonwealth Trawl Section at a low to medium fishing intensity (Figure E.18, Appendix E).

[2] CSIRO includes data where 5 boats or more operate

Fishery	Actively fished depth range	Target species/ depth range	Percentage overlap with acquisition area plus maximum TTS buffer (1.5 km)	Potential impact?
Rock Lobster Fishery – Eastern Zone (VIC)	Up to 150 m depth	Rock lobster: <150 m	Based on overlap with species depth range: 5,877 km^2 or 14% of the actively fished area ensonified.	Unlikely – despite relatively large area of overlap with the fishery/species depth range, the timing of the survey (Jan to July) will avoid impacts on rock lobsters and their catch rates. Rock lobster catches peak in August and December, declining in January, and are at relatively low levels from February through to June, and starting to rise again in July (SETFIA 2018). In addition, timing of seismic operations over South East Reef from March to April avoids periods of high effort in the fishery.
Scallop (Ocean) Fishery	Based on Koopman et al. 2018 scallop fished area (Figure 4.25)	Commercial scallop: <120 m	Based on overlap with Koopman et al. 2018 scallop fished area: 358 km^2 or 7% of the actively fished area ensonified.	No overlap with key scallop bed east of survey area. CGG has adjusted the Acquisition Area so that the area ensonified by seismic sound at levels predicted to impact scallops lies a minimum of 3.7 km from the key scallop bed. Low level of commercial fishing effort for scallops within the Gippsland Basin, catch unlikely to be impacted.
Purse Seine (Ocean) Fishery (VIC)	Actively fished area not know 20 nautical miles from coast (fishery jurisdictional boundary)	Australian salmon, Australian sardine, sandy sprat and Australian anchovy (SETFIA 2018)	1,546 km^2 or 16% of actively fished area ensonified.	Unlikely – only one licence issued within the fishery and fisher generally operates close to shore with limited overlap of operations with the Acquistion Area (SETFIA 2018). Activity is generally day trips in small vessels (<10 m) and most effort occurs during April to July. Catch rates unlikely to be impacted.
Inshore Trawl Fishery (VIC)	Actively fished area not know 20 nautical miles from coast (fishery jurisdictional boundary)	Crustaceans (eastern king and school prawns) (SETFIA 2018)	0 km^2 or 0% of actively fished area ensonified.	No overlap with Acquistion Area or Operational Area. Catch will not be impacted.
Ocean (General) Fishery (VIC)	40-60 m (octopus fishery)	Octopus: ≤725 m Australasian snapper: 0–200 m	Based on overlap with known octopus fished areas: 2224 km^2 or 7% of the actively fished area ensonified. Based on overlap with species (snapper) depth range: 6147 km^2 or 6% of the actively fished area ensonified.	Likely - overlap with key octopus fishing areas for stakeholders (identified through consultation with relevant persons, see Consultation Report, Appendix H). CGG will carry out a field and lab based before and after study of seismic effects on octopus. CGG will develop a mutually agreeable contractual/compensation proposal with octopus fishers with fixed equipment.

The consultation process identified South East Reef as an area with high sensitivity for fished species within the survey area (Figure 6.9). The reef is in less than 200 m water depth and therefore temporary albeit recoverable effects are predicted to occur within 500 m of the seismic source (Table 7). Measured levels from previous seismic surveys carried out in the Gippsland marine environment were analysed directly over the South East Reef (Figure 6.3), and show that the highest levels are within less than 500 m of the source. However, the maximum measured levels did not exceed 200 dB SPLpk, which is below any of the fish and lobster injury thresholds (i.e. 207 to 213 dB SPLpk).

CGG will use a smaller volume airgun of ≤150 in^3 over the spatial extent of the reef plus a buffer of 500 m based on the sound modelling. CGG will also reduce the cumulative exposure over the reef and 500 m buffer by reducing the number of shots from one shot every 12.5 m to one shot every 37.5 m. Received levels at offset distances for a 150 in^3 array source were modelled by CGG (Table 6.8). Fish injury thresholds (207 to 213 dB SPLpk) are predicted to occur within 20 m of the source, but would not reach the top of South East Reef (i.e. this threshold is exceeded up to 25 m water depth). Species spawning at or near the seabed (e.g. lobster) would therefore not be exposed to injurious levels, and any species spawning in the water column would also be unlikely to suffer injurious effects, as fish would need to be within a very small range directly under the 150 in^3 array and 20 m either side.

No population level effects are expected in fish due to effects on plankton or fish eggs/larvae as a result of the activity. No reductions in catch rates for commercially important fish as an indirect result of impacts on eggs/larvae. The predicted consequence for impacts to fisheries is localised and **Minor**.

Table 6.9 Modelled received sound levels (dB SPLpeak) for the 150 cubic inch array over South East Reef

Offset Distance (m)

Depth (m)	-160	-140	-120	-100	-80	-60	-40	-20	0	20	40	60	80	100	120	140	160
1	161	163	166	169	173	178	185	197	217	197	185	178	173	169	166	163	161
3	171	173	176	179	183	188	194	204	222	204	194	188	183	179	176	173	171
5	175	177	180	183	187	191	198	206	232	206	198	191	187	183	180	177	175
7	178	180	183	186	189	194	199	206	232	206	199	194	189	186	183	180	178
9	180	182	184	187	191	195	200	206	222	206	200	195	191	187	184	182	180
11	181	183	186	189	192	196	200	206	218	206	200	196	192	189	186	183	181
13	182	184	187	190	192	196	200	205	215	205	200	196	192	190	187	184	182
15	183	186	188	190	193	196	200	205	213	205	200	196	193	190	188	186	183
17	184	186	189	191	194	196	200	205	211	205	200	196	194	191	189	186	184
19	185	187	189	191	194	196	199	204	210	204	199	196	194	191	189	187	185
21	186	187	189	192	194	196	199	204	208	204	199	196	194	192	189	187	186
23	186	188	190	192	194	196	199	203	207	203	199	196	194	192	190	188	186
25	186	188	190	192	194	196	199	203	206	203	199	196	194	192	190	188	186
27	187	189	190	192	193	196	199	203	205	203	199	196	193	192	190	189	187
29	187	189	190	192	193	196	199	202	205	202	199	196	193	192	190	189	187
31	187	189	190	192	193	196	198	202	204	202	198	196	193	192	190	189	187
33	187	189	190	192	193	196	198	201	203	201	198	196	193	192	190	189	187
35	187	189	190	191	193	195	198	201	203	201	198	195	193	191	190	189	187
37	187	189	190	191	193	195	198	201	202	201	198	195	193	191	190	189	187
39	187	189	190	191	193	195	198	200	202	200	198	195	193	191	190	189	187
41	188	189	190	191	193	195	197	200	201	200	197	195	193	191	190	189	188

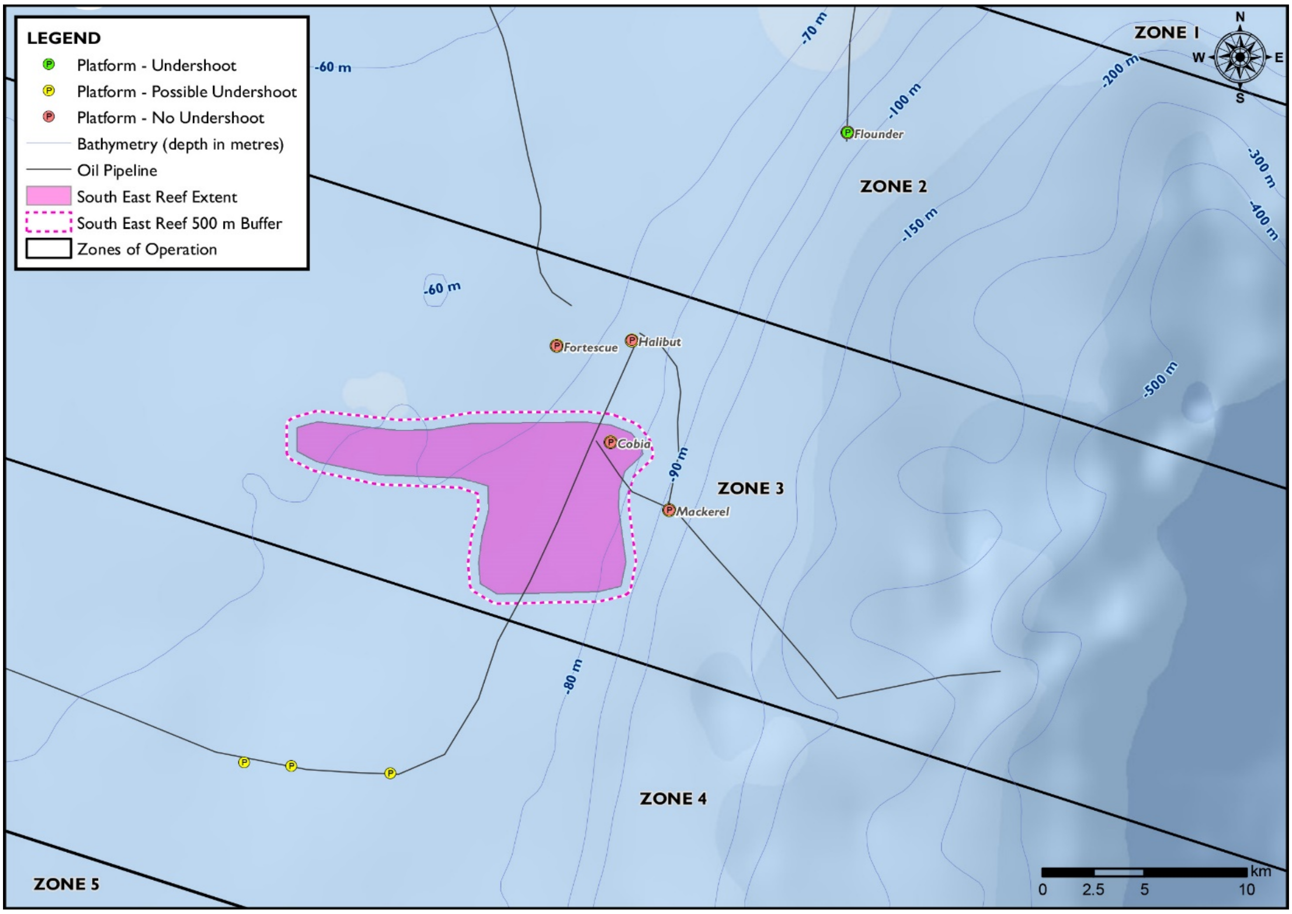

Figure 6.9 South-east reef extent and 500 m buffer area

6.1.4.4 Impacts on marine turtles

Marine turtles appear to use acoustic cues in perception of their local and distant environment on their long (sometimes thousands of kilometres) migrations between nesting and foraging sites (Swan et al. 1994). Most studies looking at the effect of seismic noise on marine turtles have focused on behavioural changes and responses as physiological damages are more difficult to observe in living animals. Studies carried out by Lenhardt (1994) showed that marine turtles increased their movements after seismic noise emissions and did not return to the depth at which they usually rested. De Ruiter and Doukara (2010) observed turtles during active seismic operations and recorded startle responses (rapid dive) to the seismic emissions; 51% of turtles dived at or before their closest point of approach to a seismic source. However, these authors could not distinguish the stimulus source of the startle response, as they did not perform a control without the seismic stimulus (De Ruiter and Doukara 2010). McCauley et al. (2000) conducted controlled experiments on a caged loggerhead turtle and a caged green turtle and exposure to noises from seismic sources louder than 166 dB re 1 µPa SPL (RMS) increased their swimming activity.

Underwater sound modelling carried out for the Gippsland MSS predicted distances to received sound levels compared with peer reviewed marine turtle guideline levels in Table 6.10. The sound modelling predicted mortality to potential mortal injury up to 145 m from the source in water depths <200 m and up to 232 m in water depths >200 m (Table 6.10). Strong avoidance behaviour is predicted up to 1 km from the source in water depths <200 m and up to 3 km in water depths >200 m. Such behavioural changes are expected to only last for the duration of a survey pass with normal behaviour anticipated to resume when the vessel has moved this distance or more away along the seismic sail line. There are no BIAs or areas known to be important for turtle life history stages in the Operational Area. Any disturbance will be limited to avoidance response followed by rapid resumption of normal activity. Given that there are no nesting areas or known foraging habitats within or in the vicinity of the survey area, there are no predicted effects to populations.

Table 6.10 Summary of modelled impact ranges for marine turtles

Guideline description	Guideline / published comparison level	Impact range (max)
Mortality and potential mortal injury (Popper et al. (2014)	>207 dB peak SPL	145 m (<200 m depth) 210 to 232 m (>200 m depth)
Behaviour: strong avoidance (McCauley et al. 2000)	>166 dB SPLrms	<1 km (<200 m depth) 1 to 3 km (>200 depth)

6.1.4.5 Impacts on cetaceans

Biologically important periods for key cetaceans in the Gippsland Basin region are shown in Table 6.11.

Table 6.11 Biologically important periods for cetaceans

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes
Humpback whale													Nov to Dec – cow/calves
Pygmy blue whale													Uncertain – may have year round presence
Southern right whale													Oct and Nov – possible cow calves

Note: CGG Gippsland MSS timing is January to July.

Marine mammals use sound for foraging, orientation, communication, navigation, echolocation of prey and predator avoidance (Richardson et al. 1995) and therefore are sensitive to underwater noise. High levels of anthropogenic underwater sound can potentially have negative impacts; ranging from changes in their acoustic communication, displacing them from an area, and in more severe cases causing physical injury or mortality (Richardson et al. 1995).

Impulse sounds from an airgun array are considered capable of causing instantaneous auditory injury resulting in a permanent threshold shift (PTS) that persists once sound exposure has ceased. PTS may also result from prolonged exposure at lower levels. Hearing loss may be considered permanent if hearing does not return to normal after several weeks. Lower noise levels or shorter exposures to noise have the potential to cause a temporary threshold shift (TTS) where animals would experience temporary auditory injury, and from which they would recover fully, particularly as they move away from the source.

Behavioural responses to low frequency acoustic sound in baleen whales range from tolerance at low–moderate acoustic levels (McCauley et al. 2000) to graduated behavioural responses including shifts in respiratory and diving patterns (McCauley 1994) at higher levels. It has been observed that the behaviour of cetaceans to differing sound levels depends on their activity at the time of exposure and is variable between and within species (Richardson et al. 1995). Cetaceans tend to be less responsive to sound when migrating or feeding than when suckling or resting with calves, or socialising.

The key marine mammal species within the Gippsland MSS Acquisition Area that may be affected by underwater noise from seismic operations have been classed into the functional hearing groups as follows:

- low-frequency cetaceans (baleen whales): limited to migrating individuals for HBWs, possible presence of foraging / migrating PBWs within the possible foraging BIA, possible migrating SRWs April to July within the migratory and resting coastal BIA, and potential presence / intermittent foraging of fin, sei, Bryde’s and Antarctic minke whales (in the east of Eden Upwelling KEF).
- mid-frequency cetaceans: limited to transiting individuals for larger dolphins, beaked whales, sperm and killer whales.

There are no high frequency cetaceans (porpoises and some dolphins) known to utilise the Gippsland Basin. Smaller cetaceans known to occur in the area such as common, bottlenose and dusky dolphins are not considered to be at high risk of seismic discharges (DEWHA, 2008) unless they are very close to the source. Therefore, only the 500 m shut-down zone will apply to the smaller cetaceans such as dusky dolphins, bottlenose dolphins and common dolphins. Larger toothed cetaceans including the larger dolphin species such as killer whales and pilot whales are included throughout.

Underwater sound modelling carried out for the Gippsland MSS for an airgun array source of 3,000 in^3 predicted distances to received sound levels compared with peer reviewed cetacean guideline levels in Table 6.12. The lower range value is the predicted impact range in the inshore direction, and the upper value is the range in the offshore and alongshore directions.

Table 6.12 Summary of modelled impact ranges for cetaceans

Scenario	Range of effect, m		
	Shallow water (35 m–200 m)	Mid-depth waters (200 m–1,000 m)	Deep waters (1,000 m–2,650 m)
PTS cumulative (SELcum (dB re 1 μPa^2·s 24 hr))*			
Low frequency cetacean (183)	183–306	265–445	653–985
Mid frequency cetacean (185)	9–11	N/E	N/E
PTS SPL Peak (dB re 1 μPa pk-pk)*			
Low frequency cetacean (219)	61–83	75–83	52–67
Mid frequency cetacean (230)	23–23	17–21	10–14
TTS cumulative (SELcum (dB re 1 μPa^2·s 24 hr))*			
Low frequency cetacean (168)	13,866–23,823	12,620–14,964	12,403–34,738
Mid frequency cetacean (170)	381–680	672–1,133	1,012–1,448
TTS cumulative fleeing (SELcum (dB re 1 μPa2·s 24 hr))#			
Low frequency cetacean (168)	772–877	602–864	1,219–2,084
Mid frequency cetacean (170)	164–249	216–343	468–653
TTS SPL Peak (dB re 1 μPa pk-pk)*			
Low frequency cetacean (213)	92–142	160–165	106–148
Mid frequency cetacean (224)	42–48	39–45	21–34
Strong behaviour response (SPLrms (dB re 1 μPa^2·s))†			
Disturbance/avoidance (160)	1,286–1,365	1,582–2,180	2,769–3,337

Note: * (NMFS 2016), † (NMFS 2013); NE = No exceedance of threshold, # (NMFS, 2018) alternative model options.

While these modelling results are based on recommendations from relevant guidance, the cumulative PTS and TTS (SELcum) exposures in particular are not expected to occur in reality; a whale is unlikely to remain stationary while a seismic vessel traverses an area, and mitigation controls such as the low-power and shut down zones would be triggered.

Using contours developed from the modelling, at 34 km range from the airguns in deep water, the broad-spectrum energy levels would on average be below 130 dB (SEL) and in mid-depth and shallow water they would be less than 140 dB (SEL) and no longer impulsive sounds. Additionally, these modelled estimates represent energy across all spectra contained within the seismic discharge whereas the cumulative TTS thresholds contain only frequencies that the frequency groups are considered sensitive to, and would be shorter if they were weighted. No scientific studies have presented any evidence that whales suffer cumulative injury and is instead a precaution. However, these energy levels are similar to or less than those known to cause behavioural responses reported by Dunlop et al. (2018) which were estimated to occur no farther than 4 km from a 3,130 in^3 airgun array. Therefore, the ranges to the cumulative TTS thresholds using the fleeing model will be applied to the impact assessment in this EP instead of those estimated from the stationary model. In support of this, data acquired during seismic survey by CGG in previous Gippsland Surveys have been analysed and provide the ranges to a selection of LF thresholds as a measured comparison to some of the modelled results presented in Table 6.9.

6.1.4.5.1 Injury, permanent and temporary threshold shifts

While intense impulse waves from underwater point sources of sound can cause injury on fauna through barotrauma (Richardson et al., 1995, NMFS, 2018), airgun arrays are not strictly point sources (DEWHA, 2008b) and are less likely than explosives or piling to create sound pressure waves intense enough to cause such injury. Furthermore, as the sound pressure wave propagates away from the source, its duration increases and peak reduces. This transformation into a non-impulsive sound reduces its potential to cause injury in the far-field (NMFS, 2018). No instances of instantaneous injury to marine mammals from seismic airguns have been recorded (DEWHA, 2008b) and there is no reason to consider that the Gippsland MSS will do so.

Modelled peak pressure noise levels from a single shot of the airgun array on full power indicate that LF cetaceans (baleen whales) could suffer PTS within 52-83 m of the airguns and MF cetaceans (sperm whales and larger dolphins) within 10-23 m depending on water depth and angle of the whale relative to the airgun array. Such an event is considered highly unlikely throughout the duration of the survey because the standard control measures of the EPBC Act PS 2.1 (pre start-up visual observations, soft start, low-power zone and shut down zone) will help ensure that whales are detected if in close proximity to the airgun array before the array is activated, and if they are detected, the airguns will not be started or will be powered down or shut down. Furthermore, the environmental description has concluded that the Operational Area is not known for high densities of whales and few are likely to be encountered especially from January to April inclusive. Species likely to be present at this time can include pygmy blue, sei, fin, Bryde’s and Antarctic minke whales. From May to July the above species will still be present but there will be a higher chance of the seismic vessel encountering HBWs during their migration north on return from high latitudes. SRW may also be encountered during this time on their return to coastal wintering grounds but numbers are thought to be low. The migration pathways of both these species are thought to be widely dispersed through the wider Tasman Sea and Bass Strait. Therefore, with the use of the standard measures employed for detecting whales, and reducing or stopping the airguns, if whales are encountered in close proximity to the source, the likelihood of causing instantaneous injury to SRWs or HBWs during the northward migration period is still remote. Permanent injury to whales in BIAs is considered highly unlikely.

Beyond 83 m individual animals may still sustain PTS but only through prolonged exposure to the airgun signals. The sound modelling for LF cetaceans predicted that prolonged exposure over 24 hours can cause PTS out to a maximum of 985 m of the source in deep water, to 445 m in mid-depth water and to 306 m in shallow water (Table 6.12). This prediction included close exposure whereby most of the sound energy “dose” would have occurred, and in reality, the range to cumulative PTS onset is likely to be much closer than this. PTS through cumulative exposure is considered unlikely because of the behavioural responses of individual animals (e.g. move away from the source) or the application of the mitigation measures when whales are spotted. Cetaceans that are susceptible to these sound levels comprise all the baleen whales that may be encountered in the Operational Area including PBWs within the possible foraging BIA which is to a maximum predicted range of 445 m due to the water depth being limited to 1000 m. Effects due to cumulative PTS onset are not likely to extend into the BIA for SRWs as the boundary is a minimum of 13.6 km from the nearest survey lines, and the sounds from the airguns will have been attenuated to below these levels in less than a kilometre from the source. Therefore, the standard mitigation measures in the EPBC Act PS 2.1 Part A apply.

MF cetaceans (such as sperm whales and dolphins) are only predicted to receive injurious levels if within 11 m of the seismic source for a 24-hour period (Table 6.12). It is considered highly unlikely that a cetacean would remain so close to the source due to the probable behavioural responses to the noise of the airguns. Furthermore, sperm whales are not likely to be exposed to prolonged airgun noise in this short range given the implementation of a low-power zone of 2 km and shut-down zone of 500 m as required under EPBC Policy Statement 2.1. Smaller dolphins are not considered susceptible to sounds from seismic airgun array (DEWHA, 2008a). However, smaller dolphins such as common, bottlenose or dusky will be protected from potentially injurious levels of noise by being included in the 500 m shut-down control. It is therefore highly unlikely that any MF cetaceans will suffer PTS through prolonged exposure to the seismic survey.

Instantaneous TTS can be caused by a single airgun shot if a cetacean is close enough or through repeated exposure to the airgun shots if further away. Instantaneous TTS (peak pressure) for LF cetaceans has been modelled to occur within 92 to 165 m of the airgun array and within 21 to 48 m for MF cetaceans. This is not considered very likely because the airgun array will only be started after the observation zone has been thoroughly searched by MMOs and if cetaceans have escaped detection, will not be exposed to full power because the airgun array will be started on low power (soft-start). This is likely to alert cetaceans to the disturbance and encourage them to move away before full power is achieved. Should cetaceans come within 2 km or 500 m of the airguns on full power, the airgun array will be powered-down or stopped respectively.

Prolonged exposure to seismic shots has the potential to cause TTS (SELcum) to greater ranges than single shots. The ranges to potential cumulative TTS of fleeing animals are presented in Table 6.12. Modelling results of 2,084 m for the deep water apply only outside the possible foraging BIA for foraging PBWs. Within the BIA for PBW, the ranges to TTS in shallow and mid-depth water apply. Modelling of an animal moving away from the source suggested the overall distance in which cumulative TTS may occur over a 24-hour period to between 602 and 2,084 m for shallow and deep water respectively. The higher range is similar to the Low-power Zone of the EPBC Act PS 2.1 which will be applied throughout the survey area and across the whole seismic survey duration. Therefore, it is concluded that injury is not expected to occur on any whales or large cetaceans, including PBWs in the possible foraging BIA through the seismic survey, provided the legislative requirements of the EPBC Act PS 2.1 are applied.

The reduction of the Acquisition Area through stakeholder consultation has increased the distance between the closest point of seismic acquisition and the SRW BIA to 13.6 km and has removed any concern that SRWs in the BIA may be injured.

6.1.4.5.2 Behavioural disturbance

Behavioural responses to low frequency acoustic sound in baleen whales range from tolerance at low–moderate acoustic levels (McCauley et al. 2000) to graduated behavioural responses including shifts in respiratory and diving patterns (McCauley 1994) at higher levels. It has been observed that the behaviour of cetaceans to differing sound levels depends on their activity at the time of exposure and is variable between and within species (Richardson et al. 1995). Cetaceans tend to be less responsive to sound when migrating or feeding than when suckling or resting with calves or socialising.

Strong behavioural disturbance from a single shot of the airgun array for all marine fauna groups including cetaceans is predicted to occur out to a maximum distance of 3.4 km from the source in deep water. In shallow water, the predicted range to strong behavioural disturbance is 1.2 km, while in mid-depth water it is up to 2 km (Table 6.12). These ranges are supported by the analysis of measurements taken during previous seismic surveys in the Gippsland Basin as discussed in Section 7.1.3.2. Southall et al. (2007) noted that certain marine mammal species and certain marine mammals in specific behavioural modes appear to be significantly more sensitive to noise exposure.

The most sensitive species to disturbance in or around the Operational Area is the PBW due to the partial overlap with the possible foraging BIA for this species. The BIA only overlaps with shallow and mid-depth water and therefore strong behavioural disturbance may be expected for PBW in the BIA out to 1.2 or 2 km of the source respectively. Strong behavioural disturbance can include avoidance of or displacement from an area. It can be assumed that PBW will be displaced where ensonification levels exceed 160 dB re 1 $\mu Pa^2 \cdot s$.

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Assessing and addressing effects from anthropogenic noise especially that causing displacement from foraging areas has been identified as a threat of high priority in the Blue Whale Conservation Management Plan (CoA, 2015). Two airgun arrays will be discharging alternately during undershoots which will occur in the middle of the BIA. The two airgun arrays will not fire simultaneously but alternately every 11 to 12 seconds. This will ensonify a combined estimated area of approximately 15.8 km^2 (assuming the airgun arrays are 800 m apart). The possible foraging BIA for PBWs in Bass Strait covers a total of 211,377 km^2 of which approximately 24,123 km^2 overlaps the Gippsland Basin and 12,647 km with the Operational Area. The portion of the BIA within the Gippsland Basin ensonified at any one time to an extent known to cause strong disturbance reactions in whales will be less than 0.01% and 0.13% of the portion of the BIA that overlaps with the Operational Area. In conclusion, the risk of excluding PBWs from within the BIA or preventing them from utilising the majority of it for foraging is extremely low. Notwithstanding the low possibility of behavioural impacts, the indirect impacts on prey availability (zooplankton) are discussed below.

The BIA for SRWs runs parallel to the Victorian coast adjacent to the Operational Area. This tract has been designated a BIA for its importance as a migratory route, potential resting embayments and connecting corridor between areas known to have been used historically by SRWs. SRWs may be present in this area between April and July during the survey period, and the few that may be present are expected to be transiting individuals; it will be too early for any calving to have occurred and pregnant females are expected to be in or travelling to calving grounds to the west. The shortest distance between active airguns and the edge of the BIA when a small number of transiting SRWs may be present will be approximately 13.7 km. The modelled distance that sounds known to cause strong disturbance may travel is 1.2 km from the airgun array in shallow water and therefore is not expected to extend into the BIA. As such, the seismic survey is not expected to disturb SRWs to the degree that they will stop using the BIA between April and July and connectivity between historical use areas will remain intact. Calves are not likely to be present during the survey period (now that the survey is not being conducted in November and December), and so the lower behavioural threshold of 140 dB re 1 µPa rms relevant to cow-calf pairs is not applicable.

Other whales that may be encountered during the survey in the Operational Area include sei, humpback, fin, Bryde’s and Antarctic minke whales. The description of the environment identified that few whales are likely in January to April inclusive but numbers are likely to increase between April and July due to the arrival of northward bound HBWs. These species may also undergo strong behavioural responses out to the modelled ranges of 1.2 m, 2 m and 3.4 km depending on the depth of the water. Should individuals or groups of these whales be encountered, they may be displaced temporarily as the seismic vessel passes, but their behaviour is likely to return to normal quickly and recommence their natural activities. It is likely that these species forage in the east of Eden upwelling system, however it may not be a key feeding area for many. No impacts at a population level are predicted for these species.

Mid-frequency cetaceans including sperm whales (*Physeter* sp.), killer whales and dolphins, may be present in the region, however there are no known BIAs or important areas for feeding, migration, resting, breeding in or close to the Operational Area. Sound modelling predictions did not reach levels that could cause PTS (injury) or TTS (disturbance) greater than 40 m from the seismic source (Table 6.12) for mid-frequency cetaceans. Behavioural disturbance may occur up to 3.4 km, however localised, short-term and recoverable. No impacts at a population level are predicted. Observers and MFOs on seismic vessels regularly see dolphins and other small-toothed whales in the vicinity of seismic surveys. In general, dolphins avoid operating seismic vessels (Stone and Tasker 2006), and in most cases, the avoidance radii for dolphins are small (1 km or less), with some individuals showing no apparent avoidance (Holst et al. 2006; Moulton and Miller 2005; Stone 2003; Stone and Tasker 2006; Weir 2008).

Sperm whales are closely associated with foraging in sub-marine canyon systems (e.g. Perth Canyon off WA, and in the GAB off SA) and GAB studies on *Physeter* sp. have shown a strong link between the canyons in the western and central GAB and sperm whales. Sperm whales could be foraging within the Acquisition Area on the Big Horseshoe Canyon KEF, modelling of potential sperm whale habitats and distribution did not indicate this was an important or high usage area (Torres et al. (2011) and Bailleul et al. (2017). Underwater noise impacts resulting in behavioural effects to sperm whales will be limited to within 3.4 km of the seismic source and short-term as the vessel traverses sail lines within the acquisition zones and recoverable. No impacts at a population level are predicted.

RPS

6.1.4.5.3 Indirect impacts on baleen whales

Indirect impacts on baleen whales could occur through the loss of zooplankton as a food resource through the airgun sound sources. As concluded in Section 6.1.5.1, the impacts on zooplankton are expected to be localised and will recover rapidly once the vessel moves to other seismic lines and zones.

Additionally, the possible feeding BIA has been designated based on historic information, a small number of observations and presence of prey items; krill in this case. The BIA has not been proven as a regular foraging area for PBWs or that the PBWs depend on it for a substantial part of their energy budget. There is no evidence to suggest it is used at any one period of time in preference to another, and the number of records of PBWs for the Gippsland Basin suggests it is not intensively used, though it is acknowledged that this is not based on systematic scientific survey. The BIA is also vast by comparison to the Acquisition Area and more so again to the zone of impact at any one time. The risk of PBW food resources being reduced to the extent that it would significantly impact PBW feeding within the BIA is negligible.

6.1.4.6 Impacts on pinnipeds

The Australian and New Zealand fur seals are the only pinniped with known breeding sites and/or haul-out sites in the vicinity of the Gippsland MSS survey area, with the closest breeding colonies being 70 km away. These sites are too distance from the seismic survey for any effects to occur, however it is possible that adult fur seals could forage in the Operational Area in water depths of up to 150 m.

The fur seal belongs to the family Otariidae, which are less sensitive to low frequency sounds (<1 kHz) than to higher frequencies (>1 kHz). Underwater sound modelling was carried out for both single shot sites and for a 24-hour cumulative exposure scenario. NMFS (2016) SEL thresholds for PTS were not reached in the modelling (Table 6.13), and SPL PK thresholds were reached only within 20 m from the source, and so no injury effects are predicted for fur seals as it is unlikely that an animal would be found/remain within 20 m of the airgun array. Cumulative TTS effects are predicted within 133 m of the source in <200 m water depth, which is the maximum depth range the fur seal is expected to occur, particularly when foraging.

It is however possible that fur seals exhibit some behavioural disturbance within 9 km of the seismic vessel (based on the NMFS (2013) 160 dB re 1µPa threshold), however this is considered a potentially overly conservative threshold (and distance) given the much lower sensitivity of otariids to seismic sound compared with cetaceans. In fact the Sea Mammal Research Unit (SMRU) has considered a higher threshold for behavioural disturbance for otarrid species of 180 dB re 1µPa (Wood et al. 2012), which if applied to this assessment would mean that disturbance would be limited to a distance of up to 330 to 750 m from the source. This seems more reasonable given the much lower hearing sensitivity of this marine mammal group in comparison with cetaceans.

Underwater noise impacts resulting in behavioural effects to the Australian fur seal will be limited to 750 m probable or <9 km (unlikely) of the seismic source and short-term (survey duration of 120 days) and recoverable. No impacts to breeding success or at a population level are predicted.

Table 6.13 Summary of modelled impact ranges for pinnipeds

Guideline description	Guideline level	Impact range (max)
PTS (NMFS 2016)	203 SELcum 232 SPL PK	No exceedance <20 m (all water depths)
TTS (NMFS 2016)	188 SELcum 226 SPL PK	up to 133 m (>200 m depth) up to 555 m (200-1,000 m depth) <40 m (all water depths)
Behaviour disturbance (NMFS 2013)	>160 dB SPLrms	up to 1.4 km (<200 m depth) up to 2.1 km (200-1,000 m depth)

RPS

6.1.4.7 Impacts on protected area values and management

CGG has undertaken the impact assessment in accordance with the management strategies and objectives of the South-east Marine Reserves Network Management Plan and consistent with Australia's IUCN Principles (Table 4.1). Protected areas and their conservation values that could be affected by seismic sound from the Gippsland MSS are summarised in Table 6.14. There are no listed cultural heritage properties in the offshore area (Section 4) nor has there been any objection to the from cultural heritage stakeholders during consultation (Section 9).

Table 6.14 Protected areas potentially directly or indirectly affected by the Gippsland MSS

Protected area	Conservation values that may be affected by the survey	Impacts from survey
East Gippsland and Beagle Marine Parks	• Important resting/migration area for SRWs • Important migration area for: HBWs • Important foraging areas for Australian fur seal, white shark, killer whale, seabirds. • High biodiversity/productivity; upwelling east of Eden	East Gippsland marine parks is located approx. 30 km to the east of the Gippsland MSS, Beagle marine park approx. 40 km to the south-west; and will not be affected by the survey. The impact assessment for environmental receptors provided throughout this section demonstrates that the survey will not have a significant impact on the values of the area for productivity, migration, resting, foraging. CGG has adopted a 'zoned' approach to the Gippsland MSS and will implement control measures to avoid disturbance to migrating cetaceans (see Section 6.1.6). Historical seismic surveys in the Gippsland Basin have not reduced biodiversity or fauna abundance in the region.
East of Eden Upwelling KEF	• Primary production/planktonic species • PBW and HBW foraging area • Other whale, seal, shark and seabird species intermittent/ opportunistic feeding	No management objectives set, refer to assessments in: • Section 6.1.5.1 (plankton) • Section 6.1.5.5 (cetaceans) • Section 6.1.5.3 (fish and sharks) • Section 6.1.5.6 (fur seals)
Big Horseshoe Canyon KEF	• Localised upwelling/biodiversity hotspots • Deep water sponges, crinoid and octocorals (on rocky reefs) • Fisheries importance above 600 m water depth	No management objectives set, refer to assessments in: • Section 6.1.5.1 (plankton) • Section 6.1.5.3 (fish and fisheries) • Section 6.1.5.5 (cetaceans). There are no expected impacts on deep water sponge or crinoid/octocorals diversity abundance in rocky reef areas of the KEF canyon from seismic sound.

6.1.4.8 Impacts analysis on human divers

The type of breathing apparatus worn by a diver, i.e. diving helmet (dry ear) or hood (wet ear), is important in determining the noise hazard as human hearing is more sensitive in air than in water (Parvin et al. 1994). This is due to the 'wet' ear effect (water in contact with the head and in the auditory canal, such as SCUBA divers and band-mask divers) versus 'dry' ear effect (wearing diving helmets and the ear is surrounded by air) (Parvin et al. 1994). Studies have shown that there is a reduction in hearing sensitivity underwater for SCUBA divers, with commercial divers wearing helmets considered the 'worst' case group in terms of sensitivity to underwater noise (Parvin et al. 1994; Anthony et. 2010).

CGG has compared the predicted received levels from the sound modelling with the threshold proposed by (Parvin et al. 2002). Based on this threshold, divers are predicted to hear underwater noise from the seismic survey at up to 2.2 km (at 155 dB SPL threshold) from the source.

There are no known commercial diving activities planned in the Operational Area, and any recreational diving activities are limited to shallow nearshore water depths (<30 m) (Section 4). In the event of diving operations planned within or within 10 km of the Operational Area, specific dive procedures will be defined in the concurrent operations (CONOPS) / simultaneous operations (SIMOPS) Plan, including an extension of the Cautionary Zone to 10 km, and the requirement for a joint risk assessment in advance of any SIMOPS. CGG will develop a SIMOPS Plan for the Gippsland MSS and affected diving operation in agreement with the affected relevant operator(s). As part of the SIMOPS Plan, CGG will establish a communications protocol outlining all key contacts, confirming schedules and identifying constraints and buffer distances that need to be observed. No impacts to human divers are predicted.

6.1.4.9 Cumulative impacts from seismic airgun discharges

Potential cumulative impacts associated with the Gippsland MSS may occur if the survey is undertaken:

- at the same time as another seismic survey within the area, there is an overlap in the areas ensonified by each survey and there are noise sensitive receptors in the overlap zone (concurrent surveys)
- within an area where previous seismic surveys have occurred, the affected marine biota are still in the same area and have not fully recovered (sequential surveys).

It should be noted that this section does not assess cumulative impacts from future seismic surveys within the area that may occur after the Gippsland EP validity, as this is the responsibility of that titleholder as part of their cumulative impact assessment.

6.1.4.9.1 Concurrent surveys

All currently submitted and approved EPs for seismic surveys have been investigated on the NOPSEMA website and those with potential spatial and temporal overlap with the Gippsland survey have been assessed for cumulative noise impacts. As outlined in the Section 4, there are no other seismic surveys planned (EP submitted or accepted) that overlap with the Gippsland acquisition or operational areas.

In the event of a survey planned at the same time as the Gippsland MSS, the industry best practice and conservative 40 km buffer between seismic vessels will keep sound levels below the level at which physiological impacts could occur. CONOPS will be prepared at least one month prior to the planned survey commencement (where necessary) and the seismic vessel will adhere to specific CONOPS procedures when operating within the Cautionary Zone around another the other vessel.

Following acceptance of this EP and as part of the pre-survey planning and notification process, the NOPSEMA website will be monitored for newly accepted EPs for marine seismic surveys which could contribute to cumulative noise in the survey area. If a survey is permitted within 40 km of the Gippsland survey area, and scheduling for both surveys may overlap, the relevant titleholder will be contacted, and arrangements made to ensure that the potential cumulative impacts will be reduced to ALARP. As a minimum, CGG will not acquire seismic data within 40 km of another actively acquiring seismic vessel.

Given the very low probability of two seismic surveys occurring simultaneously and the controls that will be implemented to establish and maintain communications prior to and during the survey to ensure such simultaneous activities would maintain an adequate separation distance (40 km), there is very little risk of cumulative impacts to marine receptors. No cumulative impacts are predicted from concurrent surveys.

6.1.4.9.2 Sequential surveys

Cumulative impacts can occur when the timing between activities is less than the recovery rate of any potential impacts to receptors. The US National Marine Fisheries Service (NMFS) applies a “resetting” of SEL_{cum} after 12 hours of non-exposure (Stadler and Woodbury 2009). Whereby, if there is a 12-hour period between the end of one pile driving operation and the start of the next, the SEL_{cum} for a fish during the pile driving operation is reset to zero for the next set of exposures. Applying a pile-driving management measure to a seismic survey is highly conservative, given the much lower number of sound pulses associated with seismic surveys and the ability of most fish and other receptors to move away from the source. Popper (2018) lends weight to the likelihood of recovery and concluded in a recent peer review of a seismic EP that effects in fish are recoverable once the seismic vessel has passed overhead and expected to occur within 24 hours.

CGG propose to carry out the undershoot surveys over a period of three weeks following the primary data acquisition, which would mean acquiring data over areas (25 x 3 km) under platforms that have previously been ensonified earlier during the survey. Where long-lived and resident receptors have been impacted and are still present in the impact area during a subsequent survey, multiple exposures may be possible. Due to the period of time between the primary data acquisition and undershooting operations it is expected that there is no lasting impact to the Gippsland Acquisition Area as a result of previous seismic surveys (i.e. full recovery has occurred); and therefore, there will be no sequential (or additive) effect as a result of the Gippsland MSS.

Based on individual fish recovery times proposed by Stadler and Woodbury (2009) of 12 hours, this indicates that it is highly unlikely that individual fish in an area where a seismic survey was acquired 1-2 years ago would not have recovered over this time. Populations would be more resilient due to immigration and recruitment of unaffected individuals. In addition, recent work has shown that fish can recover from the startle response of acoustic disturbance within minutes (Bruintjes et al 2016) and that repeated exposure can lead to habituation and reduced response within weeks (Nedelec et al 2016). Based on the above, no cumulative impacts from sequential seismic surveys are predicted for the Gippsland MSS.

6.1.4.10 Inherent impact evaluation

Using the above discussions, the impact evaluation is summarised in the following and is defined as part of the impact assessment method in Section 5.4.2. Where multiple risks or impacts have been identified on a given group of receptors with differing rankings, the worst case is quoted. Where risk ranking is Low, the potential impacts are deemed to be ALARP and acceptable and are not considered further unless additional treatments can be applied that have conservation benefits. Where risk ranking results are Medium or higher, ALARP and acceptability will be discussed and demonstrated below.

Inherent impact	Consequence	Likelihood	Risk ranking
	Minor – Plankton	Almost certain – Plankton	Medium – Plankton
	Minor – Invertebrates	Unlikely – Invertebrates	Low – Invertebrates
	Moderate – Lobster/scallop/ octopus/squid fishers	Possible – Lobster/scallop/ octopus/squid fishers	Medium – Lobster/scallop/ octopus/squid fishers
	Moderate – Fish	Possible – Fish	Medium – Fish
	Moderate – Fisheries	Possible – Fisheries	Medium – Fisheries
	Negligible – Turtles	Unlikely – Turtles	Low – Turtles
	Moderate – Cetaceans	Possible – Cetaceans	Medium – Cetaceans
	Minor – Pinnipeds	Unlikely – Pinnipeds	Low – Pinnipeds
	Moderate – Protected areas	Possible – Protected areas	Medium – Protected areas
	Minor – Human Divers	Possible – Human divers	Low- Human Divers

6.1.5 Impact treatment

Taking the above evaluations, treatments for each of the impacts deemed to be Medium or higher are identified in the following as described in Section 5.5 as part of the impact assessment method.

6.1.5.1 Demonstration of ALARP

The impacts to marine fauna from seismic noise are relatively well understood for some marine fauna groups (e.g. marine mammals) and less well understood for others e.g. invertebrates, plankton and fish. While none of the risks or impacts demonstrated above have been shown to be significant, there is still some uncertainty in the actual levels of intensity of the sounds or duration of exposure required before injury occurs to some marine taxa. Because of the impacts and the potential consequences identified in Section 6.1, and uncertainty of the distribution and abundance of some fauna groups, recognised good practice control measures are not considered appropriate on their own to manage the potential impacts to ALARP and Acceptable.

This assessment also considers the environmental impact to the location specific environmental values and sensitivities of the Operational Area (e.g. likely encounters with foraging PBWs, migrating HBWs and migrating SRWs). The potential impacts on cetaceans have been considered in the planning of the survey adjustments to the activity schedule and spatial extent of the Acquisition Area made to avoid impacting biologically important periods as follows:

- most of the original Zones 1 and 2 have been removed from the survey plan with seismic acquisition now being 13.6 km at the closest to the SRW BIA rather than the original 8 km between the closest point on Zone 1 and the nearshore BIA
- conduct the survey between January and July (not November to June) to avoid increased risk of encountering HBW and SRW cow-calf pairs using either the nearshore BIA or when passing through the Operational Area on their migration south to high latitudes.

In addition, due to the timing and location of the survey area, a precautionary approach has been applied to augment decision making further where uncertainty continues to exist. Therefore, as the inherent impact to commercial fishers is assessed as medium, CGG has reduced the survey area by approximately 20% to ensure seismic noise does not overlap an area of relatively high scallop density in nearshore waters, and to reduce overlap with trawl and squid fishing areas in northern areas. The timing of the survey has also been revised to avoid acquisition in November and December due to stakeholder concerns about impacts to seafood sales over the Christmas period as well as to catches by charter vessels over the holiday period. CGG has also applied a conservative assessment approach to important fishing areas as identified by relevant stakeholders in the consultation process, namely South East Reef. A smaller array of 150 in^3 will be used over this reef, and modelled levels in Section 6.1.4.3.1 show that the smaller array reduces the received sound levels compared to predicted modelled levels for the larger planned 3,000 in^3 array.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. On advice of the MSS Scientific Advisory Committee (SAC; Section 9.4.3), CGG thus approved independent analysis of seasonal patterns in commercial catch data within the MSS Acquisition Area to assess the most appropriate order in which zones should be completed to minimise impacts to fisheries. This analysis will be based on data for Commonwealth fisheries by month and fishing sector for each zone, with data pooled where necessary for statistical reasons. The results of this analysis will be reviewed by the SAC and inform the decision by CGG on the order in which zones are surveyed.

The impact assessment has identified potential injury or behavioural avoidance to octopus in the 40 to 60 m depth range in which they are fished. However, octopus occur down to >700 m water depth, and so biologically there is a much reduced effect on the potential stock (refer to Section 6.1.4.2). Nevertheless, CGG is cognisant of the uncertainty associated with understanding the effects of low-frequency sound on cephalopods and is aware of the scarcity of scientific studies on squid and octopus. In order to address some of this uncertainty CGG is proposing to undertake a field and laboratory-based study of the impacts of underwater sound from the Gippsland MSS seismic operations on octopus. CGG also accepts that controls aimed at minimising impacts to fishers are generally not feasible in the case of octopus fishers with equipment that is left on the seabed for weeks at a time, due to the limited range and area in which they operate (Section 4.6.5.2). A similar study is proposed to investigate the impacts from the survey on the catch/effort of Danish seine fishing operators (refer to Section 8.3.2.2). CGG is ~~will~~ also developing a contractual/compensation proposal that will allow fishers to put forward claims for compensation for loss of catch as a consequence of displacement due to survey activities. The proposal will be finalised as part of the ongoing consultation process with guidance from the SAC. The results of octopus and Danish seine fishing studies may be used to assess whether fishers claims for compensation are merited.

CGG considers the adopted controls to be appropriate in reducing the environmental impacts associated with underwater sound from seismic operations on marine fauna to ALARP. There are no other controls or measures that may practicably or feasibly be adopted to further reduce the impacts without disproportionate costs compared to the benefit of the potential impact reduction.

Table 6.15 Demonstration of ALARP – underwater sound from seismic operations

Control measures	Cost benefit analysis	Impact reduction	Control adopted
ALARP assessment technique – good practice, legislative requirements and conservation management plans			
CGG will implement all Part A standard management measures described in EPBC PS 2.1 relating to the following: • pre start-up visual observation • soft start • start-up delay • operational visual monitoring • power-down and stop work • night-time and low visibility	Benefits outweigh cost, legal requirement	Yes	Yes
CGG will implement the following precautionary zones for toothed whales from January to July: • pre-start up visual observation period to 30 mins • soft-start to 30 mins • observation zone to 3 km • low power zone to 2 km (modelling has shown 160 dB SEL for 95% of shots is reached at distance of >1 km from the seismic source) • shut-down zone to 500 m	Benefits outweigh cost, legal requirement	Yes	Yes
CGG will implement mitigation measures for operating the seismic airgun array in accordance with CGG's document: *MAR HSE PRC 013E Minimising acoustic disturbance to marine life* and the operating procedures provided in Appendix J.	Benefits outweigh cost, aligns with CGG's environmental management system (refer to Section 8.1).	Yes	Yes
ALARP assessment technique – EIA and conservation management plans			
Application of EPBC Policy Statement Part B Additional Management Measures to include the following:			
Acquisition of seismic data (including soft starts and ramping up) will be limited to within the Acquisition Area	Benefits outweigh cost, aligns with CGG's environmental management system (refer to Section 8.1).	Yes	Yes
Two trained Marine Fauna Observers (MFOs) on the seismic vessel will watch for whales during seismic operations in daylight hours; throughout the duration of the survey.	Benefits outweigh costs; aligns with management actions for cetacean management plans	Yes	Yes
MFOs will have a minimum of 20 weeks previous experience (recommended by the Marine Mammal Observer Association (MMOA)) of observing for marine mammals at sea, to have gained the skills to be competent at identifying marine mammals, estimating distance, confidence in implementing mitigation actions and experience recording data.		Yes	Yes
All marine fauna detection personnel (MFOs, trained crew) will attend the environmental induction presentation, which will include the environmental sensitivities of the survey area, environmental management strategies, EPO, and EPS as detailed in the EP. At crew changes, this information will be communicated to on-coming personnel during handover.	Prior to commencement of the survey, all marine fauna detection personnel will be briefed by the SEA, on EP commitments, their responsibilities for implementing them, the communications protocol for the survey and the reporting requirements. Benefits outweigh costs.	Yes	Yes

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24-hour period, the seismic vessel will move away from the current area and continue data acquisition in another area (>7 km away).	Benefits outweigh costs; aligns with management actions for cetacean management plans. The 7 km distance is based on the approximate turning circle of the survey vessel at the end of each sail line. This distance is double the impact range for the EPBC PS 2.1 threshold of 160 dB SEL of 3.4 km.	Yes	Yes
Relocate vessel to another area (>7 km away), if any shutdown was caused by the presence of more than three PBWs observed to be foraging in the possible foraging BIA. Three or more whales foraging in the same location could indicate that the area is rich in krill. Three animals has been selected as pygmy blue whales generally occur in small group sizes on average of less than 2 animals (Gill et al. 2011).	Vessel can relocate prior to shutdowns being triggered to avoid disturbing foraging whales. However, the conservation management plans for PBWs identify that PBWs should not be injured or displaced from the BIA. The standard power-down and shut-down will help avoid injuring the individuals and they are unlikely to be displaced from the entire BIA if disturbed on one seismic line. For low-frequency cetaceans a strong behavioural disturbance may be expected in the PBW foraging BIA out to 1.2 to 2 km, and cumulative TTS may occur over a 24-hour period to between 602 and 2,084 m for shallow and deep water respectively. Based on these impact ranges a distance of 7 km for relocation of the vessel was considered conservative, and is also the distance between sequential lines, which minimises the operational impact/cost to the survey of relocating the vessel. Potential environmental benefits outweighs costs associated with implementation.	Yes	No
In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24-hour period and the seismic vessel CANNOT move away from the current area and continue data acquisition in another area (>7 km away), CGG will implement the following additional precautionary control measures: • increased pre-start up visual observation period to 45 mins • increased soft-start to 40 mins • increased low power zone to 3 km • increased shut-down zone to 1 km	CGG recognises the importance of the Gippsland Basin for foraging PBWs, migrating HBWs, and migrating SRWs. Introducing adaptive management will provide additional protection for these ‘early’ or ‘late’ migrating animals and will engender limited cost/time loss for CGG. Benefit outweighs cost.	Yes	Yes
Passive Acoustic Monitoring (QuietSea) – to be implemented for the full duration of the survey and can detect vocalising whales within the frequencies (10 Hz – 96 kHz). Because of the 2D hydrophone array, QuietSea also has the ability to triangulate to the source of whale calls and estimate the distance and bearing. The same precautionary zones used for visual monitoring will be applied to QuietSea operation (e.g. 2 km low-power zone and 500 m shut-down zone) but all calls detected on QuietSea will be assessed by the PAM Operator regardless of range estimation.	QuietSea will allow vocalising whales to be detected when not visible at the surface and during periods of poor visibility. This offers protection of large whales at times when they would not otherwise be detectable visually and therefore benefits outweigh the costs. Specifications for QuietSea are found in Appendix F.	Yes	Yes

Control measures	Cost benefit analysis	Impact reduction	Control adopted
The streamer integrated QuietSea PAM system will be implemented on the main seismic vessel only during the survey 24 hours a day during the MFO validation exercise when the acoustic source is operational, reducing to night time or periods of low visibility once range estimation has been validated.	CGG has committed to using QuietSea PAM for detecting cetaceans 24 hours a day, and to implementing adaptive management procedures in the event of detections. CGG has investigated technologies (existing and emerging) for detection of cetaceans (particularly low frequency species) during periods of low visibility or at night. Secondary undershoot vessel will not be equipped with streamers or the QuietSea system as operation of the seismic source on both the main and secondary vessel will only occur during daylight hours (good visibility). Benefits outweigh costs; aligns with cetacean management plan management actions for no displacement to and/or injury to whales.	Yes	Yes
Two PAM Operators will operate throughout the duration of the survey to allow for daytime and low/visibility night-time detections.	CGG has committed to using PAM Operators in the validation period and during periods of poor visibility. Its ability to accurately estimate distances to vocalising whales ensures that the benefits gained outweigh the costs and potentially permits seismic acquisition to continue into periods of low visibility when otherwise the vessel would need to shut down and prolong the acoustic disturbance unnecessarily.	Yes	Yes
PAM operators will have: • minimum 20 weeks previous experience of PAM for marine mammals at sea, to have gained the skills to be competent at identifying marine mammal acoustic signals and interpreting acoustic software. • attendance of appropriate training course(s) with instruction on assembly and deployment of specific PAM equipment/software. • attendance of a course which included instruction on PAMGUARD or other suitable software		Yes	Yes
At the start of the survey on completion of the streamer array deployment when there is sufficient visibility, QuietSea detection distances will be compared with the MFO visual distance estimates to add to validation database of QuietSea. Once QuietSea estimates have been reconciled to ≤20% of the MFO distance estimates (distance estimation is inherently poor (Baird and Burkhart, 2000; Williams et al., 2007), QuietSea will be used to trigger mitigation responses when whales are detected entering the power-down and shut-down zones.	Benefits outweighs costs by protecting whales during times of low visibility and accounts for error in the system, without being too onerous on the operation and extending the period of ensonification.	Yes	Yes
The PAM Operators will use professional judgement and experience to determine whether the signal or range to signal is more accurate and decide whether or not the cetacean is likely to be within the power-down or shut-down zones.	Experience and professional judgement of the PAM Operator will provide an additional level of precaution for use around the new QuietSea technology during its initial use in Australia. Benefits of avoiding injury to cetaceans when considering the uncertainty around the technology outweigh the costs.	Yes	Yes

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
The seismic vessel will shut-down in the event of a confirmed whale detection on QuietSea (comprising 3 or more detection records for an individual whale) prior to range validation exercise irrespective of the estimated distance between the detected whale and seismic source and not commence soft-start procedures until 30 minutes has passed without further whale detection.	Benefits do not outweigh costs; if seismic acquisition was shut down during periods of low visibility whenever whales were detected, project may be delayed for whales that may be many kilometres or even tens of kilometres outside the zone of potential impact. Blue whale vocalisations can be detected from many tens of kms (Miller et al., 2013). QuietSea has been validated on previous seismic survey and shown to have similar accuracy to visual range estimation from experienced MFOs.	Yes	No
Redundancy in case of failure of the QuietSea system.	Redundancy would have to be configured into the seismic streamers which would require extra resources that are considered unnecessary for work in an area that is not known for large numbers of whales or not known to be a highly sensitive area. In addition the QuietSea system already has inbuilt redundancy due to the large number of the three different types of hydrophones in the system. It would also be CGG's responsibility to repair QuietSea in the event of failure before the airguns could be started at night. The costs outweigh the benefits.	No	No
In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24-hour period and the seismic vessel CANNOT move away from the current area and continue data acquisition in another area (>7 km away), CGG will implement the following additional precautionary control measures: • increased pre-start up visual observation period to 45 mins • increased soft-start to 40 mins • increased low power zone to 3 km • increased shut-down zone to 1 km	CGG recognises the importance of the Gippsland Basin for foraging PBWs, migrating HBWs, and migrating SRWs. Introducing adaptive management will provide additional protection for these early migrating animals and will engender limited cost/time loss for CGG. Benefit outweighs cost.	Yes	Yes
ALARP Assessment Technique – Precautionary Zones for Baleen Whales January to July			
Increased precaution zones and soft-start durations will be implemented for baleen whales only from January to July: • pre-start up visual observation period of 45 mins • soft-start period of 40 mins • low-power zone – 3 km • shut-down zone – 1 km	Benefits outweigh costs; precautionary approach to monitoring at the edge of the behavioural disturbance impact range; aligns with management actions for HBW conservation advice, PBW management plan and SRW recovery plan.	Yes	Yes

Control measures	Cost benefit analysis	Impact reduction	Control adopted
Additional Control Measures for Humpback and Southern Right Whales – to be implemented during April to July			
Escort vessel to carry out cetacean monitoring duties at edge of modelled limit of behavioural zone between April and July (HBW, SRW or an unidentified baleen whale) as follows: • one MFO will watch for whales during daylight hours • one MFO will monitor for whales during periods of low visibility and at night using the thermal imaging camera system.	Benefits of using additional MFOs on additional escort vessel does not outweigh costs because extended 3.4 km monitoring range is relevant only in deep water and the SRW and PBW BIAs are in shallow and mid-depth water only. Range to strong behavioural disturbance for shallow water is 1.3 km and in mid-depth water 2.1 km; these are within the low-power zone and within the effective viewing distance of the MFO on either seismic vessel or undershoot vessel. Furthermore, seismic survey is no longer occurring in November or December which would have been most biologically sensitive period due to the potential presence of HBW cow-calf pairs. Use of an additional vessel specifically for cetacean detection would unnecessarily increase vessel traffic and costs without any benefit to cetacean conservation.	No	No
In the event that three or more whale-instigated shut downs occur in one 24 hour period in April to July and the escort vessel is unable to complete cetacean monitoring duties without a replacement vessel, then the seismic vessel will cease seismic operations until the escort / support vessel returns and resumes monitoring.	Benefits do not outweigh costs now that seismic survey is not commencing until January and encounters with cow/calf pairs will be avoided. It has been shown above that having escort vessel applied to cetacean monitoring duties is beyond ALARP and unnecessary. Potential delays to seismic survey and vessel being placed on standby would add excessive costs to proponent.	No	No
Other Control Measures			
In the event that another vessel is acquiring seismic data in the region, the survey vessel shall not acquire data simultaneously within 40 km of the other seismic vessel in order to avoid cumulative impacts to marine fauna.	Modelling has shown that received levels reduce to below potential TTS thresholds for low frequency cetaceans at >35 km. A buffer distance of 40 km between vessels is therefore considered conservative. Benefit outweighs cost.	Yes	Yes
Aerial surveys to observe the Acquisition Area and provide vessel with locations of any observed cetaceans.	There are significant limitations associated with aerial surveys, such as limited aircraft endurance (due to size of survey area and distance offshore), ineffective at night and considerable additional safety risk and cost in using manned aircraft. Costs outweigh benefits.	Yes	No
Fish / fisheries specific controls			
The seismic source (airguns) will be reduced to a low power setting when acquiring sail lines within the boundary of South East Reef and a buffer area of 500 m around the reef. The airgun array volume will be reduced to ≤150 in^3 over this area. The shot point interval will be increased to one shot every 37.5 m.	Consultation has identified SE Reef as important habitat for commercial species. 500 m is the is the predicted maximum TTS impact distance for fish (and sharks) with no swim bladders (Table 6.7). March and April provide a window in which these species do not spawn. Benefit outweighs cost.	Yes	Yes
There will be no seismic undershooting of the four existing platforms over or in the vicinity of South East Reef, i.e. Fortescue, Halibut A, Cobia A and Mackerel A.		Yes	Yes

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
Seismic activity within the zone that encompasses South East Reef will be completed from March to April, as these months have been identified as having the lowest sensitivity for spawning for commercially important fish and invertebrate species.		Yes	Yes
Adjacent sail (survey) lines will not be acquired (shot) over a period of <24 hours (to allow recovery of fish species). This does not include the undershoot areas.	Peer reviewed papers/studies have shown that fish recovery following exposure to levels that could cause TTS occurs within 24 hours (Popper 2018). Benefit outweighs cost.	Yes	Yes
As part of the ongoing consultation process, CGG will notify all relevant persons four weeks prior to the start of the survey of the survey details including, timing, location, duration	Early notification of activities will allow fishers to plan activities around the survey and avoid negative interactions. Fishery stakeholders vary their months and locations of fishing according to market forces and personal situations. Ongoing consultation will enable CGG to plan day-to-day activities around key fisheries drivers, and to inform the fishers when an unavoidable relocation is required. Benefit outweighs cost.	Yes	Yes
Commercial fishers actively operating in the survey area and will be issued a 7 to 10 day forecast prior to activities commencing in the survey area.	Early notification of activities will allow fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Commercial fishers actively operating in the survey area are kept informed of daily survey activities through CGG's 24-hour look-ahead communication.	There is a potential benefit to fishers of being able to plan around the maximum time they may be displaced and no real cost to CGG. Benefit outweighs cost.	Yes	Yes
The Acquisition Area has been divided into five zones (Figure 6.7) within which the seismic vessel will operate for no longer than one month.	Fishers will still be able to conduct operations within the 'active zone' in compliance with normal maritime laws, (with the exception of octopus fishing). Early notification of activities will allow fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
No disruption to fishing activities (with the exception of octopus fishers) beyond that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre.	A Scientific Advisory Committee has been established which has identified an opportunity to carry out a BACI study for octopus to determine potential impacts from the seismic survey. This has been identified as a priority given the scarcity of scientific studies of the effects of low-frequency sounds on octopus and the importance of the area for local fishers.	Yes	Yes

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Table 6.16 Residual impact evaluation – underwater sound from seismic operations

Residual impact evaluation	Consequence	Likelihood	Risk Ranking
	Negligible – Plankton	Almost certain – Plankton	Low – Plankton
	Minor – Invertebrates	Unlikely – Invertebrates	Low – Invertebrates
	Minor to Moderate – Lobster/ octopus/squid fishers	Unlikely to Possible – Lobster/ octopus/squid fishers	Medium – octopus fishers Low – lobster/squid fishers
	Minor – Fish	Unlikely – Fish	Low – Fish
	Minor – Fisheries	Unlikely – Fisheries	Low – Fisheries
	Negligible – Turtles	Remote – Turtles	Low – Turtles
	Moderate – Cetaceans	Unlikely – Cetaceans	Medium – Cetaceans
	Negligible – Pinnipeds	Unlikely – Pinnipeds	Low – Pinnipeds
	Minor – Protected areas	Unlikely – Protected areas	Low – Protected areas
	Minor – Human Divers	Unlikely – Human Divers	Low – Human Divers

6.1.5.2 Demonstration of acceptability

The residual impacts are considered Acceptable because they are less than the levels of acceptability set for the activity. This is considered a reasonable demonstration of acceptability because the pre-set levels are conservative and take into account uncertainties as appropriate. The impacts on all receptors is considered acceptable on the basis of the following considerations. The definition and process of demonstrating acceptability is defined in Section 5.5.5 of the impact assessment methodology.

Table 6.17 Demonstration of acceptability for underwater sound from seismic operations

Acceptability criteria	
Marine receptors (general)	• Acquisition of seismic data (including soft starts and ramping up) will be limited to within the Acquisition Area • Seismic vessel operate in the five identified zones with scheduling of zones to be determine in conjunction with the SAC. The distance between preceding survey line and following line will be 7 to 12 km due to vessel turning circle. This is greater than the ensonified area of effect for most marine fauna species, meaning that previously ensonified areas will have between 6 and 16 hours while the vessel acquires the next line before returning to the back to the area immediately surveyed prior to that. Recovery expected within 12 to 24 hours based on Stadler and Woodbury (2009) and Popper (2018), so some if not complete recovery could be expected. • Stakeholder concerns/objections received have been merit assessed and control measures developed where required (Section 9). There are no outstanding merited concerns.
Plankton (incl. fish larvae)	• Only a small proportion of the plankton within the survey area would be exposed at any one time • Avoiding shallower areas on the continental shelf, and areas of strong upwelling, where may species are known to spawn reduces the effect to very limited with no lasting impacts on ecosystems, species or habitats and full recovery expected • No population or ecosystem level effects
Fish (incl. spawning)	• Seismic activity within the zone that encompasses South East Reef will be completed from March to April, as these months have been identified as having the lowest sensitivity for spawning for commercially important fish and invertebrate species. • Recovery expected within 12 to 24 hours based on Stadler and Woodbury (2009) and Popper 2018, so some if not complete recovery could be expected. • There are no know areas of high diversity/abundance within the survey area due to the deep water across much of the area (>1,000 m). • No population or ecosystem level effects.

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Acceptability criteria

Invertebrates (incl. spawning)	• Recovery expected within 12 to 24 hours based on Stadler and Woodbury (2009) and Popper 2018, so some if not complete recovery could be expected. See 'Fish' above and 'Fisheries' below for South East Reef. • No population or ecosystem level effects.
Marine turtles	• No predicted disturbance to marine turtles potentially transiting through the survey area beyond minor behavioural disturbance of a small number of individuals.
Cetaceans	• EPBC Act Policy Statement 2.1 Part A Standard Management Measures applied throughout duration of survey. • EPBC Act Policy Statement 2.1 Part B Additional Management Measures applied. • Changes to the survey schedule, spatial extent and the controls adopted in EP align with management actions for Blue Whale Conservation Management Plan – no injury is predicted for PBWs and no predicted displacement from their foraging BIA. There is no biologically important period defined for the BASS Strait possible foraging BIA for PBWs and therefore none to avoid. • By rescheduling the seismic survey between January and July inclusive, the biologically important period of November and December when cow-calf pairs may be encountered will be avoided. • Zone 2 has been reduced in area to avoid possibility of seismic discharges propagating into SRW BIA at intensities that may cause significant behavioural disturbance. • Control measures that have been described for both HBW, SRW and PBWs will afford protection to other baleen whales in the event that they may be encountered in the survey area. • No population level effects.
Australian and New Zealand fur seals	• No predicted disturbance to foraging fur seals (or breeding colonies/success).
Fisheries	• Survey is not planned to be carried out during peak commercial or recreational seasons in key fishing areas • The seismic source (airguns) will be reduced to a low power setting (≤150 in^3 volume) when acquiring sail lines within the boundary of South East Reef and a buffer area of 500 m around the reef. • No seismic undershooting of the four existing platforms over or in the vicinity of South East Reef, i.e. Fortescue, Halibut A, Cobia A and Mackerel A. • Seismic activity within the zone that encompasses South East Reef will be completed from March to April, as these months have been identified as having the lowest sensitivity for spawning for commercially important fish and invertebrate species. • Adjacent sail (survey) lines will not be acquired (shot) over a period of <24 hours (to allow recovery of fish species). This does not include the undershoot areas. • No disruption to fishing activities (with the exception of octopus fishers with fixed equipment) beyond that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre. • No ongoing impact on catchability as fish predicted to recover soon after survey completion. • Ongoing consultation will address any outstanding or arising issues with fishers in accordance with expectations under the OPGGS(E) Regulations
Protected areas	• No predicted loss of biological diversity in Marine Parks (aligned with IUCN principles) • No predicted disturbance to environmental values associated with KEFs.

6.1.5.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for vessel collision / equipment entanglement with marine fauna are presented below in Table 6.18.

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Table 6.18 Environmental performance outcomes, standards and measurement criteria for underwater sound from seismic operations

Environmental performance outcome	Environmental performance standard	Measurement criteria
No mortality or permanent injury to protected marine fauna species due to noise associated with the operation of the seismic source No injury to pygmy blue whales and no displacement of pygmy blue whales from their possible foraging BIA No injury to southern right whales and no restriction to southern right whales resting or migrating (connectivity) within their migration and resting on migration BIA No long term, permanent or unrecoverable effects to commercially important fish stocks or fisheries, or during their spawning seasons	CGG will implement **all** Part A standard management measures described in EPBC PS 2.1 including the following: • pre start-up visual observation for minimum 30 minutes • soft start for minimum 30 minutes in accordance with CGG procedure set out in document: *MAR HSE PRC 012E Soft Start* • start-up delay • operations monitoring • power-down and stop work • night-time and low visibility. CGG will implement the following precautionary zones: • observation zone to 3 km • low power zone to 2 km (modelling has shown 160 dB SEL for 95% of shots is reached at distance of >1 km from the seismic source) • shut-down zone to 500 m	MFO data sheets/report confirms EPBC Policy Statement 2.1 and *MAR HSE PRC 012E Soft Start* is available onboard the seismic vessel and ALL Part A and standard management measures have been implemented throughout seismic data acquisition. Seismic vessel gun logs will contain the seismic observers acoustic log of all instances the acoustic source was activated, including the acoustic source sequence activated during soft start procedures. MFO weekly reports to concur with seismic logs regarding number and timing of soft starts.
	CGG will implement mitigation measures for operating the seismic airgun array in accordance with CGG's document: *MAR HSE PRC 013E Minimising acoustic disturbance to marine life* and the operating procedures provided in Appendix J.	CGGs procedural document *MAR HSE PRC 013E Minimising acoustic disturbance to marine life* is onboard and modified to accord with the requirements of EPBC Act PS 2.1 and this EP.
	Two trained Marine Fauna Observers (MFOs) on the main seismic vessel will watch for whales during seismic operations in daylight hours; throughout the duration of the survey. One of the trained Marine Fauna Observers (MFO) on the main seismic vessel will relocate to the secondary (undershoot) seismic vessel to watch for whales during daylight hours; throughout the duration of the undershooting operations. Therefore one trained MFO on each seismic vessel during undershooting. MFOs will have a minimum of 20 weeks previous experience (recommended by the Marine Mammal Observer Association (MMOA)) of observing for marine mammals at sea, to have gained the skills to be competent at identifying marine mammals, estimating distance, confidence in implementing mitigation actions and experience recording data.	CVs for MFOs demonstrates competency MFO data sheets/report demonstrates watch maintained during daylight acquisition. MFO report confirms one MFO on each seismic vessel during undershooting. MFO report confirms no night-time / low visibility operation of the seismic source on either the main or secondary seismic vessels during undershooting.
	All marine fauna detection personnel (MFOs, trained crew) will attend the environmental induction presentation, which will include the environmental sensitivities of the survey area, environmental management strategies, EPO, and EPS as detailed in the EP. At crew changes, this information will be communicated to on-coming personnel during handover.	MFO/PAM commitments presentation; attendance sign-off sheets. Pre-survey inspection verifies MFO/PAM procedures located on bridge and PAM station.
	In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24-hour period, the seismic vessel will move away from the current area and continue data acquisition in another area (>7 km away)	MFO data sheets/report verifies implementation of procedure and vessel log confirms new location of vessel.
	In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24 hour period and the seismic vessel CANNOT move away from the current area and continue data acquisition in another area (>7 km away), CGG will implement the following additional precautionary control measures: • increased pre-start up visual observation period to 45 mins • increased soft-start to 40 mins • increased low power zone to 3 km • increased shut-down zone to 1 km	MFO data sheets/report verifies implementation of procedure
	Relocation of the seismic vessel >7 km away in the event that three or more foraging PBWs within their possible foraging BIA.	MFO data sheets/records for observations of >3 PBWs and implementation of procedure to relocate vessel >7 km away.
	Passive Acoustic Monitoring (QuietSea) – to be implemented for the full duration of the survey and can detect vocalising whales within the frequencies (10 Hz – 96 kHz).	QuietSea equipment specification confirms system capabilities for frequency range detection.
	The streamer integrated QuietSea PAM system will be implemented on the main seismic vessel only during the survey 24 hours a day during the MFO validation exercise when the acoustic source is operational, reducing to night time or periods of low visibility once range estimation has been validated.	MFO data sheets/report verifies QuietSea operations on main seismic vessel.
	Two PAM Operators will operate throughout the duration of the survey to allow for daytime and low/visibility night-time detections.	MFO and SEA report confirms location of PAM operators on main seismic vessel. MFO report confirms no night-time / low visibility operation of the seismic source on either the main or secondary seismic vessels during undershooting.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	PAM operators will have: • minimum 20 weeks previous experience of PAM for marine mammals at sea, to have gained the skills to be competent at identifying marine mammal acoustic signals and interpreting acoustic software. • attendance of appropriate training course(s) with instruction on assembly and deployment of specific PAM equipment/software. • attendance of a course which included instruction on PAMGUARD or other suitable software	PAM Operators' CVs to demonstrate experience with applying PAM and knowledge of call signatures of whales likely to be encountered in Gippsland Basin region.
	At the start of the survey on completion of the streamer array deployment when there is sufficient visibility, QuietSea detection distances will be compared with the MFO visual distance estimates to add to validation database of QuietSea. Once QuietSea estimates have been reconciled to ≤20% of the MFO distance estimates, QuietSea will be used to trigger mitigation responses when whales are detected entering the power-down and shut-down zones. The PAM Operators will use professional judgement and experience to determine whether the signal or range to signal is more accurate and decide whether or not the cetacean is likely to be within the power-down or shut-down zones.	PAM Operator weekly report shows QuietSea was being monitored through periods of poor visibility and at night during pre start-up monitoring and whenever guns were operating. MFO and PAM Operator data sheets confirms accuracy of range estimates and successful validation of QuietSea.
	Increased precaution zones and soft-start durations – to be implemented for baleen whales from January to July: • Pre-start up visual observation period of 45 mins • Soft-start period of 40 mins • Low-power zone – 3 km • Shut-down zone – 1 km	MFO data sheets/report verifies implementation of increased precaution zones for baleen whales
	In the event that another vessel is acquiring seismic data in the region, the survey vessel shall not acquire data simultaneously within 40 km of the other seismic vessel in order to avoid cumulative impacts to marine fauna. Until PAM detection distances have been validated against MFO visual observation distances, during periods of low visibility and at night the seismic vessel will shut-down in the event of a confirmed cetacean detection (comprising 3 or more detection records for an individual cetacean) and not commence soft-start procedures until 30 minutes has passed without further cetacean detection.	Communication records show that any geophysical contractors operating other seismic survey vessels have been consulted two weeks prior to the survey start and agreed to 40 km separation distance. Records confirm no incidents when vessels less than 40 km apart and actively acquiring data.
	Acquisition of seismic data (including soft starts and ramping up) will be limited to within the Acquisition Area.	SEA report and vessel logs confirm that the acquisition of seismic data (including soft starts and ramping up) is limited to within the Acquisition Area
	The seismic source (airguns) will be reduced to a low power setting when acquiring sail lines within the boundary of South East Reef including a buffer area of 500 m around the reef to avoid TTS injury to fish (including sharks) that do not have a swim bladder (Figure 6.7). The airgun array volume will be reduced to ≤150 in^3 and the shot point interval will be increased to one shot every 37.5 m over this area.	Vessel seismic logs and MFO data sheets show implementation of procedure. SEA and vessel logs confirm airgun array volume ≤150 in^3 and shot point interval of one shot every 37.5 m when acquiring over South East Reef plus 500 m buffer.
	There will be no seismic undershooting of the four existing platforms over or in the vicinity of South East Reef, i.e. Fortescue, Halibut A, Cobia A and Mackerel A.	SEA and vessel logs confirm no undershooting at Fortescue, Halibut A, Cobia A and Mackerel A platforms.
	Seismic activity within the zone that encompasses South East Reef will be completed from March to April, as these months have been identified as having the lowest sensitivity for spawning for commercially important fish and invertebrate species.	SEA and vessel logs confirm that the Acquisition Area zone that encompasses South East Reef was acquired from March to April.
	Adjacent sail (survey) lines will not be acquired (shot) over a period of <24 hours (to allow recovery of fish species). This does not include the undershoot areas.	SEA and vessel logs confirm that, with the exception of the undershoot areas, adjacent sail lines were not acquired over a period of <24 hours.
	The Acquisition Area has been divided into five zones (Figure 6.7) within which the seismic vessel will operate for no longer than one month.	Vessel logs confirm completion of each zone within one month duration.
	The order in which zones are surveyed will be the most appropriate to minimise impacts to fisheries and based on advice of the Scientific Advisory Committee.	SAC meeting minutes confirm that the order in which zones are surveyed is based on advice of the SAC.
	Pre-planning search of NOPSEMA approvals data to identify potential for overlap with other seismic surveys.	All other submitted EPs for seismic surveys in the region will be reviewed to ascertain potential overlap.
	As part of the ongoing consultation process, CGG will notify all relevant persons four weeks prior to the start of the survey of the survey details including, timing, location, duration. Pre-planning search of NOPSEMA approvals data to identify potential for overlap with other seismic surveys	Stakeholder consultation records show notification of survey details to all other relevant persons (i.e. non-fishers) four weeks prior to the start of the survey.
	Commercial fishers actively operating in the survey area and will be issued a 7 to 10 day forecast prior to activities commencing in the survey area.	Copies of forecast notifications to relevant fishers 7 to 10 days prior to activities commencing in the survey area
	Commercial fishers actively operating in the survey area are kept informed of daily survey activities through CGG's 24-hour look-ahead communications.	Sighting records of 24-hour look-ahead communications with commercial fishers who have requested the data.
	No disruption to fishing activities (with the exception of octopus fishers with fixed equipment) beyond that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre.	Stakeholder consultation and notifications confirm that fishers will be allowed access to all parts of the Operational Area to conduct their fishing operations, and will only be required to move from the immediate area of operations within a zone in the event of the seismic vessel requires passage whilst it is restricted in its ability to manoeuvre.

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6.2 Impact 2: Underwater sound – vessel / helicopter operations

6.2.1 Identification of the hazard and extent

Hazard	The seismic vessel(s) and the support/escort vessel(s) will generate low levels of machinery noise, especially when using propulsion thrusters. This noise will be at a much lower level than the noise emitted from the active airgun array. Seismic data acquisition will occur on a continuous basis (24 hours a day) throughout the survey (maximum duration of 6.5 months), with limited periods of time when the seismic source is not operational. While the seismic source is operational, the underwater noise generated by vessels will be a negligible addition to the cumulative noise levels. The assessment of underwater vessel noise below is therefore limited to the periods when underwater noise levels from vessel operations are dominant, and periods when the airgun array is not operational (e.g. line turns, during maintenance / repairs and marine fauna shut-downs). The area is already subject to frequent noise from vessels and installations due to its proximity to relatively busy shipping routes and existing oil and gas platforms in the basin. Helicopter engine noise is emitted at a range of frequencies, and generally of a low frequency below 500 Hz (Richardson et al. 1995) and may penetrate the surface waters at close range. Sound pressure is greatest at the surface and rapidly diminishes with increasing depth. Underwater noise reduces with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. Richardson et al. (1995) reported helicopter noise (for Bell 214 type) being audible in air for four minutes before it passed over receivers, but only detectable underwater for 38 seconds at 3 m depth and 11 seconds at 18 m depth for the same flight path. Helicopter noise is highly transient and is considered to pose limited risk of physiological/or significant behavioural effects to cetacean unless hovering over animals for an extended period of time (resulting in behavioural avoidance). No impacts to fish or invertebrates are plausible given their scattered distribution, low levels and highly transient nature of the sound. Importantly, it is not reasonable to apply additional controls limiting take-off and landings from the heli-deck of the vessel (i.e. in event of cetacean presence), as this manoeuvre has priority for the protection and safety of crew and infrastructure.
Extent	Operational Area
Duration	Vessel noise continuous for the duration of survey – up to 6.5 months (mid January to end July) Helicopter noise intermittent – only during crew changes

6.2.2 Levels of acceptable impact

The impact on marine receptors caused by underwater sound from vessel operations will be acceptable when the levels of acceptability are met as described below:

- seismic vessel and support/escort operations are limited to within the Operational Area
- application of EPBC Regulations Part 8 – Interacting with cetaceans and whale watching
- no direct effect on EBPC Act listed MNES that is not recoverable at a population level
- no displacement of marine fauna from biologically important areas.
- no population level or ecosystem level effects.
- vessel operations will be compliant with all maritime law relating to marine fauna, notably physical separation distances related to cetaceans.
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/ objections, where required. No outstanding merited concerns that have not been addressed in Section 9 and assessed in Section 6.1.

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6.2.3 Predicted impacts from the Gippsland MSS

This section describes the impacts that may occur on significant marine environmental receptors identified in Section 4 that are potentially sensitive to underwater sound from vessel and helicopter activities. On conclusion of the impact analysis, the inherent impacts from the hazards are evaluated. This part of the impact assessment method is described in Section 5.4.2.

Potential impacts	The potential risks and impacts to marine fauna from increased underwater noise associated with normal vessel operations are reasonably well understood limited to behavioural disturbance rather than direct physiological injury. Vessel operations in the region are widely acceptable to the community (due to the existing usage for oil and gas activities – platforms, shipping, and fishing), therefore the potential for adverse impacts from vessel noise is considered low. The greatest source of noise during the activity will be from operation of the airgun array, therefore the impact assessment for the effects of increased noise from vessel operations on marine fauna is put into the context in terms of the limited periods during which this could be the dominant noise source, i.e. when the seismic source is not operational. Noise emissions from the seismic and support vessel(s) will be influenced by the activity being conducted by the vessels, for example, the seismic vessel generates less noise when drifting and more when towing the streamer array using the azimuth thrusters. Source levels from typical seismic vessels are approximately 165 to 180 dB re 1 µPa (root mean squared (rms) @ 1 m for vessels <100 m long and 180 to 190 dB re 1 µPa (rms) @ 1 m for vessels >100 m long (Richardson et al. 1995; Kipple and Gabriel 2003; and Heitmeyer et al. 2004). Marine fauna at distance from the vessel will be exposed to much lower noise levels due to attenuation of the sound energy as it travels through the water. Sound energy from helicopter activities visiting the vessel periodically through the seismic survey can penetrate the marine environment and cause behavioural impacts similar to those from vessel noise.
Predicted effect	**Vessel noise** PBWs, HBWs and SRWs, may be encountered in the Operational Area but only the PBW (foraging) and SRW (migration) have BIAs that overlap the Operational Area and Oil EMBA respectively. The northern and western shallows of the Operational Area overlap part of the PBW possible foraging BIA as they make their way to the area west of the Bonney Upwelling (about 500 km to the west of the Operational Area) where they aggregate from November to December. From November until May, they are known to forage at the Bonney Upwelling in significant numbers and are considered less likely to be present in high abundance. HBWs have historically foraged off Eden, about 90 km north of the Operational Area (Figure 4.22), on their migration north from the Antarctic waters and southern Tasmania to waters off Queensland (Goff et al. 2018). Between April and July their migration movements north will overlap with the survey period. SRWs may traverse the Operational Area favouring the shallow waters near the coastline en route to calving and aggregating sites off Warrnambool, Port Fairy and Portland during May to October. These main aggregation areas lie approximately 500 km west of the Operational Area. The great white shark could also be present in the Operational Area, having a wide distribution across the region, and has BIAs for breeding/nursery, foraging and distribution in the vicinity of the Operational Area. Breeding/nursery areas overlap the Operational Area near Corner Inlet and the shallows along the north west of the Operational Area (Section 4.5). Foraging areas are located around the Bass Strait Islands as well as near Mallacoota and Beware Reef (about 15 km north of the Operational Area). There are no haul-out sites or known breeding colonies for the Australian fur seals along the coast parallel to the Operational Area but both Australian and New Zealand fur seals have haul outs and breeding colonies near Wingan Inlet (approximately 70 km from the Operational Area), and have been sighted at Point Hicks, Cape Conran and Beware Reef (between 16 and 26 km from the Operational Area). Australian and New Zealand fur seals may forage in the waters on the continental shelf out to around 150 m and around the East of Eden Upwelling KEF when its active, so it is possible that the vessels may encounter individuals. It is also possible that other species of marine fauna that are not regionally significant may transit through the Operational Area, e.g. fin and sei whales, fur seals, dolphins, marine turtles could be encountered, particularly during periods of nutrient enrichment associated with the East of Eden Upwelling KEF. Underwater noise emissions from vessel operations are generally within or below the range of natural noise levels experienced by marine fauna, and therefore not expected to cause any physiological damage to fauna (McCauley 1998, 2003; McCauley and Jenner 2001; and Richardson et al. 1995). The primary auditory effect of vessel noise on marine fauna is the potential masking of biologically significant sounds (Southall et al. 2007). Potential behavioural effects on marine fauna due to underwater noise from vessels also include changes in vocalisation characteristics and disturbance to foraging, navigation and reproductive activities.

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	The majority of acoustic energy radiated from large commercial vessels is below 1 kHz, and so the greatest potential for masking exists for marine fauna that produce and receive sounds within this frequency band; primarily baleen whales, pinnipeds, fish, and possibly some toothed whales (Southall et al. 2007). Acoustic masking at higher frequencies (1 to 25 kHz) may affect toothed whales (beaked whales, sperm whales, dolphins and porpoises) in close proximity to the vessel. There has been relatively little behavioural observation of cetaceans exposed to continuous, low-level underwater noise, such as from vessels. An experimental study involving acoustic tagging and controlled exposure experiments with North Atlantic right whales (*Eubalaena glacialis*), showed no effect of vessel noise on the whales. Five of the six individual whales responded strongly (interrupted dive pattern and swam rapidly to the surface) to the presence of an artificial alarm stimulus (series of constant frequency and frequency modulated tones and sweeps),but ignored playbacks of vessel noise (Nowacek et al. 2004). Small cetaceans are commonly observed swimming near vessels; this attraction indicates that the noise is not having a detrimental effect on the animals. The frequency range of vessel noise overlaps the hearing ranges of many fish species (Amoser et al. 2003). Hearing impairment (i.e. TTS) has been recorded for fish exposed to continuous noise from small boats and ferries for two hours (Vasconcelos et al. 2007). However, recovery was observed on cessation of vessel noise. In summary, marine fauna that may be present within the Operational Area are mobile and would be expected to actively avoid the seismic and support/escort vessels, especially during data acquisition. When the airguns are not operational, there may be localised behavioural disturbance of fauna in the immediate vicinity of the vessel during operations. However, this would be limited to a temporary change in behaviour due to avoidance of the area but no injury or lasting impact. No injury or mortality of marine fauna as a result of exposure to vessel noise in an already high vessel usage area; and no effects at an ecosystem function level or population level are predicted.		
	Helicopter noise Increased underwater and airborne noise from helicopter movements has the potential to cause impacts to birds along flight paths due to behavioural disturbance, and behavioural changes in cetaceans. Airborne noise from helicopters generally only penetrates water at angles greater than 26 degrees (Richardson et al. 1995), resulting in a temporary change in behaviour (e.g. diving, tail slaps in cetaceans), which return to normal behaviour once the helicopter has passed (Richardson et al. 1985; Richardson and Malme 1993). Occasional helicopters are thought to have no long-term impact on cetaceans (NMFS 2001). Compliance with EPBC Regulations (Part 8.07) including not knowingly fly the helicopter lower than 1,650 ft within horizontal radius of 500 m of a cetacean will ensure behavioural impacts on cetaceans are avoided. There are no offshore islands in the Operational Area and so no nesting or roosting for migratory seabirds. Seabirds may forage or transit through the Operational Area, and foraging seabirds with BIAs include shearwater, albatross and petrel. Helicopter movements will be intermittent and flight paths will be selected to avoid areas identified as important for aggregating seabirds described in Section 4.7.9.		
Inherent impact	Consequence	Likelihood	Risk Ranking
	Minor	Likely	Low

6.2.4 Impact treatment

Using the impact evaluations in Section 6.2.3, treatments for each of the impacts are identified in the following as part of the impact assessment methodology described in Section 5.5.

6.2.4.1 Demonstration of ALARP

Complete elimination of the impact is not possible as there is no practical alternative to the use of vessels which allow CGG to undertake the activity. The impact assessment has determined that, with the implementation of the adopted control measures, underwater noise from vessel and helicopter operations will not result in a potential impact greater than a localised area of avoidance and short-term effect on marine fauna species. Behavioural disturbance effects are expected to return to cease once the vessels are removed from the area.

The application of recognised good practice is considered appropriate to manage these risks. These are encapsulated in CGG Procedures specific to operating seismic vessels and procurement of escort vessels and helicopters to ensure the noise levels generated by the working vessels and helicopter are at their lowest levels. EPBC Regulation

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However, this risk assessment recognises the survey-specific nature of risks associated with the Gippsland MSS and the challenges in predicting the use of the Operational Area by other marine users. To augment decision making, a precautionary approach is applied where uncertainty continues to exist.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. CGG considers the adopted controls to be appropriate in reducing the environmental impacts associated with underwater sound from vessel/helicopter operations on marine fauna to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the impacts without disproportionate costs compared to the benefit of the potential impact reduction

Table 6.19 Demonstration of ALARP – vessel noise

Control Measures	Cost Benefit Analysis	Impact Reduction?	Control Adopted
ALARP Assessment Technique – Good Practice			
All internal combustion engines on board the vessel will be maintained in accordance with the manufacturer's specifications and hence noise emissions will be typical of vessels in the region.	Benefit outweighs cost	Yes	Yes
Interaction between survey vessel and cetaceans (whales and dolphins) within the operational area will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 and Australian National Guidelines for Whale Watching and Dolphin Watching 2017 (CoA, 2017): • vessels will not knowingly travel faster than 6 knots within 300 m of a whale or 150 m of a dolphin • vessels will not knowingly get closer than 100 m of a whale or 50 m of a dolphin • seismic survey vessels and support vessels will not intently approach within 150 m of a dolphin calf or within 300 m of a whale calf (Reg 8.06(2)). • If a cetacean approaches the vessel within the above zones, the vessel should avoid rapid changes in engine speed or direction. • helicopters will not fly lower than 1,650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off (Reg 8.07(2)(b)) and will not approach a marine mammal from head-on (Reg 8.07(2)(c)).	Benefit outweighs cost; legal requirement	Yes	Yes
ALARP Assessment Technique – EIA			
All control measures adopted for managing impacts from underwater sound from seismic operations to ALARP will afford added protection in reducing potential effects from vessel noise to ALARP (refer to Section 6.1.8)	Benefit outweighs cost	Yes	Yes
Do nothing – no MSS	The survey is critical in providing data to fill in data gaps in the region and to replace existing poor quality seismic data already reprocessed by CGG. Minimal benefit given the precautionary control measures to be implemented. Costs disproportionately higher than benefits.	Yes	No
Residual impact evaluation			
Residual Impact	Consequence	Likelihood	Risk Ranking
	Negligible	Unlikely	Low

6.2.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the potential impacts from underwater sound from vessel/helicopter operations are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 6.20 Acceptability criteria – vessel noise

Acceptability criteria	
Seismic vessel operations limited to within the Operational Area	• Seismic vessel only operates within the Operational Area (with exception of transit to/from Operational Area, and in the event of an emergency)
No direct effect on EBPC Act listed MNES that is not recoverable at a population level	• All control measures adopted for managing impacts from underwater sound from seismic operations to ALARP will add protection in reducing exposure of EPBC listed MNES to vessel noise (refer to Section 6.1.8)
No displacement of marine fauna from biologically important areas	• No disturbance to foraging, migration, aggregation/resting, breeding/nursery BIAs for marine fauna (including PBWs, SRWs and HBWs; great white sharks; seabirds). • the Gippsland MSS seismic data acquisition will take place from mid-January to July, i.e. outside of the SRW season for occupation of the coastal aggregation/resting BIA.
No population level or ecosystem level effects	• where may species are known to spawn reduces the effect to very limited with no lasting impacts on ecosystems, species or habitats
Vessel operations will be compliant with all maritime law relating to marine fauna, notably cetaceans	• Vessel operations will be compliant with the EPBC Regulations 2000. Predictions are therefore considered acceptable because these Regulations provide separation distances between vessels and cetaceans
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/ objections, where required. No outstanding merited concerns that have not been addressed.	• There have been no concerns/objections received from stakeholders regarding vessel noise (Table 9.1). Ongoing consultation will address any arising issues with stakeholders, including assessment of merits and development of control measures if required.

6.2.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for underwater sound from vessel operations are presented below in Table 6.17. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 6.2.4.1.

Table 6.21 Environmental performance outcomes, standards and measurement criteria for underwater sound from vessel operations

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No disturbance or displacement of marine fauna from biologically important areas. No population level or ecosystem level effects.	All internal combustion engines on board the vessel will be maintained in accordance with the manufacturer's specifications.	Records and training matrix demonstrate that a qualified marine engineer is on board throughout survey
	Interaction between survey vessel and cetaceans (whales and dolphins) within the operational area will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04) – Interacting with cetaceans: • vessels will not knowingly travel faster than 6 knots within 300 m of a whale or 150 m of a dolphin • vessels will not knowingly get closer than 100 m of a whale or 50 m of a dolphin • seismic survey vessels and support vessels will not intently approach within 150 m of a dolphin calf or within 300 m of a whale calf (Reg 8.06(2)). • If a cetacean approaches the vessel within the above zones, the vessel should avoid rapid changes in engine speed or direction. • helicopters will not fly lower than 1,650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off (Reg 8.07(2)(b)) and will not approach a marine mammal from head-on (Reg 8.07(2)(c)).	MFO report demonstrates no breaches of EPBC Regulations 2000 (Part 8). Compliance and cetacean sighting reports will be completed and provided to NOPSEMA / DoEE within 3 months of completion of the survey.
	All control measures adopted for managing impacts from underwater sound from seismic operations to ALARP will afford added protection in reducing potential effects from vessel noise to ALARP (refer to Section 6.1.8)	Refer to Section 6.2.6.1

6.3 Impact 3: Physical interaction with other marine users

6.3.1 Identification of hazard and extent

Hazard	The seismic survey vessels will operate 24 hours a day for the duration of the survey. During undershooting there will be two seismic vessels. There will also be at least one support vessel and at least one escort vessel to manage interactions with other vessels and hazard avoidance duties ahead of the seismic vessel (e.g. fishing gear), to assist with streamer deployment and recovery (if required), and other activities as required (e.g. supply and refuelling). Other marine users such as commercial and recreational fishing, charter and dive vessels, commercial shipping, and oil and gas titleholders may be temporarily displaced by the presence of the survey vessel and the streamers extending 7,050 m behind the vessel. These also present a navigational hazard to other users. Underwater noise from the seismic source (airgun array) may also affect the catchability of fish (this has been addressed in Section 6.1).
Extent	Operational Area
Duration	Continuous for the duration of survey – Commence mid January to end of July

6.3.2 Levels of acceptable impact

The impact on other marine users caused by the presence of the seismic and support vessels and their equipment will be acceptable when the levels of acceptability are met – as described below:

- Survey activity and equipment are limited to within the Operational Area and only during the survey period.
- Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. There are no outstanding merited concerns that are not being addressed.
- Vessel operations will be compliant with relevant CGG procedures and maritime law relating to navigation and safety at sea.
- Third parties are made aware of the presence and movements of the seismic and support/escort vessels at all times through the ongoing stakeholder consultation program.
- Fishers receive sufficient notification of survey operations in each zone through the ongoing stakeholder consultation program for planning of fishing trips.
- Disruption to fishing activities is limited to that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre.
- Gear does not snag/entangle with fishing equipment.

6.3.3 Impact analysis and evaluation

Sensitive receptors/ values	Review of the existing environment described in Section 4 indicates that presence of seismic survey vessels has the potential to affect adversely the following environmental receptors to varying degrees: • commercial fishers active in the Operational Area during the survey period • recreational fishers, divers and boaters active in the Operational Area during the survey period – noting that the area of impact will generally be limited to shallow near-shore areas • commercial shipping and other oil and gas activities – e.g. other seismic surveys, and vessels servicing platforms/structures.
	Potential impacts to these environmental receptors within the Operational Area include: • temporary and intermittent disruption to activities of other marine users such as transiting vessels (including other oil and gas operators), boaters, divers and commercial/recreational fishers • disruption of fishing activities due to entanglement of fishing gear (trawl nets, fish traps/pots, gillnets and long lines) with the seismic streamers.

6.3.3.1 Impacts to commercial and recreational fishing activities

Consultation with stakeholders identified concern over the loss of access to fishing grounds and interference with fishing gear (e.g. entanglement) (Appendix I and Section 9.3). Description of Commonwealth and Victorian state-managed fisheries with jurisdictional boundaries overlapping the Operational Area is provided in Appendix E, with those likely to be active within the Operational Area summarised in Section 4. An assessment of the amount of activity by each fishery is provided below in Table 6.22. This assessment is based on industry advice and current management arrangements.

Recreational fishers onboard charter and private vessels operating out of Gippsland area ports, in particular Lakes Entrance, target rocky reefs near Marlo, Cape Conran and Lakes Entrance. Fishing clubs are active in the region and host regular club competitions in marine waters (Section 4.11.6). Given the minimum distance from Lakes Entrance to the Operational Area (17 km), it is likely that some activity by fishers on larger vessels will occur within the Operational Area although this is expected to be short term and intermittent.

It will be necessary for areas in the immediate vicinity of the seismic vessel to be prohibited to recreational and commercial fishing vessels in accordance with maritime regulations. However, only minor disruption to fishing activities is expected for fishers who may set their fishing gear for several hours or less and/or who are mobile and can move away from the seismic vessel whilst still fishing (for example trawlers; Section 4.6.5.1). This is because the seismic vessel will be travelling at a slow speed and occupies a small space relative to the broader survey area which will remain open to fishing activity. Furthermore, the Acquisition

Area has been divided into smaller sections (zones) that will be progressively completed within set time frames, and this information will be communicated to other marine users so that it can be used to inform fishing activities. Pre-survey notifications will commence four weeks prior to the start of the survey for this purpose, with ongoing communication happening 7 to 10 days prior to the survey and daily during the survey period, as described in Section 9.5.

However, stakeholder consultation has identified that octopus fishers will be impacted to a greater extent than other fishers because they need to keep their pots set for three weeks at a time and they have limited fishing area that is found entirely within the Operational Area and overlaps several zones. It is also acknowledged that there is a relatively high likelihood that Danish seine fishers will experience disruption to their fishing activity due to the large overlap between their fishing and survey area (63%) compared to much lower overlap for other fishing sectors (Section 6.1.4). Catches by Danish seine fishers peak during the November to January period and are reasonably stable for the rest of the year (SETFIA 2018).

Table 6.22 Potential level of fishing effort by commercial fisheries likely to be active within the operational area

Fishery	Expected effort within the operational area
Commonwealth trawl sector	Fishing effort is widespread from SA to NSW (including Tasmania). Up to 16 Danish seiners and trawlers may work within the Operational Area throughout the year, targeting benthic species over flat seabed. This sector generally operates in water shallower than 200 m.
Commonwealth shark gillnet and shark hook sectors	Fishing effort by gillnetters is widespread from Victoria to SA (including Tasmania). It may be high in western parts of the Operational Area but is also highly seasonal, peaking in May and relatively low from September through to April. Low fishing effort by the shark hook sector is expected within the Operational Area. During consultation a shark fisher indicated he fished more than half the Operational Area, mostly in the shallower parts, and requested the Acquisition Area be split into smaller areas. This has informed impact treatment described below.
Commonwealth scalefish hook sector	Fishing effort is widespread, open throughout the year but it is at historically low levels. Combined with restrictive management arrangements, effort by this fishery is expected to be low within the Operational Area.
Commonwealth southern squid fishery	Fishing effort is widespread and at historically low levels with seven vessels active during 2015 and 2016. Most effort occurred in western Victoria and low levels are expected within the Operational Area. Although the fishery operates year-round, it is most active from January to June.
Victorian rock lobster fishery	Historic fishing effort within the Operational Area is low (< 5 vessels) and anecdotal evidence indicates that a low percentage of the Eastern Zone TACC is caught in this area. The fishery is closed between 15 September and 15 November while females are not permitted to be taken from 1 June.
Victorian scallop (ocean) fishery	This fishery is characterised by highly variable catches and since 2010/11 the TACC has been set at zero or low due to the poor status of stocks. The fishery is open throughout the year but most fishing happens from winter to early summer.
Victorian ocean (general) fishery	Most fishing effort by the fishery has historically occurred in western Victorian waters and only a small amount occurs off Lakes Entrance from April to July. Consultation with a fisher who targets octopus within the Operational Area identified concern about interactions with octopus pots left in the water.
Victorian purse seine fishery	There is one license issued in this fishery and the associated fisher is based in Lakes Entrance. Fishing activities are based close to shore and little overlap with the Operational Area is expected.
Victorian inshore trawl fishery	Historically this fishery has been based off eastern Victoria, particularly near Lakes Entrance. Although most of the licences for this fishery are currently inactive and effort is focussed on nearshore waters, no overlap within the Operational Area.

6.3.3.2 Impacts to recreational diving activities

Consultation with relevant stakeholders indicates that recreational diving operations (in particular by dive charters) focus on areas near Cape Conrad Coastal Park such as Beware Reef, located approximately 36 km outside of the Operational Area (Section 4.11.6), and are unlikely to enter the Operational Area or be affected by survey activities (noting that sound impacts to swimmers are discussed in Section 6.1).

Nevertheless, relevant dive charter operators will be kept informed of survey activities to ensure that they avoid the area in which the survey vessels are active, with ongoing communication happening 7 to 10 days prior to the survey and daily during the survey period, as described in Section 9.5.

6.3.3.3 Impacts to commercial shipping and oil and gas activities

Within the central and northern parts of the Operational Area, there is significant shipping activity, the majority of which is associated with the mining and oil and gas industry (Section 4.6.2) with some fishing (largely commercial and some recreational). The south central area of the Operational Area is a high density shipping area due to the passage of vessels from VIC, SA, Tasmania and WA through the Bass Strait to NSW, New Zealand and beyond. As described in Section 4.6.2, traffic separators require vessels to keep in lanes when travelling north east and when travelling south west. An 'Area To Be Avoided' (ATBA) intersects the Operational Area. This ATBA excludes, without permission from NOPSEMA, entry of all ships over 200 t (gross) and restricts commercial vessel traffic to shipping channels to the east and south of the area. The total area of the ATBA is 5,645 km^2.

Petroleum infrastructure present in the Operational Area includes Esso Australia Pty Ltd, Cooper Energy, Carnarvon Hibiscus Pty Ltd and SGH Energy. Supply vessels supporting these facilities may pass through the Operational Area; therefore interactions with these vessels are possible. The consultation process did not identify any seismic survey plans or major infrastructure work in any areas overlapping or in the vicinity of the Gippsland Operational Area.

CGG has consulted with Emperor Energy, Carnarvon Hibiscus Pty Ltd, Cooper Energy Limited, Llanberis Energy Pty Ltd and Esso Australia Pty Ltd and will continue to keep them informed of CGG's survey plans prior to and throughout the survey and implement appropriate controls to ensure the seismic survey will not affect activities at any operational facility/vessel, including development of a Simultaneous Operations (SIMOPS) Plan (or Concurrent Operations (CONOPs) Plan) where required.

A SIMOPS Plan will be required when the seismic vessel (or any part of its streamer), the support boat or escort vessel plans to enter the Cautionary Zone of a facility or another vessel. The Cautionary Zone is defined by a 2.5 NM (5 km) radius around a vessel, facility or major sub-sea installation. Further planning is required to ender the Petroleum Safety Zone (PSZ) around platforms which establish a 500 m exclusion buffer around petroleum facilities.

CGG will develop a SIMOPs Plan for the Gippsland MSS in agreement with the relevant operators in the Operational Area. As part of the SIMOPS Plan, CGG will establish a communications protocol outlining all key contacts, confirming schedules and identifying constraints and buffer distances that need to be observed for all known concurrent operations. In areas where diving operations are planned to take place, specific dive procedures will be defined in the SIMOPS Plan, including an extension of the Cautionary Zone to 10 km, and the requirement for a joint risk assessment in advance of any SIMOPS.

The presence of the survey vessels and towed array in the Operational Area has the potential to present a navigational hazard to other vessels; however, third parties will be made aware of the seismic and support vessels presence and movements at all times and ongoing consultation and notification of the survey timing/location, and survey vessel position during the survey will be implemented to manage any potential interactions (Section 9).

6.3.3.4 Inherent impact evaluation

Inherent impact	Consequence	Likelihood	Risk ranking
	Recreational fishers and boaters: Minor	Possible	Medium
	Recreational and charter diving: Minor	Unlikely	Low
	Commercial vessels: Medium	Unlikely	Medium
	Octopus and Danish seine fishers: Severe	Almost certain	High
	Other commercial fishers: Minor	Likely	Medium

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6.3.4 Impact treatment

6.3.4.1 Demonstration of ALARP

The potential impacts to other marine users during seismic surveys are well understood. Seismic exploration surveys have been conducted along the Australian coast and within Bass Strait for decades and there are established practices to manage the more common risks. The application of recognised good practice is considered appropriate to manage these risks. These are encapsulated in CGG Procedures specific to operation of vessels during seismic operations, including:

- Document_2018-8-4-Maritime (Marine Crew – Watch Instructions on Bridge Responsibilities)
- Document_2018-8-4_Seismic (Seismic Operations – Safe Navigation / Other Vessels).

However, this risk assessment recognises the survey-specific nature of risks associated with the Gippsland MSS and the challenges in predicting the use of the Operational Area by other marine users. To augment decision making, a precautionary approach is applied where uncertainty continues to exist. As the inherent impact to commercial fishers is assessed as High, CGG has adjusted the seismic survey period to avoid acquisition in November and December due to stakeholder concerns about impacts to seafood sales over the Christmas period and to catches by charter vessels over the holiday period. In addition, CGG has undertaken a comprehensive re-assessment of survey design in order to reduce the overall size of both the Operational and Acquisition Areas in order to avoid sensitive fishing areas (eg scallop beds) and reduce disruption to fishing activities whilst still maintaining survey objectives. This re-assessment has resulted in a reduction in Operational and Acquisition Areas of approximately twenty percent.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with interactions with other marine users to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of the potential risk reduction.

Table 6.23 Demonstration of ALARP – physical interaction with other marine users

Control measures	Cost benefit analysis	Impact reduction	Control adopted
ALARP assessment technique – good practice			
Seismic acquisition will only occur during daylight hours.	There are substantial additional costs in limiting acquisition to daylight hours. Interactions with fishing and shipping vessels would still potentially occur, therefore costs outweigh benefits.	Yes	No
The seismic vessels will adhere to specific SIMOPS procedures when operating within the Cautionary Zone around another facility/vessel. Note that the standard Cautionary Zone is 5 km.	Benefit of lower likelihood of interactions, greater preparedness, minimising operational interruptions outweighs cost.	Yes	Yes
During SIMOPS, communications will be maintained with other facilities/vessels.	Reduced risk of adverse interaction with other vessels outweighs cost.	Yes	Yes
The seismic vessels, whilst limited in their ability to manoeuvre (i.e. when streamers are deployed), will remain within the Operational Area	Reduced risk of adverse interaction with other vessels outweighs cost.	Yes	Yes
Refuelling and vessel-to-vessel transfers will occur away from shipping lanes or other high traffic areas	Reduced risk of adverse interaction with other vessels outweighs cost.	Yes	Yes

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
AIS broadcast of the vessel type, location, virtual outer tail buoy locations, azimuth, and speed.	Reduced risk of adverse interaction with other vessels outweighs cost.	Yes	Yes
ALARP assessment technique – EIA			
Payment of compensation to the rightful owner for any fishing equipment that has been damaged or lost by the survey.	Benefit to fishers' livelihoods and industry reputation outweighs the cost of compensation.	Yes	Yes
Implementation of a Fisheries Displacement Mitigation Plan (Plan) to formally manage claims by commercial fishing stakeholders for costs due to relocation and loss of catch as a consequence of survey activities.	Compensation for short term loss of catch has been identified as a key issue during stakeholder consultation. The Plan will be reviewed by the Committee and implemented prior to commencement of survey activities.	Yes	Yes
As part of the ongoing consultation process, CGG will notify all relevant persons four weeks prior to the start (or re-start) of the survey to provide details about the order in which survey zones will be completed and the anticipated date and duration for their completion.	Early notification of activities will allow stakeholders, in particular fishers, to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Commercial fishers actively operating in the Operational Area and will be issued a 7 to 10-day forecast prior to activities commencing in the Operational Area. This will include detailed maps showing the planned area of activity during the forecast period.	Ongoing consultation will allow stakeholders to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Commercial fishers actively operating in the Operational Area are kept informed of daily survey activities through CGG's 24-hour look-ahead communication.	Short-term notification of activities during the survey will allow stakeholders to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
CGG will undertake a stakeholder review four months following approval of the EP to ensure that any new stakeholders are identified and consulted.	Ensuring all relevant fishers have been consulted will allow them to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Provision of bathymetric survey data to commercial fishers who have requested the data.	CGG will consult with fishers requesting data to determine the format required for supply of data.	Yes	Yes
CGG will continue to advise relevant fishers of planned sail-lines and dates and if any issues are raised by fishing stakeholders, CGG will make reasonable effort to avoid or minimise conflicts. Controls to be considered will include: • moving to another sail-line • allowing fishers to fish area prior to seismic acquisition • minimise survey activity in areas where there is known fishing activity.	Early notification of activities will allow fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Inform the Australian Hydrographic Office of relevant survey details prior to, during (if alterations occur) and on completion of the survey to ensure a Notice to Mariners informs all third parties of survey details and are updated as required.	Notices to Mariners are issued to correct and maintain navigational charts and hence inform other vessels of navigation issues related to the MSS. Benefit outweighs cost.	Yes	Yes

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
CGG will take reasonable steps to avoid or minimise conflict with other marine users, should such a conflict be identified during ongoing consultation with stakeholders.	Design of the survey to minimise interactions, avoid certain areas and allow early notification of activities to enable third parties including fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Survey activity within the Acquisition Area is separated into five spatially distinct zones that will be completed in an order that minimises impact to fisheries and which is communicated to fishers minimum four weeks ahead of survey start.	Enables fishers to plan activities around the survey and avoid negative interactions. Benefit outweighs cost.	Yes	Yes
Seismic acquisition will only occur outside key fishing seasons.	Fishing occurs all year round in some region of the Operational Area. Costs outweigh benefits	Yes	No
ALARP assessment technique – precautionary approach			
Do nothing – no MSS	Titleholders are required by NOPTA to acquire seismic data within specified time frames. Minimal benefit given the predicted low impact on other users. Costs disproportionately higher than benefits.	Yes	No
Avoid shipping routes	Shipping occurs throughout the region and the Operational Area. Avoiding the eastern and southern sections would seriously compromise the survey objectives. Vessel interactions are manageable through the support vessel /escort vessels and the cost (loss of survey data) outweighs the benefits.	Yes	No

Residual impact evaluation			
Residual impact	Consequence	Likelihood	Risk ranking
	Commercial vessels: Minor	Unlikely	Medium
	Recreational fishers and boaters: Negligible	Possible	Low
	Octopus and Danish seine fishers: Moderate	Almost certain	High
	Other commercial fishers: Minor	Possible	Medium

6.3.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the potential impacts from physical interactions with other marine users are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 6.24 Acceptability criteria – physical interaction with other users

Acceptability criteria	
Seismic vessels remain within the Operational Area during acquisition of seismic data	• Seismic vessels will be limited to the extent of the Operational Area when acquiring seismic data.
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/ objections, where required. No outstanding merited concerns that are not being addressed.	• Claims that seismic surveys pose a risk of interference with fishing activities, or may affect fish stocks or catchability, have some merit. The merit in this specific case depends on amount of overlap of seismic activity with key fishery areas and has been addressed appropriately. • Stakeholder concerns/objections received have been merit assessed and control measures developed where required (Table 9.1) and communicated back to stakeholders. • Ongoing consultation will address any outstanding or arising issues with fishers in accordance with expectations under the OPGGS(E) Regulations. • Design changes to address concerns have been incorporated where possible (e.g. avoiding SE Reef, zonation of the area and communicating the schedule allow for pre-planning.)
Any related avoiding action by commercial shipping, should it be necessary, should not increase and/or compound the navigational risk to other shipping in the vicinity	• Refuelling and resupplying will occur outside shipping lanes and areas of high traffic in accordance with CGG's Safe Navigation Area Standard Operating Procedure (MAR_SEO_PRC_004E) • Safe recovery of a drifting streamer is undertaken using CGG procedure: MAR INS TEN 027E Drifting Streamer recovery to Escort boat • CGG Emergency Streamer Handling Standard Operating Procedure MAR_SEO_PRC_017E • Only slight deviations or change of speed is required of a ship to avoid a seismic operation due to the slow speed of acquisition (less than five knots)
Disruption to fishing activities is limited to that required for safe passage of the seismic vessel whilst it is restricted in its ability to manoeuvre (with the exception of octopus fishers).	• Fishing activities will be possible whilst the seismic vessel is located in other areas of the zone in which survey data is being acquired. Because octopus fishers leave their fishing gear deployed for three weeks at a time and their limited fishing ground is within the Operational Area it is acceptable to disrupt their fishing activities because they are being compensated and a specific research study into the impacts on octopus and their fishery is being undertaken.
Fishers receive sufficient notification of survey operations in each zone through the ongoing stakeholder consultation program.	• Completion of spatially distinct zones in an order that is communicated well in advance enables more informed decision making by fishers.
Vessel operations will be compliant with all maritime law relating to navigation and safety at sea	• The seismic vessel will maintain appropriate lighting, navigation and communication at all times to inform other users of the position and intentions of the survey vessel, in compliance with the *Navigation Act 2012* and Chapter 5 of the International Convention on the Safety of Life at Sea (SOLAS Convention).
Third parties are made aware of the presence and movements of the survey vessels and associated vessels at all times	Standard navigation practices include: • CGG crew have procedures to follow for navigation with or without gear deployed (see section 8.3) • CGG's survey vessels will work extensively within the ATBA and will obtain permission from NOPSEMA for entry of survey vessels prior to entry. CGG is also in the process of negotiating a SIMOPS plan with petroleum facility operators in the area to ensure safe operations • The Australian Maritime Union (MUA) crew provide local knowledge of the area/shipping activities • The bridge is manned by Maritime Crew at all times and supported by the CGG Seismic Navigation crew • When the operation is within four hours of crossing the shipping lane, the broadcasts will be increased to an appropriate interval and broadcasting made to all shipping within radio contact. Direct two-way communication will be made

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Acceptability criteria	
	to ships that are calculated to be within the vicinity of the crossing at the same time or within an appropriate period as the survey vessel is crossing the lane. • Multiple mapping/navigation/spatial awareness systems and high precision positional data are available to both maritime and seismic crew at all times • Monitoring and communication of all shipping is available via radar, AIS, radio, satellite phone, email for 24 hours a day • Broadcasting of seismic vessel, then shortlisting the potential hazards, and communicating directly with those ships to plan for relative movements of the vessels • The seismic vessel and supply/escort vessels will maintain communications with nearby commercial ships by broadcasting twice daily bulletins outlining the survey vessels location and planned movements over the next 24 hours (by radio, AIS, and email to all known stakeholders in the area of operation). • Regularly updated Notices to Mariners are important for warning shipping about the seismic operation • Notify AMSA's Joint Rescue Coordination Centre (JRCC) for promulgation of radio-navigation warnings 24-48 hrs before operations commence. • The use of zones to clearly identify when the seismic operation will be where is given in the Notice to Mariners, and time spent in each zone is a maximum of month to make schedules more definitive. • AIS broadcast of the operation, the vessel type, streamers, in water gear, azimuth, speed, intended turning will be received by all vessels in the locality. • Regular updated flyers of the same will be communicated to the Fishing community.

6.3.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for physical interactions with other marine users are presented below in Table 6.25. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted above.

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Table 6.25 Environmental performance outcomes, standards and measurement criteria for physical interactions with other marine users

Environmental performance outcome	Environmental performance standard	Measurement criteria
Activities are carried out in a manner that does not interfere with navigation or fishing or other Petroleum Operators to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties	The seismic vessels, whilst limited in their ability to manoeuvre (i.e. when streamers are deployed), will remain within the Operational Area (excluding transits and emergencies).	Ships logs confirm seismic vessels remained within the Operational Area when streamers are deployed (excluding transits and emergencies)
	Vessel to maintain appropriate lighting, navigation and communication at all times to inform other users of the position and intentions of the survey vessel, in compliance with the *Navigation Act 2012*, COLREGS (International Regulations for Preventing Collisions at Sea 1972), Chapter IV (Radio communications) and Chapter V (Safety of Navigation) of SOLAS (International Convention on the Safety of Life at Sea 1974).	Evidence that vessels comply with COLREGS and relevant chapters of SOLAS. Any records of failure to comply are documented.
	Vessel navigational lighting and communication system managed in accordance with AMSA Marine Orders Part 30: Prevention of collisions, Part 21: Safety and emergency arrangements, Part 27 (Safety of navigation and radio equipment.	Evidence that vessels have navigational lights and communication system that comply with relevant marine orders, including appropriate day shapes, lights and streamers, to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre.
	Continuous (24 hour) survey operations with multiple trained crew (STCW95/Elements of Shipboard Safety), and monitoring of vessel position (radar) and depth at all times during seismic acquisition.	Records confirm bridge was manned continuously during survey operations, visual and radar watches maintained at all times and that vessel crew have appropriate qualifications.
	The Australian Hydrographic Office (AHO) advised of survey details (survey location, timing) four weeks prior to mobilisation and following demobilisation on completion or suspension of activities for issue of Notice to Mariners.	Records of notification of survey details sent to the AHO four weeks prior to survey mobilisation and within two weeks of survey demobilisation (following completion or suspension).
	The AHO advised of relevant alterations to survey details as required during the survey for issue of updated Notice to Mariners.	Records of notification of survey details sent to the AHO during the survey in response to altered information
	AMSA's JRCC will be advised at the start and/or re-start (after suspension for the season) of the survey vessel's details (including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation and requested clearance from other vessels. This information will be notified to AMSA JRCC 24 to 48 hours before operations commence via email address (rccaus@amsa.gov.au) or phone (1800 641 792 or +61 2 6230 6811)	Records demonstrate that AMSA JRCC have been notified of the survey vessel details and movements 24 to 48 hours prior to the start of the survey
	AMSA JRCC will be notified at the end of the survey when operations have been completed and/or suspended (via email address (rccaus@amsa.gov.au) or phone: 1800 641 792 or +61 2 6230 6811).	Records demonstrate that AMSA JRCC have been notified of the end (completion and /or suspension) of survey operations.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	Survey vessels will be equipped with Automatic Radar Plotting Aid (ARPA) and active AIS for detection of vessels, speed and heading.	Records confirm ARPA and AIS active on survey vessels.
	AIS broadcast of the vessel type, location, virtual outer tail buoy locations, azimuth, and speed.	Records confirm AIS broadcast of the vessel type, location, virtual outer tail buoy locations, azimuth, and speed.
	When the seismic vessel is within four hours of crossing the shipping lane, broadcasts are increased to an appropriate interval and direct two-way communication will be made to ships within the vicinity of the crossing at the same time or within the period as the survey vessel is crossing the lane.	Seismic vessel communication logs confirm the timing, frequency of broadcasts and two-way communications with third party vessels in the vicinity of the crossing.
	The seismic vessel will broadcast twice daily bulletins outlining the seismic vessel location and planned movements over the next 24 hours to all known stakeholders in the Operational Area (via radio, AIS, and email).	Seismic vessel communication logs confirm the broadcast of twice daily bulletins during survey operations.
	Support and escort vessels will assist in managing interactions with other vessels and maintain communications with other vessels in the Operational Area.	Records demonstrate that dedicated support and escort vessel are employed for the duration of the activity.
	Tail buoys clearly marked to identify streamer ends to other users.	Records confirm all tail buoys marked to identify streamer ends.
	In-water equipment lost will be recovered, if retrievable where safe and practicable to do so.	Incident reports made for lost equipment show that recovery where possible.
		Detailed records of equipment lost overboard will be maintained and reported to NOPSEMA as recordable environmental incidents (Section 8.8.2), and also reported via the Post-survey Environmental Review Report (PERR) (Section 8.8.1).
	AMSA and AHO to be advised of the loss of large items of buoyant waste and lost equipment (potential navigational hazards).	Response from AMSA and AHO confirms receipt of notification in event of lost object incident.
	Access agreements will be agreed with oil and gas titleholders.	Records of access agreements for data acquisition in permit areas within the Operational Area.
	Pre-planning search of NOPSEMA approvals data to identify potential for overlap with other seismic surveys and other Petroleum Operator activities	All other submitted EPs for seismic surveys in the region will be reviewed at least one the month prior to the survey to ascertain potential overlap.
	As part of the ongoing consultation process, CGG will notify all relevant persons including fishers and Petroleum Operators four weeks prior to the start (or re-start	Stakeholder consultation records show notification of survey details to all relevant persons four weeks prior to the start of the survey.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	following suspension for the season) of the survey with survey details including, timing, location and duration.	
	Commercial fishers actively operating in the Operational Area and will be issued a 7 to 10 day forecast prior to activities commencing in the Operational Area.	Copies of forecast notifications to relevant fishers 7 to 10 days prior to activities commencing in the Acquisition Area.
	Commercial fishers actively operating in the Operational Area are kept informed of daily survey activities through CGG's 24-hour look-ahead communication.	Sighting records of 24-hour look-ahead communications with commercial fishers who have requested the data
	The seismic vessel shall notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence and on completion.	AMSA's JRCC will require the vessel details (including name, call sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.
	Provision of bathymetric survey data to commercial fishers who have requested the data.	Consultation records confirm format and supply of Acquisition Area bathymetric data to commercial fishers who have requested the data.
	CGG will undertake a stakeholder review if the survey commences more than four months after EP approval. If the survey program is re-started in the following season (January 2020), CGG will undertake a review four months prior to re-start.	Records demonstrate CGG has undertaken a review of new stakeholders if the survey commences more than four months after the approval of this EP, and four months prior to any re-start in the following season (January 2020)
	Payment of compensation to the rightful owner of any fishing equipment that has been damaged or lost by the survey.	Incident close-out report demonstrates that the rightful owner of fishing equipment shown to be damaged or lost by MSS activities was appropriately compensated.
	Implementation of a Fisheries Displacement Mitigation Plan (Plan) to formally manage claims by commercial fishing stakeholders for costs due to relocation and loss of catch as a consequence of survey activities.	Plan has been reviewed by the Scientific Advisory Committee and implemented prior to commencement of survey activities.
	The seismic vessel will adhere to specific SIMOPS procedures when operating within the Cautionary Zone around another facility/vessel. Note that the standard Cautionary Zone is 5 km.	Records demonstrate implementation of CGG SIMOPS Plan in the event of SIMOPS within another facility/vessel's Cautionary Zone.
	During SIMOPS, communications will be maintained with other facilities/vessels.	Records demonstrate communications during SIMOPS are undertaken in accordance with the communications guidelines with the SIMOPS Plan.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	In the event that another vessel is acquiring seismic data in the region, the seismic vessel shall not acquire data simultaneously within 40 km of the other seismic vessel in order to avoid cumulative impacts to marine fauna.	Communication records show that any geophysical contractors operating other seismic survey vessels have been consulted two weeks prior to the survey start and agreed to 40 km separation distance. Records confirm no incidents when vessels less than 40 km apart and actively acquiring data.
	CGG will continue to advise relevant stakeholders (such as Petroleum Operators and fishers) of planned sail-lines and dates and if any issues are raised by stakeholders, CGG will make reasonable effort to avoid or minimise conflicts. Controls to be considered will include: • Moving to another sail-line • Allowing fishers to fish area prior to seismic acquisition • Minimise survey activity in areas where there is known fishing activity.	Survey consultation records show merit assessment and consideration of controls in response to stakeholder feedback prior to and during survey.
	Refuelling and resupplying sites will not be located in shipping channels or high traffic areas	Logs show all refuelling and resupplying occur away from shipping lanes and high traffic areas
	Safe recovery of a drifting streamer is undertaken CGG procedure: MAR INS TEN 027E Drifting Streamer using recovery to Escort boat CGG Emergency Streamer Handling Standard Operating Procedure MAR_SEO_PRC_017E as required	Ships logs and incident reports confirm safe recovery of drifting streamers is undertaken in a manner compliant with CGG procedures including emergency handling procedures
	CGG will take reasonable steps to avoid or minimise conflict with other marine users, should such a conflict be identified during ongoing consultation with stakeholders.	Survey consultation records show merit assessment and consideration of controls in response to stakeholder feedback prior to and during survey.
	Survey will not start in Nov or Dec to avoid disrupting fishing activities prior to Christmas	Logs show no activity in November or December

6.4 Impact 4: Light emissions – vessels

6.4.1 Identification of hazard and extent

Hazard	Lighting is required for safe navigation (under the *Navigation Act 2012*) and for safe work practices at night; however, these light emissions may have adverse impacts on photo-sensitive fauna. Lighting typically consists of bright white (metal halide, halogen, fluorescent) lights used for internal lighting, deck lighting and for navigational purposes. Lighting from the seismic survey vessels will be the largest source of artificial light emissions during the survey, which will be restricted to the Operational Area (except for transiting to/from mainland and in the event of an emergency). There will be smaller and insignificant light emissions from the support/escort vessels. Light can typically be seen from a horizontal distance = 3.57 x √height above sea level. The vessel operational deck height may be as high as 16m, thus visible at sea level from approximately 14.3km (i.e. just visible from the coast when at the most northern section of the Acquisition Area) with deceasing intensity. The commercial fishing, other oil and gas operators and shipping vessel traffic in the area are discussed in Section 4.11.
Extent	Operational Area
Duration	Continuous within the Operational Area during the survey. Commence mid – January to end July

6.4.2 Levels of acceptable impact

The impact on light sensitive marine fauna caused by light emissions from the Gippsland MSS seismic and support/escort vessels will be acceptable when:

- The seismic survey is of short duration and vessels do not operate outside of Operational Area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill).
- No predicted direct effect on EBPC Act listed MNES at a population level, TECS or protected marine areas or visual amenity
- Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.

6.4.3 Impact analysis and evaluation

Potential impacts	Disorientation, attraction or repulsion of sensitive marine fauna (e.g. juvenile seabirds) Disruption to natural behavioural patterns and cycles, e.g. enabling nocturnal foraging and increased predation compared to unlit areas
Predicted effect	**Seabirds** Seabirds may forage or transit through the Gippsland MSS Operational Area and foraging BIAs are described in Section 4.7. Foraging seabirds with BIAs include shearwater, albatross and petrel, that may be temporarily affected through an attraction to light sources. Light emissions to sea could cause minor disruption and temporary effect (days) on seabirds migrating/foraging in the vicinity of the Operational Area. The impact to birds is related primarily to potential collision with lit infrastructure. Bright lighting can disorient birds, thereby increasing the likelihood of seabird injury or mortality through collision with infrastructure, or from starvation due to disrupted foraging at sea (Wiese et al. 2001). Nesting birds may be disorientated where lighting is adjacent to rookeries. Habitats for foraging seabirds and shorebirds is well represented throughout the region; however, no BIA nesting or resting areas for birds occur within the Operational Area. The nearest aggregation areas are wetlands near Lakes Entrance, Cape Conran and Corner Inlet – all more than 13 km from the Operational Area when the light source has diminished for receptors at sea level. Nearest roosting spots for the little penguin are >50 km away in the Beagle Islands, Island, Gabo Island and Tullaberga Island. Given the short duration of the activity and distance offshore from breeding and resting sites, light disturbance to birds is likely to be restricted to behavioural changes by a small number of birds in the immediate vicinity of the vessels. Any effect of exposure is not expected to impact on migration or other behaviours (nesting/foraging), with no detectable effects at a population level.

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	Marine turtles Artificial light on, or near, nesting beaches poses a threat to marine turtles because it can disrupt critical behaviours such as adult emergence and nesting, hatchling orientation, sea-finding and dispersal behaviour, which may reduce the overall reproductive output of a stock (Commonwealth of Australia 2017). There are no nesting sites or BIAs for turtles in the region of the Operational Area, and vessel lights from shore are reduced to pinpricks, therefore the potential impact to marine turtles is negligible, with no detectable effects at a population level.
	Other marine fauna Fish and plankton are described in Section 4.5. Other marine life may also be attracted to the light spill from the vessel. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al., 2001), with traps drawing catches from up to 90 m (Milicich et al., 1992). The concentration of organisms attracted to light results in an increase in food source for predatory species, and marine predators are known to aggregate at the edges of artificial light halos. This could potentially lead to increased predation rates compared to unlit areas but population recovery is predicted to be rapid through reproduction and migrations with the tide. Although this effect is expected to be greater in a stationary vessel, worms, squid, plankton and fish can aggregate directly under downward facing lights on the water. This in turn can attract predatory fauna such as seabirds, cetaceans, fish and squid. There is minor potential for changes in inter-specific dynamics as some species are more able to exploit the longer foraging periods and to prey on phototropic prey species. The constant movement of the vessels will reduce this potential significantly. It is expected that any potential impact of increased predation would be undetectable at a population level, especially for plankton where recruitment is rapid. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds et al., 2004), so light is not considered to be a significant factor in cetacean behaviour or survival.

Inherent impact	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

6.4.4 Impact treatment

6.4.4.1 Demonstration of ALARP

There is no safe or practical alternative to the use of artificial lighting during the activity; therefore the associated impacts cannot be totally eliminated. The use of lights for navigational purposes is a legislated requirement, and subsequently a well-practiced and understood activity. The performance standards outlined in this EP align with the requirements of *Navigation Act 2012* (Cth) Part 3 (Prevention of Collisions) and AMSA Marine Order 30 (Prevention of Collisions).

Additional controls have been considered and adopted where they can further reduce risks to ALARP. Where the cost of implementing the additional control measures is disproportionate to the benefit gained, they have not been adopted.

Control measures	Cost benefit analysis	Impact reduction	Control adopted
ALARP assessment technique – good practice			
Non-essential lighting will be switched off when not in use.	Benefit outweighs cost	Yes	Yes
Use only long wavelength yellow and red light and extensive shrouding	Typically used more for light intensive activities in the vicinity of turtle nesting. Given no BIA sites for light sensitive receptors in close proximity or in the Operational Area, the cost of re-fit outweighs benefit	Limited benefit due to low likelihood of night-time encounters with sensitive receptors in Operational Area	No

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Control measures	Cost benefit analysis	Impact reduction	Control adopted
External lighting will be directed onto the deck, reducing light spill to the environment where practicable for safe operations.	Benefit outweighs cost	Yes	Yes
ALARP assessment technique – EIA			
No night-time operations.	Limiting seismic activities to daylight hours would significantly extend the time required to acquire data for individual activities. The majority of activities will take place more than 14 km from land which will reduce likelihood of attraction of shorebirds/seabirds/light sensitive fauna. No turtle BIA in region or shorebird BIA nesting near the Operational Area. Negligible environmental benefit in 12-hour operations, but significant increase in vessel charter costs and length of survey. Sacrifice (additional vessel costs) disproportionately higher than benefit.	Limited benefit due to low likelihood of night-time encounters with sensitive receptors in Operational Area	No
Residual impact evaluation			
Residual impact	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

6.4.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the potential impacts from light emissions are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 6.26 Acceptability criteria – light emissions

Acceptability Criteria	
The seismic survey is short duration and vessels do not operate outside of Operational Area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill)	• The Acquisition is planned to take place between mid January and end July with vessels constantly on the move. • Impacts are temporary. The seismic vessels will be limited to the extent of the Operational Area (except during transit between operational area and mainland and in the event of an emergency e.g. oil spill)
No predicted direct effect on EBPC Act listed MNES at a population level, TECS or protected marine areas or visual amenity	• Restricted to behavioural changes by a small number of birds in the immediate vicinity of the vessels. Any effect of exposure is not expected to impact on migration or other behaviours (nesting/foraging), with no detectable effects at a population level. • There are no other EPBC Act listed MNES, TECs or marine protected areas in or near the Operational Area predicted to be negatively affected by light emissions from the seismic or support/escort vessels • No more than possible localised effects to fish, plankton or other marine life with no population or ecosystem level effects • No cumulative impacts predicted as vessels are generally apart unless refuelling/resupplying for short periods (hours) • Seismic vessels will be in constant motion and will remain within Operational area which is for the most part of the survey >14 km from closest shoreline and mainland campsites/communities and will therefore not impact visual amenity.
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns	• No specific stakeholder concerns have been raised concerning impacts of light emissions from vessels. • Operational Area is well used in terms of existing commercial shipping, fishing and oil and gas operators and any additional lighting burden is temporary.

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6.4.4.2.1 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for light emissions are presented below in Table 6.27. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 6.6.4.2.

Table 6.27 Environmental performance outcomes, standards and measurement criteria for light emissions

Environmental performance outcome	Environmental performance standard	Measurement criteria
External vessel lighting conforms to that required by maritime safety standards	Light glow is minimised by managing external vessel lighting in accordance with: • AMSA Marine Orders Part 30 (Prevention of Collisions). • AMSA Marine Orders Part 59 (Offshore Support Vessel Operations).	Vessel class certifications are current.
Minimise potential for adverse impacts on light sensitive marine fauna	Non-essential lighting will be switched off when not in use.	Inspection during survey confirms non-essential lighting is switched off at night. Induction material demonstrates that vessel crew has been inducted in light spill reduction protocols, especially switching off non-essential lights.
	External lighting will be directed onto the deck, reducing light spill to the environment where practicable for safe operations.	Record of inspection during the activity to confirm orientation of all external work lights in use has been checked and adjusted where practicable.

6.5 Impact 5: Routine discharges – vessels

6.5.1 Identification of hazard and extent

Hazard	Seismic survey and escort/support vessels routinely discharge small volumes of liquid and solid waste into the marine environment, such as putrescible wastes (food scraps), deck drainage), bilge water, sewage and grey water (such as water from showers, laundries and dishwashing), cooling water and brine. The discharge source in the case of the seismic and support escort vessels are constantly moving with the vessels only alongside (hours) during resupplying or refuelling. Approximately 95% of the Acquisition Area is deeper than 50 m and in open ocean. **Food waste:** food waste from the vessel galleys will be macerated and discharged. The average volume of putrescible waste from each vessel depends largely on the number of Persons on Board (POB) and is anecdotally around 1-2 kg/person/day (NERA, 2018), totalling 70-140 kg for the larger vessels spread over the day. **Deck drainage** comprising seawater from waves/spray, rainwater and deck wash-down water, may contain minor quantities of oil, grease and detergents that have been spilled on the decks. B**ilge waters** includes deck drainage captured in a closed-loop system (e.g. bunded areas) and machinery/engine space oily water that has been directed to the oil water separator (OWS) for removal of the oil prior to discharge of the treated water once the discharge is ≤15 ppm oil-in-water (OIW) as required by MARPOL. The oil is returned to shore for reuse/disposal). **Sewage and grey water:** The vessels are yet to be determined; however, a typical seismic vessel of the size required carries approximately 70 POB. Escort/support vessels will carry approximately 15 POB. The volume of discharges during the survey are expected to be approximately 170 L/day/person (United States Environmental Protection Agency 2011), yielding a total daily grey water volume of approximately 12,000 L for the seismic vessel. **Cooling water:** Seawater is used as a heat exchange medium for cooling machinery engines and other equipment. Seawater is drawn up from the ocean, where it is de-oxygenated and sterilised by electrolysis (release of chlorine from the salt solution) and then circulated as coolant for various equipment through the heat exchangers (in the process absorbing heat from the machinery) and is then discharged to the ocean

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	and may contain low concentrations of residual biocide and scale inhibitors if used to control biofouling and scale formation. **Brine** (hyper-saline water) is created through the vessel's desalination process that creates freshwater for drinking, showers, cooking etc. This is achieved through reverse osmosis (RO) or distillation; both processes resulting in the discharge of seawater with elevated salinity. The freshwater produced is then stored in tanks on board. The potential impacts of routine discharges to marine waters during seismic surveys are well understood with legislative requirements and standard marine industry agreed practices to manage risks. The application of recognised good practice is considered appropriate to manage the impact; particularly due to the distance of the Acquisition Area from any sensitive receptors (such as wetlands of importance or World/National heritage places) and the well-mixed offshore marine waters of the Acquisition Area.
Extent	Operational Area
Duration	Intermittent during survey. Commence mid – January to end July

6.5.2 Levels of acceptable impact

The impact on marine receptors caused by routine vessel discharges will be acceptable when the levels of acceptability are met as described below:

- potential impacts to marine fauna (seabirds, pelagic fish and plankton) in the water column are minor, localised and temporary
- the seismic survey is short duration and seismic vessels do not operate outside of operational area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill)
- all vessel operations are compliant with all maritime law relating to routine discharges and industry good practice
- no predicted direct effect on EBPC Act listed MNES at a population level, KEF, TEC or marine protected areas
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. There are no outstanding merited concerns.

6.5.3 Impact analysis and evaluation

Potential impacts	Temporary localised decline in water quality in the immediate vicinity of the discharge Localised increase in biological oxygen demand (bod) Localised increase in turbidity of surrounding waters Temporary toxicity to marine flora and fauna (bilge water discharges) Temporary and localised increase in sea surface water temperature Temporary and localised increase in sea surface salinity
Predicted effect	**Water quality** **Food waste**: Food waste can cause temporary localised increases in the nutrient content of surface waters close to the discharge potentially affecting plankton, seals and pelagic fish and attracting scavenger seabirds. Rapid dispersion and biodegradation ensure potential impacts are negligible **Sewage and grey water:** Discharges of treated sewage and grey water will be rapidly diluted in the surface layers of the water column and dispersed by currents. There is potential for phytoplankton uptake of the extra nutrients from sewage and localised, temporary increases in primary productivity. The biological oxygen demand of the treated effluent is unlikely to lead to oxygen depletion of the receiving waters (Black et al., 1994), as it will be treated prior to release. On release, surface water currents will assist with oxygenation of the discharge. Woodside (2011) conducted monitoring of sewage discharges at their Torosa-4 Appraisal Drilling campaign which demonstrated that a 10 m^3 sewage discharge reduced to approximately 1% of its original concentration within 50 m of the discharge location. In addition to this, monitoring at distances 50, 100 and 200 m downstream of the platform and at five different water depths confirmed that discharges were

rapidly diluted and no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station.

Grey water from galleys, showers/basins and laundries may include a range of pollutants of varying toxicities such as hydrocarbons, detergents, grease, particulates, chemicals, food waste and coliform bacteria. Grey water is also treated through the sewage treatment plant, so pollutants are largely removed from the discharge.

Given the temporary intermittent nature of the discharges in any one location, the small volumes, treatment before discharge, the rapid dilution and dispersion in the open ocean, high biodegradability and low persistence of sewage and grey water no measurable increases in nutrient concentrations, oxygen demand, turbidity or effects to plankton are expected.

Bilge tanks potentially containing small volumes of hydrocarbons, detergents, solvents and chemicals. The OWS then treats this water to MARPOL requirements before discharging overboard. The volume of treated water discharges is typically small and intermittent

The greatest risk is to plankton and pelagic fish. These discharges will be rapidly diluted, dispersed and biodegraded to undetectable levels local to the discharge. The small volumes and low concentrations of oily water from bilge discharges may temporarily reduce water quality but are not expected to induce acute or chronic toxicity impacts to marine fauna or plankton through ingestion or absorption through the skin. In the event the OWS malfunctions and discharges of off-specification water, these impacts may occur, though this is only likely in a highly localised area and temporary (meaning that few individuals would be exposed).

Decks that are not bunded and drain directly to the sea may result in the discharge of contaminated water which may cause temporary and localised reduction in surface water quality.

Cooling water: The maximum cooling water discharge rate and temperatures for the vessels that may be used, are unknown but typically are several degrees above ambient, depending on design, efficiency and throughput.

Once in the water column, cooling water will remain in the surface layer, where turbulent mixing and heat transfer with surrounding waters will occur rapidly. This will cause very localised and temporary increases in water temperature, potentially resulting in thermal stress to sensitive biota. Impacts on most marine organisms will be negligible given the buffering and dispersive capacities of the receiving seawater and as the vessels are constantly in motion, the impacts are considered negligible with full recovery in the short term.

Brine: Brine discharge salinity typically ranges from 40 – 60 ppt (parts per thousand). It is denser than seawater (approximately 35 ppt). As such, discharged brine water will sink through the water column potentially exposing receptors that are sensitive to salinity to levels approximately 14-70% above ambient and to potential toxicity impacts from residual biocide and scale inhibitors used to prevent marine growth and corrosion.

However, sinking through the water column will aid rapid mixing with receiving waters and dispersion by ocean surface currents. Modelling of continuous waste water discharges by Woodside (2008, Torosa South -1) found discharge water temperature decreased rapidly to less than 1°C above background levels within 100 m (horizontally) of the discharge point, and within background levels within 10 m vertically.

Birds, pinnipeds, cetaceans, plankton and pelagic fish may be in the immediate vicinity of the discharge. Increased temperatures may result in physiological changes such as avoidance (or attraction), stress or mortality depending in part on mobility and sensitivity.

Walker and MacComb (1990) found that most marine species can tolerate short-term fluctuations of 20-30% in water salinity, so most pelagic species (other than plankton) passing through a denser saline plume would not suffer adverse impacts. Given the rapid, localised dispersion predicted by the modelling, such impacts are considered negligible.

The biocides used in de-salinators are typically low concentrations when added, highly reactive, rapidly biodegradable and deactivate during the inhibition process, resulting in little or no residual toxicity on discharge (Black et al., 1994). Given the localised rapid dispersion, the small volumes and the constant movement of the vessels, there is low potential for adverse effects.

Protected areas and other marine habitats and communities

Grey water, sewage, bilge water and putrescible waste discharges will be rapidly diluted and dispersed and the concentrations of any potential contaminant or nutrient will reach background levels quickly within the Operational Area. No effects on communities are expected for pelagic or benthic receptors. Any reduction in water quality would be localised and temporary (short term) and unlikely to have any measurable impact on species diversity or abundance. Fisheries and fish resources will not be affected as impacts are localised and temporary. There are therefore no predicted effects beyond the Operational

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	Area to the East Gippsland, Flinders or Beagle Marine Parks, coastal parks or TECs lying close to the Operational Area. The Eden Upwelling KEF lying in the north-east of the Operational Area and Big Horseshoe Canyon on the east of the Operational Area may be crossed by the survey vessels intermittently as well as by fishing vessels and commercial ships using the shipping lanes through the Operational area (Section **4.6.7**). Given the water depths of Big Horseshoe Canyon at 1500m, the intermittent nature of the discharges, vessel speeds while discharging (around 4-5 knots constantly), small volumes discharged and the open ocean environment of the Operational Area, the risk is ranked low. The maximum number of vessels in close contact at any time with each other will be two (e.g. refuelling, re-stocking) – as such, they are alongside for a short time and not discharging bilge or sewage, cumulative impacts are unlikely, and consequences rated negligible.		
Inherent impact	Consequence	Likelihood	Risk ranking
	Negligible	Unlikely	**Low**

6.5.4 Impact treatment

6.5.4.1 Demonstration of ALARP

The offshore disposal of sewage, grey water and putrescible wastes may cause a small, localised (immediate area), temporary (short term) increase in the nutrient content in the water column in the immediate vicinity of the discharge. Discharges of brine and cooling water also have the potential to reduce water temperature and increase salinity in the immediate vicinity of the vessel. However, due to the small volumes discharged and well-mixed open ocean environment in the Gippsland survey Operational Area, any changes to ambient water quality (including salinity and temperature), nutrient levels or dissolved oxygen in the receiving waters are expected to be negligible.

CGG considers the adopted controls to be appropriate in reducing the environmental impacts associated with routine vessel discharges to the marine environment to ALARP. Additional controls have been considered and adopted where they can further reduce risks to ALARP. Where the cost of implementing the additional control measures is disproportionate to the benefit gained, they have not been adopted.

Control measures	Cost benefit analysis	Impact reduction	Control adopted
ALARP assessment technique – good practice			
Installation and use of sewage systems equivalent to internationally recognised MARPOL 73/78 Annex IV (sewage) and Annex V (garbage) specifications	Benefit outweighs cost; legal requirement.	Yes	Yes
All waste holding tanks are to be fully operational prior to survey commencement	Benefit outweighs cost.	Yes	Yes
Vessel survey crew will be inducted in waste management and made familiar with the vessel GMP.	Benefit outweighs cost.	Yes	Yes
Installation and use of Oil water separators equivalent to MARPOL 73/78 Annex I and AMSA Marine Order – Part 91 Marine Pollution Prevention – Oil specifications (i.e .treating OIW<15 ppm)	Benefit outweighs cost; legal requirement.	Yes	Yes
The vessel must not be stationary when undertaking discharge and oil in water (OIW) separator shut off value must be maintained and operational.	Benefit outweighs cost.	Yes	Yes
Deck drain scupper plugs available.	Benefit outweighs cost.	Yes	Yes
Minor oil/lubricant spills will be mopped up immediately with absorbent materials that	Benefit outweighs cost.	Yes	Yes

Control measures	Cost benefit analysis	Impact reduction	Control adopted
will be stored on board and disposed of onshore as hazardous waste in accordance with the vessel SOPEP.			
ALARP assessment technique – EIA			
Retain all or some waste streams on board to avoid discharging at sea.	Additional storage on board, increased handling and HSE implications and onshore disposal impacts result in disproportionate costs outweighing benefits.	Limited	No
Installation of a higher specification sewage treatment system	Likely to require refitting most vessels which has availability and schedule impacts	Yes	No
Requiring vessels to use alternative cooling devices such as fin fans	Fin-fan cooler systems typically require additional space and power, introducing additional environmental impacts	No	No
Residual impact evaluation			
Residual impact	Consequence	Likelihood	Risk ranking
	Negligible	Rare	Low

6.5.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the potential impacts from routine vessel discharges are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 6.28 Acceptability criteria – routine discharges

Acceptability criteria	
Potential impacts to fauna (seabirds, pelagic fish and plankton) in the water column are minor, localised and temporary	Routine operational discharges result in and localised (within vicinity of discharge) minor reduction in water quality, which will be short-term due to the well-mixed marine waters of the Gippsland Operational Area and open oceanic waters (roughly 95% of the Acquisition Area is >50 m water depth).
The seismic survey is short duration and vessels do not operate outside of Operational Area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill)	Survey is planned to commence mid-January and be completed by end July. Seismic vessels will be limited to the extent of the Operational Area (except during transit and in the event of an emergency e.g. oil spill)
Vessels operations will be compliant with all maritime law relating to routine discharges from vessels.	The performance standards comply with the requirements of: • *Navigation Act* 2012 (Cth): Chapter 4 (Prevention of Pollution) and AMSA Marine Order 96 (Marine Pollution Prevention- sewage). • MARPOL 73/78 and the *Protection of the Sea (Prevention of Pollution from Ships)* Act 1983. Predictions are therefore considered acceptable because MARPOL requires relevant vessels to have a garbage management plan, spill management plans and compliant sewage and OWS systems which if applied correctly will minimise impacts from routine discharges from vessels on a global scale.

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Acceptability criteria	
No predicted direct effect on EBPC Act listed MNES at a population level, KEF, TEC or marine protected areas	• No EPBC Act listed MNES are predicted to be impacted by the potential impacts from routine vessel discharges. Approximately 95% of the Operational Area the operational area is located in open oceanic waters >50 m water depth where discharges are diluted rapidly in the surface waters. • No more than possible incidental temporary effects to flora and fauna in the local vicinity of the discharge and no impact on critical activities or habitats, wetlands of importance or heritage places. No population or ecosystem level effects. Absence of areas of sensitive habitats susceptible to long-term effects from minor discharges. Full recovery of any areas disturbed with no medium to long-term effects on diversity. • No predicted effects to the Horseshoe Canyons, Eden Upwelling, TECs Commonwealth Marine Parks or State Reserves. conservation values either from individual vessels or cumulatively
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns	No specific stakeholder concerns have been raised concerning impacts of routine discharges from vessel operations.

6.5.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for routine vessel discharges are presented below in Table 29. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted above.

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Table 6.29 Environmental performance outcomes, standards and measurement criteria for routine vessel discharges

Environmental performance outcome	Environmental performance standard	Measurement criteria
Meet legislated discharge requirements for permissible discharges	Compliance with MARPOL 73/78 Annex IV (sewage) and Annex V (garbage), (as applied in Australia under Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983)); and AMSA Marine Orders – Part 96: Marine Pollution Prevention – Sewage, as required by vessel class • Vessel will have a Garbage Management Plan (GMP) and Garbage Record Book for vessels >100 gross tonnes or certified to carry 15 persons or more) that sets out the procedures for minimising, collecting, storing, processing and discharging garbage. • Treated sewage discharged >3 NM from land or untreated sewage discharge >12 NM from land and at a speed of greater than 4 knots • In the event of a STP malfunction, untreated sewage and grey water is only discharged when the vessel is greater than 12 NM from shore in accordance with Regulation 11 of MARPOL Annex IV (enacted by AMSA Marine Orders Part 96, Sewage). • Operational on-board sewage treatment plant approved by the International Maritime Organization (IMO) International Sewage Pollution Prevention (ISPP) Certificate	Records of any non-compliance with MARPOL are documented; and corrective actions identified and undertaken. Maintenance records demonstrate regular maintenance undertaken of on-board STP / macerator Survey-specific discharges and emissions register confirms that treated sewage is only discharged when the vessel is greater than 3 NM from shore Survey-specific discharges and emissions register verifies that untreated sewage is only discharged when the vessel is greater than 12 NM from shore. Records demonstrate the vessels hold a valid ISPP certificate and verifies the installation of a MARPOL approved STP, as required by vessel class.
	• Operational on-board organic waste macerator compliant with MARPOL Annex V • All food waste is macerated to ≤25 mm in size prior to overboard discharge, any discharge must be at a speed of greater than 4 knots • Un-macerated putrescible waste is only discharged overboard when the vessel is greater than 12 NM from the coastline • Non-putrescible galley waste is returned to shore for disposal	A MARPOL compliant Garbage Record Book is in place (for vessels >400 gross tonnes or certified to carry 15 persons or more) and verifies waste discharge volumes and locations Records verify that the macerator is functional and regularly maintained. A Garbage Record Book is in place that verifies non-macerated food waste is returned to shore
	• All waste holding tanks are to be fully operational prior to survey commencement	Records demonstrate that the vessels waste holding tanks are fully operational prior to survey.
	• Vessel survey crew will be inducted in waste management and made familiar with the vessel GMP.	Vessel induction confirms that survey crew are inducted in waste management procedures and GMP.
	Compliance with MARPOL 73/78 Annex I (as applied in Australia under Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983)); and AMSA Marine Order – Part 91 Marine Pollution Prevention – Oil) • oil content of any discharged water to be <15 ppm • bilge water contaminated with hydrocarbons must be contained and disposed of onshore, except if the oil content of the effluent without dilution does not exceed 15 ppm or an IMO approved oil/water separator (as required by vessel class) is used to treat the bilge water • The seismic vessels have an International Oil Pollution Prevention (IOPP) certificate as appropriate.	Oil Record Book confirms volume and concentration of discharge. Records demonstrate the survey vessel holds a valid IOPP certificate, as required by vessel class. Calibration records verify that the OWS is set to 15 ppm. Vessel engineers / chief engineer to confirm that OIW is in good working order during vessel audit during the survey (inspection within the last 12 months).

Environmental performance outcome	Environmental performance standard	Measurement criteria
	The residual oil from the OWS is pumped to tanks and disposed of onshore.	The Oil Record Book verifies that waste oil is transferred to shore.
	The vessel must not be stationary when undertaking discharge and oil in water (OIW) separator shut off value must be maintained and operational.	Records show vessel was moving (not stationary) when undertaking discharge and OIW separator shut-off valve was maintained and operational.
	Minor oil/lubricant spills will be mopped up immediately with absorbent materials that will be stored on board and disposed of onshore as hazardous waste in accordance with the vessel SOPEP.	Records show that response measures for minor oil/lubricant spills were carried out in accordance with the SOPEP. contaminated clean-up wastes stored on board in covered bins prior to onshore disposal at a licensed waste management facility. Records show spills and leaks are recorded and investigated; and corrective actions identified and undertaken.
Minimise discharges to ocean	Scupper plugs or equivalent drainage control measures are readily available to the deck crew so that deck drains can be blocked in the event of a hydrocarbon or chemical spill on deck to prevent or minimise discharge to the sea.	Site inspection verifies that scupper plugs (or equivalent) are available on the main deck.
Equipment that requires cooling by water, and the RO plant, will be maintained in accordance with the vessel PMS so that they are running within specified operating parameters	Engines and associated equipment that require cooling by water will be maintained in accordance with the vessel PMS so that they are operating within accepted parameters.	PMS records verify that the equipment is maintained to schedule.
The marine crew is competent in spill response and have appropriate response resources to respond to a spill.	The vessel crew is competent in spill response and has appropriate response resources in order to prevent or minimise hydrocarbon or chemical spills discharging overboard.	Training records verify that vessel crews receive spill response training.
Level 1 spills (<10 m3) of oil or oily water overboard are rapidly responded to by the vessel operator.	The vessel-specific Shipboard Oil Pollution Emergency Plan (SOPEP) is implemented in the event of a large spill of hydrocarbons or chemicals overboard.	Incident report verifies that the SOPEP was implemented.

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6.6 Impact 6: Atmospheric emissions – vessels

6.6.1 Identification of hazard and extent

Hazard	Atmospheric emissions of greenhouse gases and other pollutants will be produced through: • Combustion of marine gas oil or diesel from the seismic and support/escort vessel engines and fixed and mobile deck equipment during the survey • Solid non-hazardous waste combustion within an incinerator, if logistics don't allow for the timely removal of waste from the vessel. The main emissions that present an environmental impact are: • nitrous oxides (NOx) • sulphurous oxides (SOx) • particulate matter <10 µm • non-methane volatile organic compounds (VOCs) • benzene, toluene, ethylbenzene and xylenes (BTEX) • greenhouse gases (predominantly carbon dioxide).
Extent	Operational Area (seismic vessels) Operational Area (support/escort vessels)
Duration	Continuous within the Operational Area during the survey (start mid – January to end July)

6.6.2 Levels of acceptable impact

The impact on marine receptors caused by atmospheric emissions will be acceptable when the levels of acceptability are met as described below

- emissions from the seismic and support/escort/escort vessels will result in localised temporary (short term) reductions in air quality with no loss of visual amenity or health impacts to the general public
- no direct effect on EBPC Act listed MNES at a population level that is not recoverable.
- the seismic survey is short duration and vessels do not operate outside of operational area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill
- vessel operations will be compliant with all maritime law relating to atmospheric emissions from vessels
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns that are not being addressed.

6.6.3 Impact analysis and evaluation

Potential impacts	Localised and temporary decrease in air quality due to emission of gaseous and particulate matter from marine gas oil or diesel combustion Contribution to the global greenhouse gas (GHG) effect.
Predicted effect	The potential impacts of atmospheric emissions from vessels are well understood with legislative requirements and industry agreed good practices to manage impacts. The application of recognised good practice is considered appropriate to manage the impact. The combustion of marine gasoil and diesel fuel can create continuous or discontinuous plumes of particulate matter (soot or black smoke) and the emission of non-GHG, such as sulphur oxides (SOX) and nitrous oxides (NOX). Inhalation can cause or exacerbate health impacts to humans such as vessel personnel or coastal communities depending on the concentrations of particles inhaled. Similarly, the inhalation of particulate matter may affect the respiratory systems of fauna – in this case, limited to seabirds overflying the vessel/s. Particulate matter released from the source and support vessels is not likely to impact on the health, cause smog or adversely affect the amenity of the nearest human coastal settlements (such as Lakes Entrance or Golden Beach) as local and offshore winds will rapidly disperse and dilute particulate matter.

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	This rapid dispersion and dilution will also ensure that seabirds are not exposed to concentrated plumes of particulate matter from any exhaust point. GHG such as carbon dioxide, methane and nitrous oxide will add to the atmospheric GHG load which adds to global warming potential. However, volumes are relatively small on a regional and global scale, representing an insignificant contribution to overall GHG emissions. The activity is similar to other industrial activities contributing to the accumulation of GHG in the atmosphere including local shipping, other oil and gas operators and commercial fishing in the Operational Area. Given the short duration of the survey, and constant movement of the vessel, emissions from the combustion of fuel on board the vessels will not affect sensitive receptors in the vicinity of the Operational Area (including the health or amenity of the nearest human settlements which are more than 13km from the Operational Area at the closest). Cumulative impacts from multiple vessels being in the same area are not predicted as combined discharges will still be localised and disperse rapidly with little or no effects (ecologically or on visual amenity).

Inherent impacts	Consequence	Risk ranking
	Negligible	Low

6.6.4 Impact treatment

6.6.4.1 Demonstration of ALARP

The use of vessels and hence fuel cannot be eliminated. Alternative fuels (solar, wind, biofuels) have not been commercially proven. CGG considers the adopted controls to be appropriate in reducing the environmental impacts associated with atmospheric emissions from vessels to ALARP. Additional controls have been considered and adopted where they can further reduce risks to ALARP. Where the cost of implementing the additional control measures is disproportionate to the benefit gained, they have not been adopted.

Control measures	**Cost benefit analysis**	**Impact reduction**	**Control adopted**
ALARP assessment technique – good practice			
Compliance with equivalent requirements as those internationally defined in MARPOL 73/78 Annex VI and accepted by the wider international shipping industry	Benefit outweighs cost, legal requirement	Yes	Yes
Survey, supply/escort and supply vessels only uses MGO or MDO grade fuel as opposed to heavy fuel oil or bunker fuel	Benefit outweighs cost	Yes	Yes
All engines to be well maintained in accordance with manufacturers specifications	Benefit outweighs cost	Yes	Yes
ALARP assessment technique – EIA			
A MARPOL approved incinerator is used to incinerate solid waste (food waste, paper, cardboard, rags, plastics) if logistics don't allow for the timely removal of waste from the vessel.	Benefit outweighs cost	Yes	Yes
Oil and other noxious liquids and solids will not be incinerated.	Benefit outweighs cost	Yes	Yes
Residual impact evaluation			
Residual impact	Consequence	Likelihood	Risk ranking
	Negligible	Rare	Low

6.6.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the potential impacts from atmospheric emissions from vessels are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

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Table 6.30 Acceptability criteria – atmospheric emissions

Acceptability Criteria	
Emissions from the seismic and escort/supply vessels will result in localised temporary reductions in air quality with no loss of visual amenity	Emissions will be localised to the Operational Area and be rapidly dispersed and diluted in the atmosphere in the short term by the constantly moving vessels
No direct effect on EBPC Act listed MNES or TECs at a population level that is not recoverable	There are no EPBC Act listed MNES predicted to be impacted by the potential impacts from atmospheric emissions from vessels. Temporary and localised reduction in air quality. No more than possible incidental effects to passing birds, and no impacts on TECS, KEFs or marine protected areas due to rapid dispersion/dilution and remote location in the open ocean environment at least 13km offshore
The seismic survey is short duration and vessels do not operate outside of Operational Area (except for transiting to/from mainland and in the case of an emergency e.g. oil spill)	Survey will be undertaken between mid-January and end July. Seismic vessels will be limited to the extent of the Operational Area (except during transit and in the event of an emergency e.g. oil spill) Vessels will likewise have associated GHG emissions whilst in the Operational Area but as refuelling/resupplying is the only time the vessels are alongside (hours) cumulative impacts are considered negligible considering the open ocean environment
Vessels operations will be compliant with all maritime law relating to atmospheric emissions from vessels.	Operations will be compliant with the MARPOL 73/78 and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. MARPOL is an internationally agreed standard to minimise pollutant emissions on a global scale.
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns that are not being addressed	No specific stakeholder concerns have been raised regarding impacts of atmospheric emissions from vessels.

6.6.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for atmospheric emissions from vessels are presented below in Table 6.31. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 6.8.4.1.

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Table 6.31 Environmental performance outcomes, standards and measurement criteria for atmospheric emissions

Environmental performance outcome	Environmental performance standard	Measurement criteria
Combustion systems comply with MARPOL VI (Prevention of Air Pollution from Ships) requirements.	Compliance with MARPOL 73/78 Annex VI as applied in Australia under Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and Marine Order – Part 97 (Part IIID Marine Pollution Prevention – Air Pollution), where applicable to vessel class including • survey vessel will hold a valid International Air Pollution Prevention (IAPP) Certificate • only fuel that contains less than 3.5% m/m sulphur will be bunkered • Survey, escort and supply vessels only uses MGO or MDO grade fuel • Vessels >400 gross tonnes must ensure that firefighting and refrigeration systems are managed to minimise Ozone Depleting Substances (ODS)	Records demonstrate the vessel(s) hold a valid IAPP certificate, where applicable to vessel class
		Inspection of bunkering records to confirm that the survey vessel is using fuel with <3.5% sulphur by mass
		MSDS and vessel bunker receipts confirm the use of low-sulphur fuel and MGO or MDO or lighter grade fuel for main engines.
		ODS book is available and current
	All combustion equipment will be maintained in accordance with the PMS to ensure they are operating to design specifications.	PMS records confirm that combustion equipment is maintained to schedule.
	A MARPOL approved incinerator is used to incinerate solid waste (food waste, paper, cardboard, rags, plastics) if logistics don't allow for the timely removal of waste from the vessel.	IAPP certificate verifies the incinerator meets MARPOL requirements.
	Incineration is only conducted when the vessel is >12 NM from the shore	Survey-specific discharges and emissions register indicates no incineration within 12 NM of the shore.
	Oil and other noxious liquids and solids will not be incinerated.	The Oil Record Book and Garbage Record Book verify that waste oil and other noxious substances are retained on board for transfer to shore.
Fuel use will be measured, recorded and reported	Fuel use will be measured, recorded and reported for abnormal consumption, and in the event of abnormal fuel use, corrective action is taken to minimise air pollution	Fuel use is recorded in the daily operations reports.

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7 Environmental risk assessment – unplanned events

7.1 Summary of risk ranking from unplanned events

This section of the EP presents the results of the risk assessment for unplanned (accidental) events that could occur during the Gippsland MSS. As required by Regulation 13(5) and 13(6), this assessment demonstrates that with appropriate treatment the risks associated with the activity will be reduced to ALARP and will be of an acceptable level. A summary of the risks and acceptability for the Gippsland MSS is presented in Table 7.1.

Table 7.1 Summary of risk rankings for unplanned events for the Gippsland MSS

Risks	Risk evaluation			Acceptability
	Consequence	Likelihood	Risk ranking	
Physical interaction – collision or equipment entanglement with marine fauna	Major – collision	Rare	Medium – collision	Section 7.2.4.2
	Minor – entanglement		Low – entanglement	
Introduction and establishment of invasive marine species	Negligible	Rare	Low	Section **7.3.4.2**
Seabed disturbance – loss of solid materials	Minor	Rare	Low	Section **7.4.4.2**
Accidental release – hazardous materials	Minor	Rare	Low	Section **7.5.4.2**
Accidental oil spill (refuelling)	Negligible	Unlikely	Low	Section **7.6.4.2**
Accidental oil spill (vessel collision)	Minor	Unlikely	Low	Section **7.7.4.2**
Oil spill response	Minor	Unlikely	Low	Section **7.8.4.2**

7.2 Risk 1: Physical interaction – collision or equipment entanglement with marine fauna

A description of the hazards and their extent from the risk of collision or entanglement (environmental aspect) are identified here and is the first stage of the risk and impact assessment process defined in Section 5.4.

7.2.1 Identification of hazard and extent

Hazard	The survey and escort / supply vessels working within the Operational Area may present a potential physical hazard (risk of collision) to large marine fauna such as whales, seals, sharks, dolphins and turtles that may be transiting through the area at/near the sea surface. The physical presence of the streamers (up to 7050 m long) may present a potential risk of entanglement with marine fauna, and turtles have been known to become trapped in the tail buoys that are attached to the end of seismic streamers. However, not all tail buoy designs present a risk of entrapment. In the event of loss of a streamer, there is a potential for entanglement as the seismic streamers are fitted with pressure-activated, self-inflating buoys that are designed to bring the equipment to the surface if lost accidentally during a survey. As the equipment sinks it passes a certain water depth at which point the buoys inflate and bring the equipment back to the surface where it can be retrieved by the seismic or supply/escort vessels. Recovery of streamers would be undertaken where safe and practicable to do so, which would remove the risk of faunal entanglement.
Extent	Operational Area
Duration	Continuous during survey duration. Start mid – January to end July.

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7.2.2 Levels of acceptable risk

The risk of adverse effects on large marine fauna caused by vessel collision or equipment entanglement will be acceptable when the criteria below are met:

- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. There are no outstanding merited concerns
- vessel operations are compliant with all maritime law relating to cetaceans
- no predicted direct effect on EBPC Act-listed MNES fauna at a population level
- no direct effect on EBPC Act listed MNES at a population level. No disruption of key ecological processes for key marine fauna values (migrating or foraging blue whale, humpback, southern right or pygmy blue whales) of the Beagle and Gippsland marine parks (Australian IUCN Reserve Management Principle, Cat VI) or key values of the East of Eden Upwelling or Big Horseshoe Canyon
- EP risk treatment aligns with the relevant management actions from the Conservation Management Plan for the Blue Whale
- EP risk treatment aligns with the relevant general recommendations of the Conservation Management Plan 2012 for the Southern Right Whale
- EP risk treatment aligns with the relevant management actions from the Conservation Advice for the Humpback whale, Sei and Fin whales.

7.2.3 Risk and impact analysis and evaluation from vessel collision and entanglement associated with the Gippsland MSS

This section describes the impacts that may occur on marine environmental receptors identified in Section 4 that may be at risk of collision with vessels or entanglement with the seismic array (streamers and airgun array). This part of the risk and impact assessment method is described in Section 5.4.1. Each of the subsequent sections then undertake the risk and impact analysis as defined in Section 5.4.2.

Risk	Vessel collisions are a cause of mortality of marine fauna and large cetaceans (Lutcavage et al. 1997; Hazel and Gyuris 2006; Hazel et al. 2007, Knowlton and Kraus 2001; Laist et al. 2001; Jensen and Silber 2003). Fauna at highest risk of collision are those that spend a high percentage of time in surface waters, are slow moving and/or large. The risks associated with vessel/equipment interactions with marine fauna are as follows and can range from minimal (e.g. behavioural changes) to severe (i.e. serious injury or mortality): • vessel collision with marine fauna such as cetaceans, pinnipeds and turtles • equipment entanglement with marine fauna such as cetaceans, pinnipeds, turtles • disturbance leading to behavioural changes or displacement of fauna. The fauna that could occur in the Operational Area during the timing of the Gippsland MSS include baleen and toothed whales (particularly during periods of the East of Eden upwelling), great white shark, the Australian and New Zealand fur seal (likely shallower waters <150m) and transiting turtles. These fauna are mobile and would be expected to actively avoid the survey vessels where possible.
Potential effects	While seismic vessels may attain speeds of 10 to 12 knots during transit to the Operational Area, the survey vessels will maintain a cruising speed of 4 to 5 knots during data acquisition and turning. Vessel speed has been identified as a contributing factor in the occurrence and severity of vessel collisions with various marine fauna (Laist and Shaw 2006, Hazel et al. 2007); large whale species in particular (Laist et al. 2001, Jensen and Silber 2003, Pace and Silber 2005, Vanderlaan and Taggart 2007). Damage and risk of injury is greatly increased at higher speeds and is a higher risk for vessels travelling at 14 knots or faster because the fauna have less time to take evasive action (Laist et al. 2001). However, an actively acquiring seismic vessel will acoustically announce its approach from distance and fauna are more likely to be aware and able to evade the slow-moving vessel. Vulnerability of cetaceans to vessel collision will vary according to behaviour (e.g. surfacing habits, direction of travel in relation to shipping routes); morphology; the function of preferred habitat (e.g. breeding, feeding) in areas of vessel activity; and aspects of shipping such as vessel type, speed, density and location. Slow moving species that occur frequently at the surface in areas that overlap with shipping activity are the most vulnerable (Clapham et al. 1999).

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	The likelihood of vessel/cetacean collision being lethal is influenced by vessel speed: the greater the speed at impact, the greater the risk of mortality (Laist et al. 2001; Jensen and Silber 2003). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale because of a vessel strike increases from less than 10% at 4.5 knots, to about 20% at 8.6 knots and 80% at 15 knots. During seismic data acquisition, the survey vessel will be moving at a speed of approximately 4 to 5 knots, so the risk of lethal injury is lower than for most of the freighters transiting the area. Vessel-whale collisions at this speed are uncommon and, based on reported data contained in the US National Ocean and Atmospheric Administration database (Jensen and Silber 2003) there are only two known instances of collisions when the vessel was travelling at less than 6 knots, both of these were from whale watching vessels that were deliberately placed amongst whales Pygmy blue, southern right, fin and sei whales, as well as toothed whales (sperm whales, killer whales), may be encountered in the Operational Area but only the pygmy blue whale (foraging), great white shark (breeding, distribution) have BIAs that overlap the Operational Area while the southern right whale (migration and resting on migration) humpback whale (migration) and grey nurse shark (breeding and foraging) have BIAs that overlap with the Oil EMBA. The great white has breeding/nursery areas near Corner Inlet and the shallows along the north west of the Operational Area, foraging areas around the Bass Strait Islands as well as near Mallacoota and Beware Reef (about 15km north of the Operational Area) and a wide distribution across the region. The northern and western part of the Operational Area landward from the 1000 m isobath overlaps part of the pygmy blue whale foraging BIA as they make their way to the area west of the Bonney Upwelling (about 500km west of the Operational Area) where they aggregate from November to December. From January till end April, they are known to forage at the Bonney Upwelling in significant numbers. Humpback whales have historically foraged off Eden, about 70 km north of the Operational Area (Section 4.5.8), migrating north from the Antarctic waters and southern Tasmania in April and May, then migrating south in November and December typically in shallower waters. Southern Right whale resting during migration may traverse the Operational Area favouring the shallows near the coastline en route to calving and aggregating sites off Warrnambool, Port Fairy and Portland during May to October. These main aggregation areas lie approximately 500 km west of the Operational Area. It is also possible that other species of whale that are not regionally significant but possibly traversing the Operational Area, as well as sharks, seals and dolphin could be encountered, particularly during periods of nutrient enrichment associated with the Eden Upwelling, as surveys have identified other species (fin, sei, humpback) feeding in the coastal upwelling (Gill et al. 2015). There are no haul-out sites or known breeding colonies for the Australian fur seals along the coast parallel to the Operational Area but both Australian and New Zealand fur seals have haul outs and breeding colonies near Wingan Inlet (The Skerries, about 70km east of Cape Conran and 70km from the Operational Area), and have been sighted at Port Hicks (approximately 26km from the Operational Area), Cape Conran (approximately 17km from the Operational area) and Beware Reef (approximately 16km from the Operational Area. Australian and New Zealand fur seals may forage in the waters on the continental shelf out to around 150 m and around the East of Eden Upwelling when its active, so it is possible that the vessels may encounter individuals. Anecdotal sightings of marine turtles have been recorded during the summer and autumn months on the southern Australian coastline (VIC, SA, TAS) by the DIE at Deakin University, comprising mainly individual leatherback and loggerhead turtles in coastal waters. It is possible that turtles could also be encountered by the seismic and supply/escort vessels in the shallower parts of the Operational Area, however there are no BIA in the region. In summary, these fauna are mobile and would be expected to actively avoid the survey vessels, especially during data acquisition. Few encounters with large marine fauna are expected and the survey and associated vessels will acquire data at a speed of typically <5 knots. However, in the event of a collision it is possible that injury or death of an individual of a protected species could occur.; No effects at an ecosystem function level or population level are predicted. Equipment entanglement leading to injury of marine fauna, and behavioural disturbance / displacement of marine fauna could cause minor disruption and temporary effects (days) on individual protected species, however no effects on critical behavioural processes are expected, and no threats at a population level.

Inherent risk	Consequence	Likelihood	Risk ranking
	Major – collision Minor – entanglement	Possible – collision Unlikely – entanglement	High – collision Low – entanglement

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7.2.4 Impact and risk treatment

Taking the above evaluations, treatments for each of the impacts deemed to be Medium or higher are identified in the following as described in Section 5.5 as part of the risk and impact assessment method.

7.2.4.1 Demonstration of ALARP

The risks from vessel collision / equipment entanglement with marine fauna are relatively well understood, with regard to the potential for injury and/or mortality from high speed collisions. In general, the application of recognised good practice is considered appropriate to manage the risks. In addition, this assessment considers the risk to the location specific environmental values and sensitivities (e.g. likely encounters with large, slow moving marine fauna). To augment decision making further, a precautionary approach is applied where uncertainty continues to exist.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. Where the cost of implementing the additional control measures is disproportionate to the benefit gained, they have not been adopted. CGG has applied a precautionary approach in managing potential encounters with pygmy blue whales with the application of additional control measures described for impacts from underwater sound from seismic operations. These controls include measures for relocation of the vessel in the event >15 whales are present in the observation zone during the pre-start observation check, precautionary shut-down procedures, and adaptive management including PAM. These are also referred to below.

CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with collision / equipment entanglement with marine fauna to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs

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Table 7.2 Cost benefit analysis and residual risk evaluation – vessel strike and entanglement

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
The interaction of support vessels and the seismic vessel (when not towing equipment) with cetaceans during the survey will be managed consistently with the Part 8 of the EPBC Regulations (2000) • survey vessel will not travel at greater than 6 knots within 300 m of a cetacean (caution zone) • survey vessel will not approach closer than 50 m for a dolphin and/or 100 m for a whale (with the exception of animals bow riding).	Benefits outweigh costs; Legal requirement.	Yes	Yes
Soft start procedures will be conducted prior to acquisition commencing. This will encourage noise sensitive marine fauna to move away from the vessel, reducing the likelihood of collision or entanglement.	Benefits outweigh costs; Legal requirement.	Yes	Yes
MFO to maintain watch for marine fauna during the day when the seismic source is active, with observed fauna to be avoided if possible.	Benefits outweigh costs.	Yes	Yes
Use of streamer tail buoys fitted with appropriate turtle guards.	Benefit outweighs cost (increased downtime)	Yes	Yes
Buoys and automatic recovery devices attached to streamer to facilitate recovery in the event of loss.	Benefits outweigh costs.	Yes	Yes
Supply/escort vessel available to assist with recovery of lost streamers.	Benefits outweigh costs.	Yes	Yes
Slow speed of vessel during seismic acquisition (4 to 5 knots) will reduce collision risk	Benefits outweigh costs.	Yes	Yes
All vessel crew are inducted in their responsibilities as required regarding marine fauna interactions.	Benefits outweigh costs.	Yes	Yes
All entangled marine fauna recovered to the vessel will be returned to the sea as quickly as practicable.	Benefits outweigh costs.	Yes	Yes
All vessel strike incidents are reported in the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike.	Benefits outweigh costs; aligns with management actions for cetaceans management plans.	Yes	Yes

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – EIA			
In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24 hour period, the seismic vessel will move away from the current area and continue data acquisition in another area (>10 km away). In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24 hour period and the seismic vessel CANNOT move away from the current area and continue data acquisition in another area (>10 km away), CGG will implement the following additional precautionary control measures • increased pre-start up visual observation period to 45 mins • increased soft-start to 40 mins • increased observation zone to 4 km • increased low power zone to 3 km • increased shut-down zone to 1 km	CGG recognises the importance of the foraging BIA for pygmy blue whales and that there is the potential for some animals to be present en route to the more significant aggregations off the Bonney (peak February) Introducing adaptive management will provide additional protection for these 'early' or 'late' migrating animals and will engender limited cost/time loss for CGG. Benefit outweighs cost.	Yes	Yes
Relocate vessel after a shutdown to another area (>10 km away), if greater than 15 whales are present in observation zone during the pre-start observation, but not close enough to prevent soft start commencing (i.e. outside low power zone).	A large number of whales in the observation zone could indicate that the vessel is heading into a migrating pod. Vessel can relocate prior to shutdowns being triggered to avoid disturbance to the whales. Minor cost implication as shutdowns and relocation likely anyway. Potential environmental benefit to be gained outweighs costs associated with implementation.	Yes	Yes
Two trained Marine Fauna Observers (MFOs) on the seismic vessel will watch for whales during daylight hours; throughout the duration of the survey. Two passive acoustic monitoring (PAM) operators will operate throughout the duration of the survey; working on rotation to cover both day time and night time monitoring.	CGG recognises that pygmy blue whales are likely to be present within the foraging BIA that overlaps with the Operational Area. Implementing these additional mitigation procedures will ensure greater probabilities of detecting whales prior to entry into the 3 km observation zone. This will provide additional protection in the event that low densities of migrating humpback whales are encountered moving through the Acquisition Area. CGG has also committed to using PAM (Quietsea) for detecting cetaceans 24 hours a day, and to implementing adaptive management procedures in the event of detections. CGG will investigate emerging technologies to improve reliability of PAM detections and distance estimation, as well as other possible methods of detection during periods of low visibility or at night. Benefit outweighs cost.	Yes	Yes
Towed PAM will be implemented on the seismic vessel 24 hours a day when the acoustic source is operational. The PAM system will have the capability to detect vocalisation of whales within the frequencies The seismic channels of Quietsea record vocalisations in the seismic bandwidth (10 Hz to 200 Hz) with high redundancy due to plurality of sensors. The higher frequency range (200 Hz to 96kHz) is monitored via		Yes	Yes

Control measures	Cost benefit analysis	Risk reduction	Control adopted
modules installed along the streamer and below the seismic sources for accurate crossline and inline detection/localisation	The East of Eden upwelling is episodic It is historically an aggregation area for PBW and SR, however sightings are not as common as for the Bonney Upwelling and aggregation areas around Portland and Warrnambool which are roughly 500km west of the Operational Area.		
Monitor the sea temperatures at the Eden Upwelling to determine whether the Eden Upwelling is active and hence increased cetacean, seal and predator presence can be expected.	The East of Eden Upwelling is not as pronounced or documented an event as the Bonney Upwelling where significant numbers of whales (particularly the Pygmy blue and Southern right) are known to aggregate in specific seasons. Mitigation already in place to manage operations during multiple sightings. As such costs outweigh benefits	Limited	No
Reduce number of vessels in the field by not using support vessels	Reducing vessels numbers used increases safety risk and reduces ability to manage stakeholder interactions, potential risks are higher than the benefits gained by implementing this control measure.	No	No
Remove streamers from water when not in use	It would increase health and safety risks and would prolong the overall activity time. Minimal reduction in risk of equipment loss/entanglement. Costs disproportionately higher than benefits.	No	No
No night-time operations	Limiting seismic activities to daylight hours only would significantly extend the time required to acquire data for individual activities. This would at least double the survey time and, therefore, increase the likelihood of interactions with diurnal fauna, the overall duration of seismic impacts, and interaction with commercial fisheries. CGG has also committed to using PAM for detecting cetaceans 24 hours a day. Costs disproportionately higher than benefits.	Minimal environmental benefit from avoiding night-time operations.	No
No survey	Complete elimination of the risk is not possible as there is no practical alternative to the use of vessels which allow CGG to undertake the activity. Costs disproportionately higher than benefits.	No	No
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Major – collision	Rare	Medium – collision
	Minor – entanglement	Rare	Low – entanglement

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7.2.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the risk of adverse effects from collision / entanglement with marine fauna are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 7.3 Acceptability criteria – entanglement or ship strike

Acceptability Criteria	
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.	No specific stakeholder concerns have been raised regarding vessel collisions with marine fauna.
Vessel operations will be compliant with all maritime law relating to cetaceans	Operations will be compliant with the EPBC Regulations 2000. Predictions are therefore considered acceptable because these Regulations provide vessel speeds and approach separation distances between vessels and whales to mitigate risks collisions occurring.
No direct effect on EBPC Act listed MNES at a population level. No disruption of key ecological processes for key marine fauna values (migrating or foraging blue whale, humpback, southern right or pygmy blue whales) of the Beagle and Gippsland Marine Parks (Australian IUCN Reserve Management Principle, Cat VI) or key values of the East of Eden Upwelling or Big Horseshoe Canyon	By aligning EP commitments with EPBC Regulation requirements and with applicable cetacean Conservation Advice and Management Plans (see below), it is considered that the potential vessel strikes: • will not affect population levels, • will not disrupt key ecological processes for key marine fauna values of the Beagle or Gippsland Marine Parks, • will not disrupt key values of the East of Eden Upwelling or Big Horseshoe Canyon Use of streamer tail buoys fitted with appropriate turtle guards
Aligns with the relevant management actions from the Conservation Management Plan for the Blue Whale Aligns with the relevant general recommendations of the Conservation Management Plan for the Southern Right Whale Aligns with the relevant management actions from the Sei Whale Conservation Advice (DoE 2015) and Fin Whale Conservation Advice (DoE 2015)	Conservation Management Actions identified in the Management Plans and Conservation Advice for protected species (humpback, blue, pygmy blue, southern right, sei and fin whales) to minimise vessel collisions are aligned with the control measures adopted in Section **7.3.4.1**. To this effect, this EP**:** • ensures all vessel strike incidents are reported in the National Ship Strike Database (see Table 7.2). In addition, the reporting of all vessel strike incidents adheres to CGG's internal procedure: *Contingency Procedure for Marine Animal Event* (Doc MAR HSE PRC 014E) which clarifies roles and responsibilities following a marine animal event. • Includes requirements for reducing vessel speed or by separating vessels and whales • Additional precautionary control measures are described in Section 7.2.4.1 for precautionary action to be taken on multiple sightings • enhance education programs to inform vessel operators of best practice behaviours and regulations for interacting with humpback whales. This is achieved through ensuring seismic and support vessels crews are inducted in their responsibilities as required regarding marine fauna interactions.
Ensure the risk of vessel strike on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required appropriate mitigation measures are implemented to reduce the risk of vessel strike	• The survey area is within the area defined as 'species core range' for humpback whales (see section 4.5.8.1). CGG recognises that the distribution of whales may extend beyond their BIAs and has taken a precautionary approach to the assessment as described in Table 7.2). • In addition, at least two MFO will be present onboard the seismic vessel during data acquisition observing whales and whale sharks out to a distance of 3 km of the seismic/supply vessels. The risk of vessel collision during the survey is therefore low.

7.2.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for vessel collision / equipment entanglement with marine fauna are presented below in Table 7.2. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.3.4.1.

Table 7.4 Environmental performance outcomes, standards and measurement criteria for collision or equipment entanglement with marine fauna

Environmental performance outcome	Environmental performance standard	Measurement criteria
No injury or death of marine fauna due to a vessel collision or entanglement with seismic streamers during the Gippsland MSS	When streamers are not deployed: the interaction of seismic and support vessels with cetaceans during the survey will be managed consistently with the Part 8 of the EPBC Regulations (2000) • seismic survey and support vessels will not travel at greater than 6 knots within 300 m of a cetacean (caution zone) • seismic survey and support vessels will not approach closer than 50 m for a dolphin and/or 100 m for a whale (with the exception of animals bow riding).	MFOs reports document appropriate responses to whale and dolphin interactions. All records of breaches of Part 8 of the EPBC Regulations (2000) documented and reported Records indicate crew inductions include requirements for implementing the guidelines
	When streamer deployed, the seismic vessel will comply with EPBC Policy Statement 2.1 (Part A) to reduce the potential for marine fauna interactions, including the implementation of soft starts to encourage all large noise sensitive marine fauna (i.e. cetaceans, whale sharks, turtles) to move areaway from the vessel.	MFO records confirm compliance with EPBC Policy Statement 2.1 (Part A), including implementation of soft starts prior to acquisition commencing.
	Buoys and automatic recovery devices attached to streamer to facilitate recovery in the event of loss.	Pre-start inspection shows evidence that buoys and automatic recovery devices are attached to the streamers.
	Support vessel available to assist with recovery of lost streamers.	Incident report for lost equipment documents assistance provided by support vessel to retrieve lost streamers.
	Two trained Marine Fauna Observers (MFOs) on the seismic vessel will watch for whales during daylight hours; throughout the duration of the survey.	MFOs reports confirm presence onboard and CVs for MFOs demonstrates competency.
	Seismic survey vessel will not travel at greater than 4-5 knots during seismic acquisition.	Vessel log confirms vessels speed did not exceed 5 knots during acquisition.
	Seismic and support vessels crews are inducted in their responsibilities as required regarding marine fauna interactions.	Records show that the seismic and support vessel crew inductions include responsibilities regarding marine fauna interactions
	All vessel strike incidents are reported in the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike	MFO report confirms that all vessel strike incidents are reported in the National Ship Strike Database.
	All known or suspected threatened fauna injuries or death will be reported to the DoEE within 2 hours of the incident.	Incident report verifies contact was made or attempted to DoEE within 2 hours of the incident.
	Use of streamer tail buoys fitted with appropriate turtle guards.	Inspection of tail and head buoys during survey and prior to use records presence of turtle guards.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	All entangled marine fauna recovered to the seismic or support vessels will be returned to the sea as soon as practicable.	MFO report confirms that any marine life recovered with wet equipment was recorded and then returned to the ocean as soon as practical.
	In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24 hour period, the seismic vessel will move away from the current area and continue data acquisition in another area (>10 km away). In the event that there have been three or more whale-instigated power-down or shut-down situations during the preceding 24 hour period and the seismic vessel CANNOT move away from the current area and continue data acquisition in another area (>10 km away), CGG will implement the following additional precautionary control measures • increased pre-start up visual observation period to 45 mins • increased soft-start to 40 mins • increased observation zone to 4 km • increased low power zone to 3 km • increased shut-down zone to 1 km	MFO report verifies implementation of procedures
	Relocate vessel after a shutdown to another area (>10 km away), if greater than 15 whales are present in observation zone during the pre-start observation, but not close enough to prevent soft start commencing (i.e. outside low power zone).	MFO report verifies implementation of procedures
	Two passive acoustic monitoring (PAM) operators will operate throughout the duration of the survey; working on rotation to cover both day time and night time monitoring.	CVs of PAM operators to demonstrate competency MFO report demonstrates PAM operations maintained during day time and night time.
	Towed PAM will be implemented on the seismic vessel 24 hours a day when the acoustic source is operational. The PAM system will have the capability to detect vocalisation of whales within the frequencies (10 Hz – 200 kHz).	MFO report verifies implementation of procedures. SEA confirms PAM system frequency range prior to mobilisation of vessel from port to the Acquisition Area.

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7.3 Risk 2: Introduction and establishment of invasive marine species

7.3.1 Identification of hazard and extent

Hazard	The Convention on Biological Diversity (1992) defines a non-native species as “a species introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce”. Non-native species are known from all parts of the world and have been transported by several different anthropogenic means (Carlton and Geller 1993). Australia has over 250 Invasive Marine Species (IMS) and although most do not cause a problem, some may become aggressive pests with detrimental effects on biodiversity and ecology (www.marinepests.gov.au). The following activities have the potential to lead to the introduction and transfer of IMS during a marine seismic survey: • discharge of ballast water from the seismic survey and escort vessels • biofouling on vessel hulls and other external niches (e.g. propulsion units, steering gear and thruster tunnels) • biofouling of vessel internal niches (e.g. sea chests, strainers, seawater pipe work, anchor cable lockers and bilge spaces) • marine biofouling of in water equipment (e.g. streamers, tail buoys). The potential biofouling risk posed by a vessel relates to its history prior to entering the Operational Area. The main risk factors for marine biofouling are: • time spent in foreign ports, especially those with known IMS infestations • transit from similar bioregion • suitability of Operational Area habitats for IMS establishment • time since hull cleaning • condition and age of anti-fouling • type of ballast water.
Extent	Operational Area
Duration	Continuous during survey. Start mid – January to end July.

7.3.2 Levels of acceptable risk

The risk of adverse effects on environmental receptors caused by the introduction and establishment of IMS will be acceptable when the levels of acceptability are met as described below:

- vessel operations will be compliant with all maritime law relating to IMS
- no predicted direct effect on EBPC Act listed MNES at a population level
- no predicted direct effect on benthic habitats or communities or protected Marine Parks
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.

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7.3.3 Risk and impact analysis and evaluation of the introduction and establishment of invasive marine species from the CGG Gippsland MSS

<table>
<tr><td>Risk</td><td colspan="3">Introduction and establishment of IMS through biofouling or ballast water discharge has the potential to result in potential effects to seabed habitat and marine ecosystems due to:
• competition with native species for resources, reducing native species diversity and abundance
• predation on local species.</td></tr>
<tr><td>Potential effects</td><td colspan="3">Ballast water exchanges have been implicated in the introduction of marine pest species (DAWR 2017) with impacts including significant eradication and potential cost impacts to commercial fishing. Marine pests found in Port Phillip Bay (~300km west) and the port of Eden (140km north east) include species such as the New Zealand screw shell, Northern Pacific seastar, European green shore crab and European fan worm (Section 4.5.5). Most prefer a shallow environment (<30 m water depth) while the shore crab, screw shell and basket shell clam have been found in waters up to 60 m, 130 m and 150 m respectively.
In the unlikely event that a species is introduced, and it survives in the new environment, it has the potential to colonise a new region and establish a new population. Over time the population may increase, and the species become established in the area. This can cause a range of ecological effects, including increased competition with native species. However, the probability of successful establishment of IMS is dependent on a number of factors including survival of the propagules during their transfer to the area, the suitability of the environmental conditions at the recipient site (water temperature, salinity, depth, habitat types, competitors, and predators), the survival of the propagules to reproductive state and the continued success of the introduced population.
If established, IMS can compete with native species, modify habitats and can threaten endemic diversity and abundance. The operational area does not present n environment conducive to IMS survival of the known species given a large portion is located in deep oceanic waters (roughly 95% of the Acquisition Area is >50 m water depth. Establishment of IMS is mostly likely to occur in shallower waters (<50 m) in areas where large numbers of vessels are present and are stationary for an extended period.</td></tr>
<tr><td rowspan="2">Inherent risk</td><td>Consequence</td><td>Likelihood</td><td>Risk ranking</td></tr>
<tr><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
</table>

7.3.4 Impact and risk treatment

7.3.4.1 Demonstration of ALARP

The risks and potential effects of the introduction and establishment of IMS during seismic surveys are well understood with legislative requirements and industry agreed good practices to manage risks. The application of recognised good practice is generally considered appropriate to manage the risk.

The Commonwealth Department of Agriculture and Water Resources (DAWR) is the lead agency for management of ballast water and sediments on international vessels and administers the mandatory Australian Ballast Water Management Requirements (DAWR 2017) under the Biosecurity Act 2015. For the petroleum industry, it regulates the condition of vessels and drill rigs entering Australian waters with regard to ballast water and hull fouling. The regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the biosecurity officers.

Under these arrangements, all vessels that have travelled from international waters are obliged to assess and manage their ballast water in accordance with the DAWR requirements. These arrangements prohibit the discharge of high-risk ballast water within Australian territorial seas (within 12 NM of Australian territories) including Australian ports. It is also recommended by DAWR that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. Where the cost of implementing the additional control measures is disproportionate to the benefit gained, they have not been adopted.

CGG will undertake a biofouling risk assessment of the survey vessels and equipment to determine whether the vessels should be either cleaned (hull, niches, workboat and equipment), or can be cleared as a low risk of introducing marine pest species. The risk assessment will follow the recommended approach of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009). The risk assessment will be conducted prior to vessel entry into Australian waters, or mobilisation to the Acquisition Area if the vessel is sourced from within Australian waters. If the risk assessment indicates an unacceptable risk of introducing marine species, CGG will require an inspection and clearance to be conducted.

Submersible equipment (i.e. wet equipment) will be cleaned and maintained regularly and will undergo routine inspection prior to, and during, the activity (if recovered during the survey). Submersible equipment that has been dry for more than three days will be considered low risk as attached organisms will die through desiccation and exposure. Any biofouling observed during the survey that could be considered a potential IMS will be reported to the DAWR and treated in accordance with DAWR instructions (e.g. killed with a biocide).

CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with introduction and establishment of IMS to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of the potential risk reduction.

Table 7.5 Cost benefit analysis and residual risk evaluation – introduction of IMS

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
• No planned ballast water exchanges, but if required, ballast water exchange will occur >12 NM from land • No discharge of ballast water from survey and support vessels within 12 NM of land without prior authorisation from the DAWR. • Ballast water discharges recorded as >12 NM from land in Ballast Water Management Summary Sheet. • Adherence to Australian Ballast Water Management Requirements (DAWR 2017) under the *Biosecurity Act 2015*.	Benefits outweigh costs, legal requirement	Yes	Yes
Adherence with National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) • Biofouling Record Book kept outlining marine fouling management actions • biofouling risk assessment shows low risk of IMS presence prior to entry into Australian waters • recent hull inspections (if required based on biofouling risk assessment). Survey vessel has a certified anti-fouling coating on the hull and coating is in sound condition.	Benefits outweigh costs; legal requirement	Yes	Yes
Routine cleaning and inspection of all wet equipment (e.g. airgun array, streamer, workboats), consistent with the requirements of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009).	Benefits outweigh costs.	Yes	Yes
ALARP assessment technique – EIA			
Use of freshwater ballast on board the survey vessel to inhibit survival of marine species.	Costs associated with this measure are high, and disproportionate to the benefit.	No	No
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Negligible	Rare	Low

7.3.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the risk of impacts from introduction and establishment of IMS are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

Table 7.6 Acceptability criteria – introduction of IMS

Acceptability criteria	
Vessels operations will be compliant with all maritime law relating to IMS	• Operations will be compliant with the *Biosecurity Act 2015* and the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry. • Predictions are therefore considered acceptable because the Act and national guidance mandates quarantine requirements and risk assessments for vessels to follow prior to entering Australian waters.
No direct effect on EBPC Act listed MNES at a population level.	• There are no EPBC Act listed MNES predicted to be impacted by the risk of impacts from introduction and establishment of IMS.
No predicted direct effect on benthic habitats or communities at an ecosystem level.	• Many of the invasive species found in Port Phillip Bay (~300km west) and near Eden (~140km km north east) prefer habitats <30m water depth in secluded bays. Much of the Operational Area within which the seismic vessel(s) will be confined does not present an environment conducive to IMS survival because vessels are moving largely in deeper oceanic waters (roughly 95% of the Acquisition Area is >50 m water depth and roughly 33% >100m water depth) so likelihood is reduced.
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/ objections, where required. No outstanding merited concerns.	• No specific stakeholder concerns have been raised regarding IMS.

7.3.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for introduction and establishment of IMS are presented below in Table 7.3. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.3.4.1.

Table 7.7 Environmental performance outcomes, standards and measurement criteria for introduction and establishment of IMS

Environmental performance outcome	Environmental performance standard	Measurement criteria
No introduction and/or establishment of IMS into Australian waters	• No planned ballast water exchanges to take place during the activity, but if required, ballast water exchange will occur >12 NM from land (with the exception of an exchange to maintain the stability of the vessel in an emergency) • No discharge of ballast water from survey and support vessels within 12 NM of land without prior authorisation from the DAWR. • Ballast water discharges recorded as >12 NM from land in Ballast Water Management Summary Sheet.	Ballast water exchange records show • No recorded occurrence of a ballast water exchange during the survey (with the exception of an exchange to maintain the stability of the vessel in an emergency) without prior authorisation from the DAWR. • Ballast water discharges recorded as >12 NM from land in Ballast Water Management Summary Sheet

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	• Adherence to Australian Ballast Water Management Requirements (DAWR 2017) to meet the Australian requirements under the *Biosecurity Act 2015*.	• Adherence to Australian Ballast Water Management Requirements (DAWR 2017): Maritime Arrivals Reporting Systems (MARS) is available and approved by the Director of Biosecurity • Approved ballast water management options are in place.
	Survey vessel and supply/escort vessel/s comply with National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) • Biofouling Record Book kept outlining marine fouling management actions • Biofouling risk assessment shows low risk of IMS presence prior to entry into Australian waters • Recent hull inspections (if required based on biofouling risk assessment) • Survey vessel has a certified anti-fouling coating on the hull and coating is in sound condition. Anti-fouling system certification is in place in accordance with AMSA Marine Order Part 98 (Anti-fouling systems).	• Prior to survey sight operational history since last dry-docking, cleaning, anti-fouling renewal. • Biofouling risk assessment report confirming survey vessel poses low risk of introducing IMS. • Prior to survey a copy of the International Anti-fouling System Certificate is sighted and is in date.
	Routine cleaning and inspection of submersible equipment (airgun array, streamers, tail buoys), consistent with the requirements of the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009).	Evidence / records confirm submersible equipment inspected and found free of biofouling prior to commencing the activity. In the event that biofouling is observed on equipment, it is cleaning and a record of the type of cleaning is kept.

7.4 Risk 3: Seabed disturbance – accidental loss of solid materials and emergency anchoring

7.4.1 Identification of hazard and extent

Hazard	During normal operations, the survey vessel will tow eight to 12 seismic streamers with a maximum length of 7,050 m, at approximately 4.5 to 5knots (8 to 9.3 km/h). Should a seismic streamer become detached from the survey vessel or drag on the seabed it has the potential to cause minor physical damage to benthic habitats. Lost streamers would be recovered where practicable and safe to do so. Non-hazardous and hazardous solid wastes (i.e. dropped objects) may be released by accidentally dropping objects overboard (e.g. tools, streamer depth controllers) due to human error, equipment failure or adverse weather. Under normal operations, no anchoring will be undertaken by the seismic and support vessels within the Acquisition Area. Unplanned anchoring could occur in the event of an emergency to maintain the safety of the vessel and crew. Anchoring may result in localised disturbance to the benthic environment in contact with the anchor and anchor chain or inadvertently anchoring over shipwrecks or pipelines. The extent of disturbance will depend on the nature of the seabed and the area disturbed.
Extent	Operational Area
Duration	Continuous during survey. Start mid – January to end July

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7.4.2 Levels of acceptable risk

The risk of adverse effects on marine receptors caused by accidental loss of solid materials from vessels or emergency anchoring will be acceptable when the levels of acceptability are met as described below

- the seismic survey impacts from accidental loss of solid materials will be short term
- vessel operations will be compliant with all maritime law relating to waste management and good practice regarding lifting loads
- no predicted direct effect on EBPC Act listed MNES at a population level
- no predicted direct effect on Big Horseshoe Canyons or Eden Upwelling values
- no predicted loss or disturbance to shipwrecks or pipelines from emergency anchoring
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.

7.4.3 Risk and impact analysis and evaluation on benthic habitats from the loss of solid materials and anchoring

Risk	The known and potential environmental impact of seabed disturbance are • temporary smothering / displacement of a small area of seabed habitat • disturbance to unmarked shipwrecks.		
Potential effects	Dragging of streamers along the seabed may occur in the event that a streamer becomes damaged and sinks to the sea floor while the vessel is in motion. Dragging of the streamer may result in localised physical disturbance of substrates, benthic habitats and communities, however, given that and the absence of any emergent features, the risk of anything more than short-term effects are unlikely. The seismic vessel's operating procedures require a minimum clearance requirement of approximately 10 m between the sea floor and the deepest point on the streamer. Due to the water depth of the operational area (minimum depth of 36m m) the streamer will never be closer than about 18-30m above the seabed and will maintain a tow depth of <20 m below the sea surface (streamers typically 6-18m below surface). The Big Horseshoe Canyon has steep, rocky slopes that provide hard substrate habitat for attached large megafauna. Sponges and other habitat forming species provide structural refuges for benthic fishes, including the commercially important pink ling. The operational area overlaps the westernmost extent of the KEF feature, which extends in a Y shape to the east. At 1500m depth, and with steep rocky sides the area is impractical for anchoring and will not snag streamers. There is one protected shipwreck with an exclusion zone within the Operational Area (Glenelg at 75m water depth) mapped in Figure 4.24. In the event of loss of a streamer, the streamers are fitted with pressure-activated, self-inflating buoys that are designed to bring the equipment to the surface if lost accidentally. As the equipment sinks, it passes a certain water depth at which point the buoys inflate and bring the equipment back to the surface. Once at the surface the survey or support vessel will recover the streamer. Smaller items lost overboard, or larger items as they break down, may be ingested by mobile fauna such as turtles and cetaceans. However, the probability of this material being accidentally released is rare in the event that the vessel Garbage Management Plan (GMP) is followed correctly. The survey and supply/escort vessels will use thrusters to maintain position and will not need to anchor unless in an emergency. Should the seismic vessel lose use of the thrusters, the escort/supply will immediately tow it to safety. Should a support/escort vessel lose power, it will be towed to safety by the second support/escort vessel or the seismic vessels. In the event of anchoring, seabed disturbance will be created at the anchor location and there is likely to be some associated anchor chain drag. There will be no emergency anchoring over the Big Horseshoe Canyon due to the water depth and steep sides. None of the benthic habitats in the area are particularly susceptible to physical disturbance. In the event of loss of a seismic streamer / unplanned anchoring, potential environmental effects will be limited to physical disturbance of substrates, benthic habitats and communities in a localised area (i.e. immediate footprint of the disturbance), with only short-term effects on communities in the disturbance footprint and no effects on ecosystem function.		
Inherent risk	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

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7.4.4 Impact and risk treatment

7.4.4.1 Demonstration of ALARP

The risks relating to seabed disturbance from loss of solid materials are relatively well understood. In general the application of recognised good practice is considered appropriate to manage the risks. However, the assessment has also specifically considered the site-specific nature and scale of the risk on sensitive receptors such as the Big Horseshoe Canyon.

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with seabed disturbance from loss of solid objects to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of the potential risk reduction.

Table 7.8 Cost benefit analysis and residual evaluation – accidental loss of solids

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
Operational procedures will be in place on board the seismic vessel for deployment and retrieval of towed equipment on board, to reduce potential for steamer loss	Benefits outweigh costs	Yes	Yes
Streamers equipped with streamer recovery devices (SRDs) and buoys designed to bring the equipment to the surface if lost accidentally and facilitate recovery.	Benefits outweigh costs	Yes	Yes
Any lost equipment will be recovered where safe and practicable to do so.	Benefits outweigh costs	Yes	Yes
GMP provides direction and specifications for waste storage/handling equipment, waste storage containers equivalent to internationally recognised MARPOL 73/78 Annex V	Benefits outweigh costs	Yes	Yes
All waste receptacles in locations with potential for overboard waste loss, covered with tightly fitting, secure lids or netting to prevent any solid wastes from blowing overboard	Benefits outweigh costs	Yes	Yes
AMSA and AHO to be advised of the loss of large items of buoyant waste (potential navigational hazards)	Benefits outweigh costs	Yes	Yes
Any accidental release of significant wastes to the marine environment will be recovered where safe and practicable to do so.	Benefits outweigh costs	Yes	Yes
ALARP assessment technique – EIA			
In the event of emergency anchoring all measures will be taken to avoid the canyon heads of the Big Horseshoe Canyon, and any shipwrecks, without compromising vessel or personnel safety	Benefits outweigh costs	Yes	Yes
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Minor	Rare	Low

7.4.4.2 Demonstration of acceptability

Given the nature and scale of the activity, CGG consider that the risk of impacts from seabed disturbance due to loss of solid materials are of an acceptable level as the predicted impacts are below the defined acceptable levels of impact as described below.

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Table 7.9 Acceptability criteria – accidental loss of solids

Acceptability Criteria	
The seismic survey impacts from accidental loss of solid materials will be short term	• The Gippsland MSS is planned to start mid -January and be completed by end July. Downtime during this period required to account for weather, stakeholder interactions and marine fauna management, so it is possible that it could be completed in a shorter space of time.
Vessel operations will be compliant with all maritime law relating to waste management	• Operations will be compliant with the vessel's Garbage Management Plan (required under MARPOL 73/78) which if applied correctly will prevent accidental loss of solid objects.
No direct effect on EBPC Act listed MNES at a population level	• There are no EPBC Act listed MNES predicted to be impacted by the risk of impacts from accidental loss of solid materials. In addition, the Operational Area is largely located in deeper waters (roughly 95% of the Acquisition Area is in waters >50m water depth and 33% >100m) where surface discharges are unlikely to impact the benthic habitats, limiting potential impacts on dependent MNES. No predicted population level effects
No direct effect on Big Horseshoe Canyon KEF values	• Due to the depth of the sensitive areas of the Canyon (~1500 m), the loss of large objects (e.g. streamer) will be unlikely to impact the Canyon seabed. Emergency anchoring is most unlikely given the depth and steep sides making the area unfavourable. • Streamers will be recovered through activation of floatation device, then retrieved back to support or seismic vessels.
No loss or disturbance to shipwrecks or pipelines from emergency anchoring	• One protected shipwreck (Glenelg) with an exclusion zone within the Operational Area -at around 75m water depths.3 other wrecks >75 years old lie within the Operational Area. All known shipwrecks within the Operational Area will be marked on all navigation charts to ensure emergency anchoring avoids them. • The support/escort vessels will immediately assist the seismic vessels should the seismic vessels lose use of the thrusters, and likewise the support vessels will assist each other should either lose power. • Locations of pipelines will be monitored on vessel navigation charts so they can be actively avoided in emergency anchoring
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns	• No specific stakeholder concerns have been raised regarding seabed disturbance from equipment loss / emergency anchoring.

7.4.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for seabed disturbance from accidental loss of solid materials are presented below in Table 7.9. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.4.4.1.

Table 7.10 Environmental performance outcomes, standards and measurement criteria for seabed disturbance (accidental loss of solid materials)

Environmental performance outcome	Environmental performance standard	Measurement criteria
No loss or disturbance to benthic habitats pipelines or shipwrecks due loss of equipment or emergency anchoring	Operational procedures will be in place on board the seismic vessel for deployment and retrieval of towed equipment on board	Vessel inspections show evidence of implementing CGG procedure for streamer retrieval and recovery
	No planned anchoring during the survey unless in the event of an emergency.	Vessel log indicates vessel did not anchor in the Acquisition Area.
	Streamers equipped with Streamer Recovery Device (SRDs) designed to bring the equipment to the surface if lost accidentally. The tail of each streamer has an RGPS tailbuoy. If a streamer is lost then the RGPS position of the tailbuoy combined with the visual presence of the SRDs would be used to locate and retrieve it. The sources are all suspended from floats and each float will be fitted with an RGPS unit.	Records demonstrate that streamers are equipped with SRDs set to auto-inflate at less than actual water depth and in good working order
	Streamers not to be closer than 10m from the seabed at all time	Data from survey show the tow depth was at least 10 m above the seabed.
	Lost streamer recovery procedure (including shallow water recovery e.g. by grappling) carried on board survey vessel.	Records of streamer loss and recovery by escort vessel (as guided by Streamer Recovery to Support Vessel MAR INS TEN 027E)
	All shipwrecks and pipelines in the Operational Area will be marked on vessel navigation systems and actively avoided during emergency anchoring	Vessel logs show areas around shipwrecks and pipelines avoided during emergency anchoring
	Any lost equipment will be recovered where safe and practicable to do so.	Records of streamer loss will be documented
		Records show equipment lost to the marine environment and attempts to recover lost towed equipment
No loss or disturbance to benthic habitats due dropped objects	Compliance with MARPOL 73/78 Annex V as applied in Australia Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Part IIIB, Division 2, Section 26D) and have a vessel GMP (Regulation 10.2) that must contain as a minimum • Waste handling equipment, waste storage containers, and closed bins appropriate to the type and volume of waste will be provided at waste storage areas.	Vessel Garbage Management Plan (GMP) is carried on board and complies with MARPOL requirements. Vessel audit/inspection confirms waste is managed in accordance with the Garbage Management Plan (GMP).
		Vessel audit/inspection shows that a waste manifest (or Garbage Record Book) is used to track all waste types and volumes transferred to support vessels for onshore disposal.
		Garbage Record Book records verify that all hazardous waste is segregated.
		Vessel audit/inspection shows evidence of waste handling equipment, waste storage containers available at waste storage areas on board the survey vessel
		Records of any loss of wastes are documented and corrective actions identified and undertaken.

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	All waste receptacles in locations with potential for overboard waste loss, covered with tightly fitting, secure lids or netting to prevent any solid wastes from blowing overboard	Vessel audit/inspection of waste bins in locations with potential for overboard waste loss confirms secure tightly fitting lids or netting stored to prevent overboard loss.
	AMSA and AHO to be advised of the loss of large items of buoyant waste (potential navigational hazards)	Response from AMSA and AHO confirms receipt of notification, in the event of an incident.
	All large, bulky items are securely fastened for the voyage intended to prevent loss at sea.	Pre-departure deck inspection indicates bulky goods are securely sea-fastened and checked regularly.
Avoid objects being dropped overboard	The crane handling and transfer procedure is in place and implemented by crane operators (and others, such as dogmen) to prevent dropped objects.	Completed handling and transfer procedure checklist, PTWs and/or risk assessments verify that the procedure is implemented prior to each transfer.
	The crane operators are trained to be competent in the handling and transfer procedure to prevent dropped objects.	Training records verify that crane operators are trained in the loading and unloading procedure.
	Visual inspection of lifting gear is undertaken every quarter by a qualified competent person (e.g., maritime officer) and lifting gear is tested regularly in line with the vessel PMS.	Inspection of PMS records and Lifting Register verifies that inspections and testing have been conducted to schedule.

7.5 Risk 4: accidental release – hazardous materials and solid objects

7.5.1 Identification of hazard and extent

Hazard	As part of normal seismic survey vessel operations, a range of chemicals and oily substances (such as lubricating oils, wastes and hydraulic fluid) will be stored on the deck of the survey and support vessels. Hydraulic fluid is also contained in reservoirs, hoses and lines on hydraulic equipment, such as cranes or winches. There is potential for accidental loss of these fluids through operator error or machinery malfunction. In the event of an accidental on-board spill of oily substances or chemicals (such as a containment leak), there is potential for the spill to be washed overboard and released into the marine environment. Chemicals (e.g. solvents and detergents) will typically be stored in small containers of 5 to 25 L capacity with a secondary containment measure (e.g. bunds) in place to contain leaks or spills. Chemicals are stored in internal areas where any leak or spill would be retained on board and cleaned up in accordance with the SOPEP and associated spill clean-up procedures. For a spill on deck to result in a release to the marine environment, there would need to be an un-confined spill that flowed overboard. Given that the use of oils or other chemicals on deck would be largely confined to bunded areas, this is highly unlikely to occur and would require the failure of a bund or extreme weather conditions. The realistic worst-case spill volume would be typically 25 L (largest capacity container) should a chemical spill in an unconfined area eventuate in release to the marine environment, or a drum is compromised during handling. Loss of a drum or other large container used for storage on deck could lead to a floating object (if buoyant) or debris on the seabed.
Extent	Operational Area
Duration	Continuous during survey. Start mid – January to end July.

7.5.2 Levels of acceptable risk

The risk of adverse effects on marine receptors caused by accidental loss of hazardous materials (oily wastes and chemicals) from vessels will be acceptable when the levels of acceptability are met as described below

- the impacts from accidental loss of hazardous materials from the seismic survey will be short term
- vessel operations will be compliant with all maritime law relating to hazardous materials management
- no predicted direct effect on EBPC Act listed MNES at a population level
- stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.

7.5.3 Risk and impact analysis and evaluation of the accidental release of hazardous materials and solid objects through the Gippsland MSS

Risk	The known and potential environmental impacts from the loss of hazardous and non-hazardous wastes and chemicals include • temporary localised decline in water and sediment quality • temporary toxicity to marine fauna • creating navigation hazards for other vessels if object floats • providing “rafting” opportunities for marine species (including potential IMS). Typically, hazardous materials are stored in accordance with the vessel Garbage Management Plan (GMP) and are not stored on the deck of vessels; therefore, these items are unlikely to be accidentally lost overboard. However, should this occur, then benthic communities may be affected by toxicity
Potential effects	**Water quality and marine habitats and communities** Should accidental disposal of such wastes occur, the effects will be dependent upon the receiving environment and the nature of the hazardous material. There is the potential for fluid storage containers to leak and release their contents on the deck of the vessel. The spilled liquids may be washed overboard or spill overboard in adverse weather. The sea floor of the Gippsland Basin is largely sandy with outcrops of reef. Macroalgal communities are not common on subtidal reefs in east Gippsland, possibly due to exposure, poor light levels and abrasion by moving sand and sand/silt habitats in deeper waters, where the majority of the Operational Area is located, and is not particularly sensitive to physical disturbance from small amounts of hazardous wastes. Such wastes (e.g. oily wastes) and chemical spills could however cause localised decreases in water quality if accidentally released in significant quantities, which could indirectly affect marine flora and fauna. In the event a loss to sea does occur, impacts to the marine environment would be minimal, due to the small potential volumes released, and the fact that spilt oil and chemicals will rapidly evaporate, disperse and weather. In the open ocean environment, the spilled liquids would be rapidly dispersed and diluted to concentrations at which they are. The survey is located in offshore waters 34 to 2,676 m deep with roughly 5% of the area being shallow water<50m. Water circulation in the vicinity of the Operational Area are well mixed by winds and tides. Release of small volumes of oily waste or chemicals would result in a localised adverse effect on water quality. Any effects to pelagic species would be extremely localised and temporary (short term) and is unlikely to have any impact on species diversity or abundance within these areas. Given the small volumes involved (maximum container size of typically 25 L) any impacts on the marine environment are likely to be limited to short-term toxicity effects on biota and reduced water quality. The high energy nature of the receiving environment will facilitate rapid dispersion and dilution to non-toxic concentrations.
	Protected species The Operational Area overlaps with the pygmy blue whale foraging BIA and lies adjacent to the southern right whale migratory BIA (Figure B). Due to the proposed timing of the survey from mid-January to end July, it is likely that pygmy blue whales and humpbacks could occur in the Operational Area as may southern right (migrating or resting on migration) which are known to stay within the shallower coastal waters (<10 m depth) once they arrive at the start of the aggregation/calving season in May off Portland and Warrnambool (500km to the west), staying until they leave in October/Nov. It is less likely that

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	humpback whales would occur in large numbers as their aggregation area is roughly 70 km north-east off Eden and their migratory route to Antarctic waters from the NSW coast is broad and unconfined. Marine turtles (leatherback and green turtles) may be in the Operational Area but likely in small numbers in the shallows as there are no known BIA in the region. Great white shark may breed and forage in the Operational area. Hazardous items may be mistakenly ingested and cause discomfort or adverse health effects for individuals. However, this would be limited to a small number of individual animals and ingesting small volumes of hazardous material; no lethal effects and no population effects would be expected. Vessels operations will be compliant with all maritime law relating to hazardous materials management No predicted direct effect on EBPC Act listed MNES at a population level. Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/objections, where required. No outstanding merited concerns.		
Inherent risk	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

7.5.4 Impact and risk treatment

7.5.4.1 Demonstration of ALARP

The risks and potential effects to due to accidental release of hazardous materials are well understood, with legislative requirements and industry agreed good practices to manage risks. In general, the application of recognised good practice is considered appropriate to manage the risk, particularly due to the distance of the Operational Area from sensitive receptors and the well-mixed offshore marine waters. In addition, the assessment has also considered the site-specific nature and scale of the risk (e.g. to sensitive receptors such foraging pygmy blue whales and migrating southern right and pygmy blue whales).

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are not disproportionate to the sacrifice (e.g. cost) of implementation. CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with seabed disturbance from loss of solid objects to ALARP. There are no other controls measures that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of the potential risk reduction.

Table 7.11 Cost benefit analysis and residual risk evaluation – loss of hazardous and non-hazardous material

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
Compliance with internationally recognised standards such as stipulated in MARPOL 73/78 Annex V	Benefits outweigh costs, legal requirement.	Yes	Yes
Solid (no fluid-filled) streamer to be used, reducing potential for toxicity from lost streamer.	Benefits outweigh costs. Solid streamers used	Yes	Yes
Survey vessel crew will be inducted in waste management and made familiar with the vessel GMP.	Benefits outweigh costs	Yes	Yes
Compliance with internationally recognised MARPOL 73/78 Annex I and national standards as per AMSA Marine Order – Part 91 Marine Pollution Prevention – Oil):	Benefits outweigh costs, legal requirement.	Yes	Yes
Hazardous materials will be stored with a form of secondary containment to contain leaks or spills in accordance with their MSDS.	Benefits outweigh costs	Yes	Yes
Deck scupper plugs on board vessel.	Benefits outweigh costs	Yes	Yes

Control measures	Cost benefit analysis	Risk reduction	Control adopted
Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will have as a minimum primary bunding (e.g. deck edge lips or up-stands)	Benefits outweigh costs	Yes	Yes
Spill response bins/kits are maintained and located in close proximity to hydrocarbon storage areas and deck areas for spill recovery / containment	Benefits outweigh costs	Yes	Yes
Spills from fixed internal equipment, such as engines and generators, are enclosed and spills captured via bilges that drain via the oil in water (OIW) separator.	Benefits outweigh costs	Yes	Yes
Minor oil/lubricant spills will be mopped up immediately with absorbent materials that will be stored in covered containers and disposed of onshore as hazardous waste in accordance with the vessel SOPEP	Benefits outweigh costs	Yes	Yes
Survey vessel crew are inducted in their responsibilities for chemical storage and handling and under the SOPEP	Benefits outweigh costs	Yes	Yes
Loose objects on deck will be secured to prevent loss overboard	Benefits outweigh costs	Yes	Yes
ALARP assessment technique – EIA			
Below-deck storage of all hydrocarbons and chemicals	Access to chemicals and oils on deck is required during operations Chemicals would still need to be brought onto deck when required during operations. This measure would inhibit operations; costs outweigh benefits.	Yes (limited)	No
A reduction in the volumes of chemicals and hydrocarbons stored on board the vessel	Chemical transfer during operations would be required, which has associated risks. Could also result in delays to operations Costs outweigh benefits due to additional risks associated with transfer of chemicals during the survey.	No	No
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Minor	Rare	Low

7.5.4.2 Demonstration of acceptability

This risk of adverse effects from an accidental spill resulting from a bunkering incident is therefore considered acceptable because predictions are below the defined levels of acceptability as described below.

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Table 7.12 Acceptability criteria – loss of hazardous and non-hazardous material

Acceptability Criteria	
The impacts from accidental loss of hazardous materials from the seismic survey will be short term	• The Gippsland MSS is planned to commence mid-January through to end July with downtime during that period to account for weather, stakeholder interactions and marine fauna management; It is possible that it could be completed in a shorter space of time. All adverse impacts arising from accidental spills are predicted to be short term with full recovery.
Vessel operations will be compliant with all maritime law relating to hazardous materials management	• Operations will be compliant with the MARPOL 73/78 and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983.* • Predictions are therefore considered acceptable because MARPOL requires seismic vessel to have a GMP and SOPEP in place, which if applied correctly will prevent accidental loss of solid objects and pollution events
No direct effect on EBPC Act listed MNES at a population level.	• There are no EPBC Act listed MNES predicted to be impacted by the risk of impacts from accidental loss hazardous materials. In addition, roughly 95% the operational area is located in deeper oceanic waters (>50m and roughly 33% > 100 m water depth) in the open ocean where spills would disperse and diffuse rapidly in the surface waters, reducing potential water column effects. • No more than possible incidental effects to flora and fauna in the local vicinity of the discharge or footprint of disturbance, and no impact on critical activities or habitats. No population level effects. • Absence of areas of sensitive habitats susceptible to long-term effects, recovery of any areas disturbed with no medium to long-term effects on diversity. • Small potential volumes and the nature of waste results in no predicted effects to the east of Eden Upwelling, Big Horseshoe Canyons, the East Gippsland or Beagle CMR conservation values due to separation distances.
Stakeholder concerns/objections received have been merit assessed and control measures developed to address merited concerns/ objections, where required. No outstanding merited concerns	• No specific stakeholder concerns have been raised regarding loss of hazardous or non-hazardous substances

7.5.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for accidental release of hazardous materials are presented below in Table 7.5. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Table 7.5.4.1.

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Table 7.13 Environmental performance outcomes, standards and measurement criteria for accidental release of hazardous materials

Environmental performance outcome	Environmental performance standard	Measurement criteria
Hazardous and non-hazardous wastes are stored, handled, disposed of and retrieved in a manner that prevents marine pollution.	Compliance with MARPOL 73/78 Annex V as applied in Australia Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Part IIIB, Division 2, Section 26D) and have a vessel GMP (Regulation 10.2)	Vessel Garbage Management Plan (GMP) is carried on board and complies with MARPOL requirements. Vessel audit/inspection confirms waste is managed in accordance with the Garbage Management Plan (GMP).
	Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS.	Vessel audit/inspection confirms relevant MSDS' for hazardous waste types are on board the vessel and are being followed.
	Vessel survey crew will be inducted in waste management procedures and made familiar with the vessel GMP.	Records show that the project induction includes information on waste management requirements, and sign-off register indicates all personnel on board have received the induction.
	Solid streamers to be used	Inspection prior to commencement of survey confirms solid streamers used.
Chemicals or oily wastes are stored, handled, disposed and cleaned up in a manner that prevents marine pollution.	Compliance with MARPOL 73/78 Annex I (as applied in Australia under Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983)); and AMSA Marine Order – Part 91 Marine Pollution Prevention – Oil): • current Shipboard Oil Pollution Emergency Plan (SOPEP) in place • survey vessel holds a valid IOPP certificate, where required, under vessel class	Vessel audit/inspection confirms SOPEP on board survey vessel Vessel audit/inspection demonstrate the survey vessel holds an IOPP certificate, if required under vessel class Vessel audit/inspection demonstrate that SOPEP drills have taken place
	Chemicals and/or hydrocarbons on deck will be stored with a form of secondary containment measure to contain leaks or spills in accordance with their MSDS.	Inspection during survey records demonstrate that hydrocarbon storage is designed and maintained to prevent and contain deck spills entering the marine environment.
	Hydrocarbon and chemical storage areas (e.g. engine room) are bunded and/or stored safely to prevent spills overboard and drain to the bilge water tank.	Vessel audit/inspection verifies that the main deck and hydrocarbon and chemical storage areas are bunded and/or stored safely to prevent spills overboard.
	Hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS.	Vessel audit/inspection indicates that hazardous wastes materials are stored in accordance with the corresponding MSDS.

Environmental performance outcome	Environmental performance standard	Measurement criteria
	All hazardous substances will be included in the Material Safety Data Sheet (MSDS) registers. These registers are available in key locations of the vessels (e.g. bridge, chemical locker) and kept up to date so that chemical spills to deck can be safely managed.	Vessel audit/inspection shows that MSDS' for all hazardous waste types are available on board.
		Vessel audit/inspection shows that MSDS registers are in key locations (i.e. where chemicals are stored) and a relevant crew member is responsible for ensuring they are kept up to date.
	Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will have as a minimum primary bunding (i.e. deck edge lips or up-stands)	Vessel audit/inspection demonstrates that all equipment located on deck utilising hydraulic fluids have primary bunding
	Spills from fixed equipment, such as engines and generators, are enclosed and spills captured via bilges that drain via the OIW separator.	Vessel audit/inspection confirms oily water from machinery spaces collects in bilges for treating in the OWS to MARPOL requirements.
	Minor oil/lubricant spills will be mopped up immediately with absorbent materials that will be disposed of onshore as hazardous waste in accordance with the vessel SOPEP	Vessel audit/inspection shows that response measures for minor oil/lubricant spills were carried out in accordance with the SOPEP, and contaminated clean-up wastes stored on board in covered bins prior to onshore disposal at a licensed waste management facility.
		Vessel audit/inspection of incident reports for minor spills to the marine environment.
	Survey vessel crew are inducted in their responsibilities under the SOPEP and is competent in spill response and has appropriate response resources in order to prevent hydrocarbon or chemical spills discharging overboard.	Vessel audit/inspection show that the project induction includes responsibilities of survey crew under the SOPEP and that regular spill drills are being carried out.
		Incident reports record lessons learnt, and corrective measures are being implemented on board.
	Scupper plugs or equivalent drainage control measures are readily available to the deck crew so that deck drains can be blocked in the event of a hydrocarbon or chemical spill on deck to prevent or minimise discharge to the sea.	Vessel audit/inspection verifies that scupper plugs (or equivalent) are available on the main deck.
	Spill response kits are available in relevant locations around each vessel, are fully stocked and used in the event of a spill to deck to prevent or minimise discharge overboard.	Vessel audit/inspection verifies that spill response kits are available in relevant locations in accordance with vessel plans.
Avoid objects being dropped overboard	The crane handling and transfer procedure is in place and implemented by crane operators (and other such as dogmen) to prevent dropped objects	Completed handling and transfer procedure checklist, PTW verify the procedure is undertaken prior to each transfer

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7.6 Risk 5 – accidental oil spill (refuelling)

7.6.1 Identification of hazard and extent

Hazard	The survey vessel(s) will be fuelled by marine gas oil (MGO) (or marine diesel oil, MDO) and will need to refuel at sea during the survey. Therefore, there is potential for an accidental release of fuel during refuelling if, for example, a typical refuelling hose were to break. Also deck equipment may require diesel (e.g. deck generator). If the hose was full and the entire contents were lost to the sea, this could result in a spill of approximately 125 L of MGO or diesel (a Level 1 spill scenario). Dry break couplings would prevent any more than the hose volume being spilled in the event of hose failure. In reality, a more likely scenario is that a minor leak from a damaged hose would be detected first and the situation rectified before the hose could burst. An MGO/diesel spill as a result of a bunkering spill was not considered as the worst-case credible hydrocarbon spill risk to set the worst-case Environment that May Be Affected (EMBA) for the CGG Gippsland MSS. The worst-case Oil EMBA is discussed in Section 7.7. Spill response risks are addressed in Section 7.8, and therefore not considered in this section.
Extent	Operational Area
Duration	Duration of survey commencing mid – January to end July

7.6.2 Levels of acceptable risk

The risk of adverse effects of a hydrocarbon release resulting from a bunkering incident will be acceptable when:

- There will be no predicted unrecoverable effects on EPBC Act listed MNES.
- Operations will be compliant with maritime law and marine good practice.

7.6.3 Risk and impact analysis and evaluation from accidental oil spill through refuelling during the Gippsland MSS

Risk	The risks and potential effects of a fuel spill from vessels associated with the oil and gas industry has been the subject of much investigation, and it is accepted that the risks are much less than those associated with spills from, for example, exploratory and operational oil wells. In general, the risks are well understood, with legislative requirements and industry agreed good practices to manage risks. The application of recognised good practice is considered appropriate to manage the risk; particularly due to the well-mixed offshore marine waters of the Operational Area that would hasten the natural weathering and dispersion of the plume. In addition, the assessment has considered the site-specific nature and scale of the risk and the environmental values and sensitivities (e.g. presence of habitats susceptible to medium- to long-term effects and likely encounters with marine fauna). No direct concerns related to accidental hydrocarbon spills were raised by stakeholders during the consultation process.
Potential effects	In the event of an MGO or diesel spill, surface slicks and plumes of entrained hydrocarbons can cause a localised reduction in water quality and may have toxic effects on marine fauna and flora. Potentially affected biota includes plankton, fish, seabirds, cetaceans, turtles that may come into contact with a surface hydrocarbon slick. If surface slicks or entrained and dissolved hydrocarbons were to contact shallow waters or emergent features adjacent to the operational area, then a range of benthic habitats and communities could be at risk of impacts. The environmental values and sensitivities within the Operational Area that could be affected in the event of a spill are • water quality • protected species • open water pelagic habitats. The majority of spilled fuel will be concentrated in surface waters, either as a surface slick or as entrained oil in near surface waters. The elevated concentrations of dissolved aromatic hydrocarbons associated with surface diesel/MGO slicks would likely cause a localised reduction in water quality and may be acutely toxic to organisms present in surface waters in the area of a spill. However, ADIOS2 modelling infers that

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	the surface slick would travel up to around 8 km before weathering makes the slick undetectable, which means it would not reach the coast from the Operational Area. Commercial fishing and shipping in the area could potentially be affected for a short period (<5 h, based on ADIOS2 modelling). Due to the water depth being >50 m deep for roughly 95% of the Acquisition Area (and >100m for roughly 33% of the Acquisition Area), the seabed is highly unlikely to be exposed to impacts from a 125 L instantaneous surface hydrocarbon release at concentrations that may cause adverse effects greater than temporary localised degradation of water quality. Details of impact assessment from a large hydrocarbon spill are provided in Section 7.7. Once background water quality conditions have re-established, the plankton community will recover in the short term by reproduction by survivors or migration of plankton from unaffected areas (Volkman et al., 2004). Fish, birds, cetaceans and turtle are mobile and able to avoid areas of elevated hydrocarbons or tolerate temporary reductions in water quality so as not to be impacted on population levels. Any impacts of a bunkering hydrocarbon spill to planktonic communities in the pelagic environment would be short term given the rate at which the spill would disperse and weather, and the dynamic nature of planktonic communities (Davenport et al. 1982).		
Inherent risk	Consequence	Likelihood	Risk Ranking
	Negligible	Possible	Low

7.6.4 Impact and risk treatment

7.6.4.1 Demonstration of ALARP

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are practicable – and hence not disproportionate to the sacrifice (e.g. cost) of implementation Control measures have not been adopted where the cost of implementation is disproportionate to the benefit gained.

CGG considers the adopted controls to be appropriate in reducing the environmental risks and impacts associated with accidental oil spill from refuelling to ALARP. No other controls measures have been identified that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of risk reduction.

Table 7.14 Cost benefit analysis and residual risk evaluation – refuelling spill

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
Undertaking bunkering activities during daylight hours	Benefits outweigh costs	Yes	Yes
Refuelling of vessels will be undertaken under favourable wind and sea conditions as determined by the Vessel Master	Benefits outweigh costs	Yes	Yes
Vessels will refuel in the offshore Operational Area to minimise impacts to shorelines or shallow water receptors	Modelling shows a bunkering spill may travel about 8 km. All the Operational Area is >13 km offshore, so spills will not reach the shore. Commercial traffic is heavier in the Offshore Operational Area, so collision risk is increased. Thus refuelling outside heavy traffic zones is safer from collisions with third party vessels, albeit closer to shore. No additional benefit by being further offshore.	No	Refuel only out of shipping lanes and high traffic areas
All valves and flexible transfer hoses checked for integrity prior to use; dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses	Benefits outweigh costs	Yes	Yes

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – EIA			
Avoiding refuelling at sea by bringing seismic vessels to port for refuelling	Costs disproportionate to the benefits gained	Yes	No
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Negligible	Unlikely	Low

7.6.4.2 Demonstration of acceptability

This risk of adverse effects from an accidental spill resulting from a bunkering incident is therefore considered acceptable because predictions are below the defined levels of acceptability as described below.

Table 7.15 Acceptability criteria – refuelling spill

Acceptability Criteria	
There will be no unrecoverable effects on EPBC Act listed MNES	• Should a spill occur, predictions from ADIOS2 indicate that an unmitigated surface slick resulting from an instantaneous 125 L diesel/MGO bunkering spill will persist for around 5 hours, with a potential distance travelled during that time of up to 8 km. The vessel SOPEP will be implemented to mitigate risk. • The risk of exposure at levels that may cause unrecoverable impacts to MNES is predicted to be unlikely, and therefore considered acceptable because • the risk of interaction with the surface slick is low (small spatial area, restricted to surface waters, low spatial density of MNES) • levels of hydrocarbons with potential to cause ecological harm are not persistent – diesel/MGO rapidly spreads to a very thin sheen (dynamic viscosity of MGO : 4 @ 25 °C, diesel :4.3 @ 50 °C) and will both weather rapidly (typically diesel<5 hr).
Operations are compliant with maritime law	• Operations will be compliant with MARPOL 73/78 Annex I (as applied in Australia under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*)), and AMSA Marine Orders – Part 91 Marine Pollution Prevention – Oil) – and therefore considered acceptable because these Acts and Orders provide marine pollution prevention measures to mitigate risks of spills occurring.

7.6.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for a bunkering incident are presented below in Table 7.16. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.6.4.1

Table 7.16 Environmental performance outcomes, standards and measurement criteria for an accidental oil spill (fuel spill)

Environmental performance outcome	Environmental performance standard	Measurement criteria
No oil spill in sensitive marine environments during the activity	Compliance with MARPOL 73/78 Annex I (as applied in Australia under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*)); and AMSA Marine Orders – Part 91 Marine Pollution Prevention – Oil): • current SOPEP in place • survey vessels hold a valid IOPP Certificate, where required, under vessel class	Records demonstrate the SOPEP is in place on the survey vessel
		Records demonstrate the survey vessel holds an IOPP certificate, if required under vessel class
	The SOPEP and OPEP are approved and tested prior to the survey vessel commencing acquisition (emergency response drills) and can be implemented in the event of a spill	Records demonstrate the SOPEP and OPEP are approved, tested (desktop exercise) and available to relevant persons on the survey vessel
		Records demonstrate that SOPEP/OPEP drills have taken place immediately prior to the start of the survey
	Support vessel(s) will undertake surveillance (during a spill) and manage interactions with other marine users and vessels transiting near the seismic vessel or streamers	Support vessel log confirms vessel is employed for the duration of the activity and manages interactions with other marine users and vessels
	Survey, escort and supply vessels only uses MGO and MDO for fuel and diesel for deck equipment such as cranes.	Bunkering records demonstrate vessels used MGO, MDO and diesel
	Responsibilities of survey crew under the OPEP and SOPEP are communicated to relevant personnel and included as part of the project induction	Records show that the project induction (including induction material) includes responsibilities of survey crew for response and notification protocols under the OPEP and SOPEP
	All relevant crew trained in implementation of the OPEP and SOPEP	Training, induction and competency matrix to confirm that crew have been trained on implementation of the OPEP and SOPEP prior to commencing seismic data acquisition
	Refuelling at sea subject to seismic vessel refuelling procedure • refuelling of vessels will be undertaken under favourable wind and sea conditions as determined by the Vessel Master • refuelling will take place during daylight hours only • Job Hazard Analysis (JHA), bunkering checklist or equivalent in place and reviewed in toolbox meeting before each fuel transfer • both vessels will have a Deck Officer supervising the mooring lines • all re-fuelling equipment, including valves and flexible transfer hoses are checked for integrity prior to use; dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses • communications between the two vessels will be tested by the Vessel Masters prior to bunkering commencing	Copies of relevant seismic vessel procedures and work instructions available onboard vessel. Records kept of the bridge crew and support vessel confirming receipt of the documents
		Records/vessel logs confirm refuelling of vessels undertaken under favourable wind and sea conditions and during daylight hours only
		Records of toolbox meeting prior to each fuel transfer, include completed and review of JHA, bunkering checklist or equivalent
		Visual inspection (as noted in completed bunkering checklist) verifies that mooring lines were installed
		Records shows dry break couplings (or similar) are in place
		All re-fuelling equipment, including valves and flexible hydrocarbon transfer hoses have been inspected for integrity prior to use
	All re-fuelling equipment will be maintained in accordance with the PMS to ensure they are operating to design specifications	PMS records confirm that re-fuelling equipment is maintained to schedule

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7.7 Risk 6 – accidental oil spill (vessel collision/grounding)

7.7.1 Identification of hazard and extent

Hazard	The survey vessels (and escort/supply vessels) will be fuelled with MGO or MDO, carried in separate fuel cells that are inter-connected and isolatable. In the event of an incident such as a catastrophic vessel collision/grounding that ruptured a fuel cell, a significant volume of fuel may be released to the ocean. The total loss of fuel would be reduced by isolating the compromised fuel cell and transferring fuel to adjacent cells. Support and escort vessels will typically have similar or smaller fuel tanks. AMSA's Technical Guidelines for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA 2015a) recommends that the maximum realistic spill scenario for vessel collisions or grounding is the loss of the entire volume of the single largest fuel tank (AMSA 2015). The vessel to be used for the CGG Gippsland MSS has not yet been selected, and so the largest tank in the vessel fleet was used for the purposes of assessing spill risk and identifying appropriate spill response strategies. Consequently, the maximum realistic spill scenario herein is based on the rupture of the largest fuel tank in the fleet with a capacity of 286 m^3 (a Level 2 spill scenario). This is a conservative estimate as the maximum size tank on the likely vessel analogue, the *Geo Coral* is 257m^3, the tanks are never completely filled, some fuel has usually been used and/or some fuel lies below the puncture point and/or the hole may be patched in some manner or pumped to other tanks etc. Modelling allowed for an initial discharge of 75% of the fuel tank volume within the first 20 minutes and the remaining 25% over the next 40 minutes to represent a ruptured tank. Such a fuel spill has been used to set the worst-case EMBA (section 4.1.1). Although this scenario is considered a realistic worst case, it is also an unlikely occurrence given the control measures in place to manage interactions with other users (Section 7.2) and the controls in place to mitigate the loss of fuel in the event of a tank rupture (Section 7.7.4.3). It is, however, credible that a vessel collision could occur due to the vessel traffic in the shipping routes, oil and gas activities and fishing in the area. Approximately 12 vessels per day use the Gippsland Traffic Separation Scheme, with over 90% comprised of cargo vessels, such as container ships and bulk carriers, or tankers) in the vicinity of the southern section of the Acquisition Area (Section 4.6.8). Vessel collision spills make up 11.6% of the marine spills over one tonne, with most of these occurring in ports or other areas where vessels work in close proximity (DNV 2011). Based on a review of the Australian Transport Safety Bureau's marine safety database there are no recorded instances of collisions, grounding or sinking of a seismic vessel or its support vessels in Australian waters in at least the last 30 years (ATSB, 2018). The Australian registered research vessel Rig Seismic grounded on an uncharted reef while engaged in seismic operations in the Philippines in 1992. The vessel suffered only minor damage and it was re-floated without assistance and no pollution occurred. Spill response risks are addressed in Section 7.8. The vessel(s) might be anywhere within the Acquisition Area and buffer zones so an accidental release could occur anywhere within the Operational Area.
Extent	Spill originates in Operational Area, potential to spread to Oil EMBA
Duration	Duration of survey Commencing mid- January to end July

7.7.2 Levels of acceptable risk

The risk of adverse effects from a hydrocarbon release resulting from a vessel collision/grounding will be acceptable when

- There will be no predicted long-term unrecoverable effects on EPBC Act listed MNES, Marine Reserve Management Plan Values and Species Conservation Advice/Recovery plans,
- There will be no predicted long-term unrecoverable effects on fish stocks or commercial fishing
- No specific stakeholder concerns have been raised and are unresolved. There are no outstanding merited concerns
- Operations are compliant with maritime law, OPGGS Act relating to preventing pollution / collisions at sea reporting and responding effectively to spills.

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7.7.3 Risk and impact analysis and evaluation from accidental oil spill associated with vessel collision or grounding for the Gippsland MSS

Risk

The risks and potential effects of a fuel spill from vessels associated with the oil and gas industry have been the subject of much investigation, and it is accepted that the risks are much less than those associated with spills from, for example, exploratory and operational oil wells. In general, the risks are well understood, with legislative requirements and industry agreed good practices to manage risks. The application of recognised good practice is considered appropriate to manage the risk; particularly due to the well-mixed open ocean waters of the Operational Area that would hasten the natural weathering and dispersion of the plume. In addition, the assessment has considered the site-specific nature and scale of the risk and the environmental values and sensitivities (e.g. presence of habitats susceptible to medium- to long-term effects and likely encounters with marine fauna).

A precautionary approach has also been taken in the decision-making process, where the oil spill risk assessment is based upon a worst-case spill scenario of complete loss of the contents of one fuel tank in the event of vessel collision/grounding. Given the extremely low likelihood of two very unlikely events occurring (catastrophic collision/vessel grounding and complete loss of fuel tank) as the defined realistic worst-case spill scenario, the assessment is considered inherently conservative.

The grounding of the vessels is considered unlikely given that no operations will occur in less than 36 m of water, or closer than around 13 km to land. No direct concerns related to accidental hydrocarbon spills were raised by stakeholders during the consultation process.

Potential effects

In the event of a fuel spill, surface slicks and plumes of entrained hydrocarbons can cause a localised reduction in water quality in surface waters, which at specific thresholds and exposure hours may have toxic effects on marine fauna and flora. Potentially affected biota includes plankton, fish (including commercial stocks such as squid and tuna), seabirds, cetaceans and turtles that may come into contact with a surface hydrocarbon slick. If surface slicks or entrained fuel were to contact shallow waters or emergent features adjacent to the operational area, then a range of benthic habitats and communities including threatened communities (such as kelp beds, coastal salt marshes) could be at risk of impacts depending on the location of the spill and tide/weather conditions. Stranded oil can impact coastal parks and reserves, shorelines and public amenities. When considering the risk presented to a specific receptor the following sensitivities were considered (Table 7.18).

Table 7.17 Sensitivity of receptors (low, medium, high) relevant to the Gippsland Oil EMBA

Protected areas	Biota	Socio economic	Coastal habitats
TECs Multi use zones	Macroalgae Plankton Pelagic Fish Benthic habitats Non threatened species Populations well represented regionally Occasional visitors	Remote sandy beaches	Coarse grained sandy beaches Exposed rocky shorelines
KEFS	Marine reptiles Seabirds Shorebirds Populations >1 year to recover Threatened species	Public amenities	Sheltered bays Exposed tidal flats Exposed estuaries Mixed sand and grave beaches
RAMSAR State and Commonwealth Marine Parks/sanctuaries Special purpose zones	Seabirds (MNES, BIA) Shorebirds (MNES, BIA) Cetaceans Pinnipeds Species known to be present at the time susceptible to oiling or take a long time to recover from oiling	Commercial fishing Cultural, recreational Tourist precincts	Mangroves Sheltered tidal flats

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Fuel properties may vary according to the blend of gasoil with heavier feedstocks. A spill of a marine gasoil (MGO) typically used by the *Geo Coral* and supply/escort vessels has been modelled, albeit at a greater volume than the biggest fuel tank onboard. The low dynamic viscosity (4.0 cP at 25°C) (Table 7.18), means the fuel will spread quickly and will thin out to a film; increasing the initial rate of evaporation.

Table 7.18 Physical characteristics of marine fuel

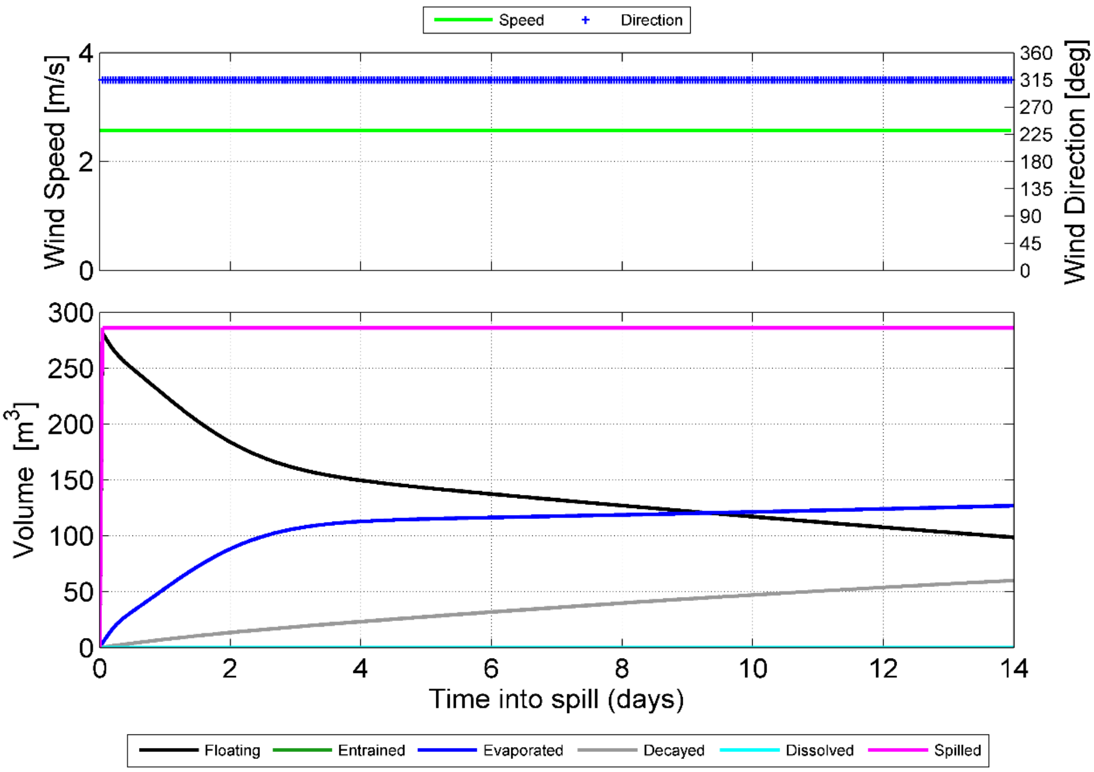
Parameter		Marine gas oil (MDA blend)		
Density (kg/m^3)		829 (at 25 °C)		
API		37.6		
Dynamic viscosity (cP)		4 (at 25 °C)		
Pour point (°C)		-14		
Oil category		Group 2		
Characteristic	**Volatiles (%)**	**Semi-volatiles (%)**	**Low volatiles (%)**	**Residual (%)**
Boiling point (˚C)	<180	180 – 265	265 – 380	>380
Marine Gas Oil	6.0	34.6	54.4	5
	Non-persistent			*Persistent*

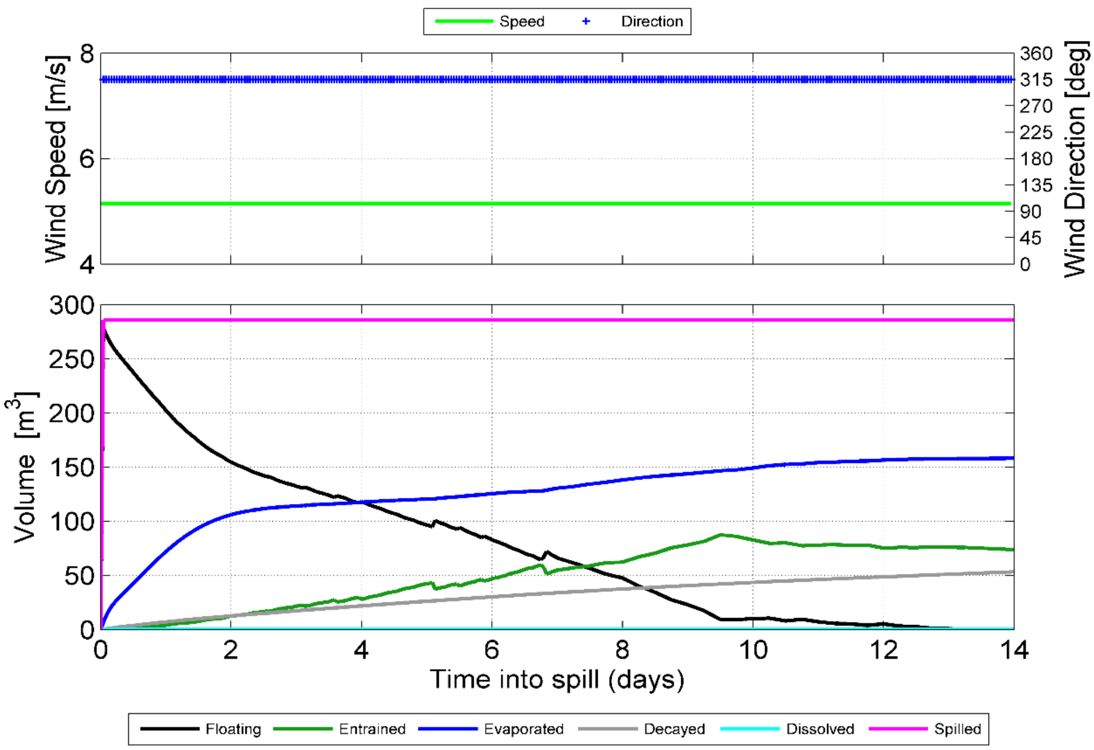
The components listed above suggest around 40% of the spilled volume will evaporate within the first day and about 55% of the volume may persist for over a week on the surface under calm conditions. A further 40% will resist evaporation for 1-3 weeks and thus can contribute to the exposures opportunities considered over the time-scale that is the subject of this assessment. Approximately 5% (by mass) of the oil will not evaporate over the longer term (several weeks). MGOs (and MDOs) are categorised as a Group 2, non-persistent oil according to the International Tanker Owners Pollution Federation (ITOPF, 2014). Given that a source vessel has yet to be contracted, the exact blend and characteristics of the fuel to be used are unknown and the characteristics of a typical marine MDA blend have been used in the modelling.

Table 7.19 Fates of spilled MGO in the marine environment relevant to the Gippsland MSS operational area

Fate	Description
Spreading	MGO is a relatively low viscosity fuel oil and spreads rapidly, influenced by metocean conditions (waves, wind, tides and currents); faster surface currents result in faster spreading.
Evaporation	Volatile components evaporate to the atmosphere, with increased wind speeds and ambient temperatures resulting in a higher evaporation rate. Lighter hydrocarbon fractions (boiling point <200°C) will typically evaporate almost entirely within 24 hours in temperate conditions. The larger the surface area of a slick increases the rate at which it will evaporate. Remaining hydrocarbons will have a higher density and viscosity, which slows the spread and evaporation of the remaining spill.
Dispersion/ entrainment	A large proportion of the spilled MGO will become entrained (or dispersed) in the upper water column; droplets of oil become suspended in the upper layer of the water column assisted by winds and waves. Dispersion occurs more readily with relatively low viscosity MGO in the presence of breaking waves and when wind speeds exceed 5–7 knots (~2.6 to 3.6 m/s). Once dispersed into smaller droplets, the oil is prone to faster biodegradation and photo-oxidation. When metocean conditions are no longer suitable to sustain entrainment, the remaining droplets of oil may return to the sea surface, with the rate of return influenced by the buoyancy of the oil particles. On the sea surface, the droplets may form a slick that is subject to further evaporation. Entrained oil is generally more persistent as it is no longer subjected to evaporation at the surface and it may travel further in subsurface currents than the surface slick.
Dissolution	While most of components within an MGO spill are not water soluble, some components may dissolve in sea water. The lighter fractions of the oil are typically more soluble (e.g. aromatic hydrocarbons), and these are generally also more toxic than the heavier fractions. Given the relatively small portion of soluble hydrocarbons present in MGO, along with their rapid decomposition, the percentage of spilled oil that will become dissolved in the event of a fuel spill is expected to be small.

Weathering rates and the distribution of MGO over time between the water surface, water column and atmosphere will vary with the wind and sea conditions as shown in Figure 7.1 .


Speed
Direction
Wind Speed [m/s]
Wind Direction [deg]
Volume [m^3]
Time into spill (days)
Floating
Entrained
Evaporated
Decayed
Dissolved
Spilled


Speed
Direction
Wind Speed [m/s]
Wind Direction [deg]
Volume [m^3]
Time into spill (days)
Floating
Entrained
Evaporated
Decayed
Dissolved
Spilled

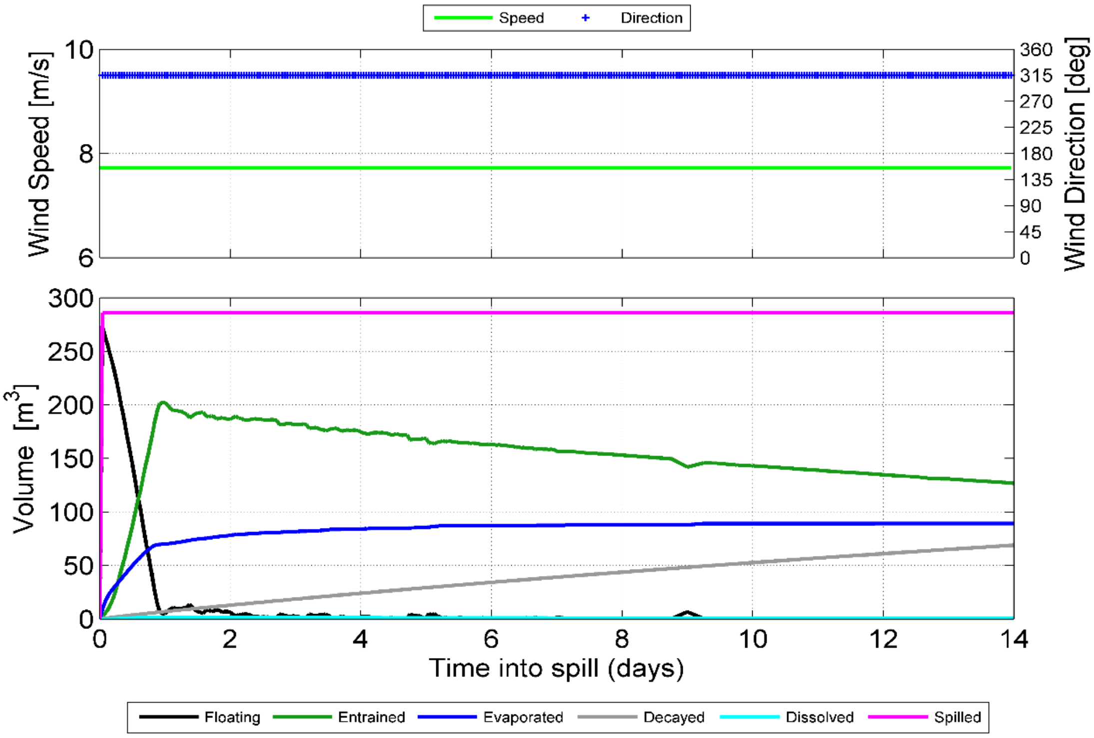


Figure 7.1 Weathering and fates graph, as a function of volume, under 5, 10 and 15 knot static wind conditions. Short-term release of 286 m^3 of MDO (weathering calculated for 14 days)

Methodology (RPS 2018): The modelling study used the Spill Impact Mapping and Planning (SIMAP) model to determine the trajectory, spread and weathering of spilled oil as influenced predominantly by the current, wind, wind-generated waves and sea temperature. The modelling and analysis methods undertaken, meet and exceed the ASTM Standard F2067-13 "*Standard Practice for Development and Use of Oil Spill Models*".

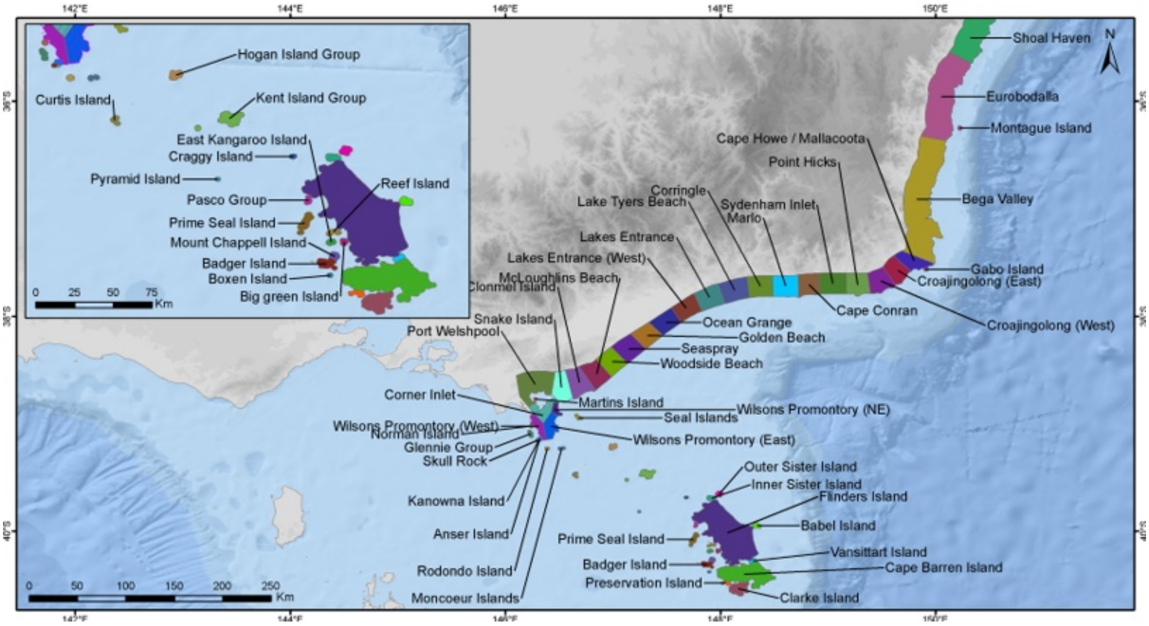
To account for trends and variability in these conditions, a 5-year database of wind and current data for the area, spanning the years 2008–2012 was sampled as input to multiple simulations. To improve accuracy, this data was derived from measurements and hind-casting of metocean conditions for the region, carried out by linking meteorological and hydrodynamic models.

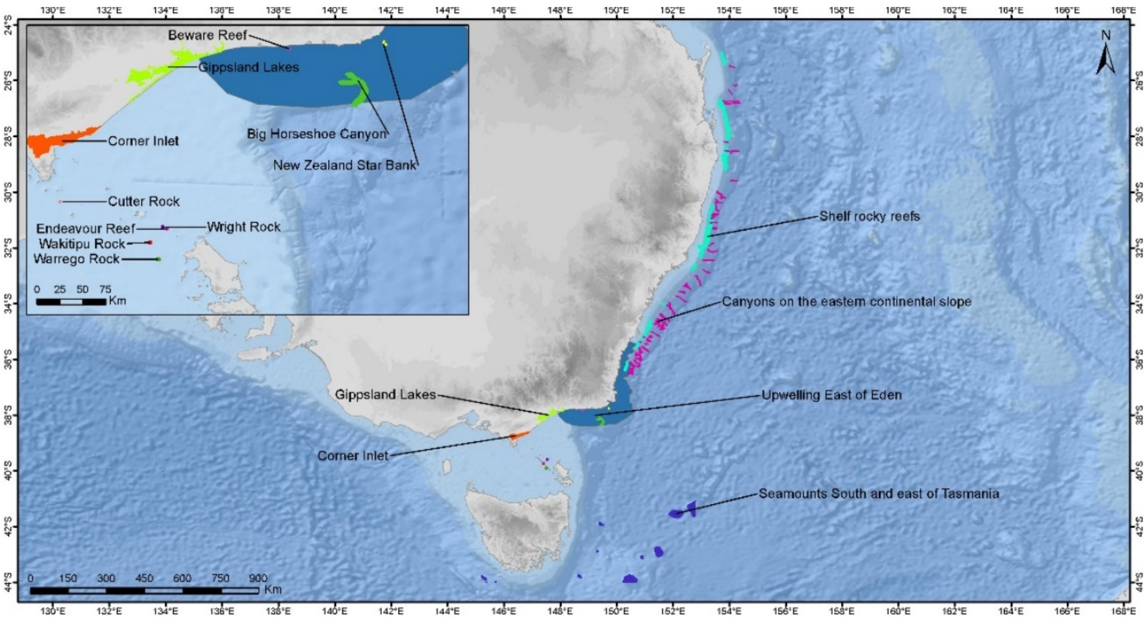
Modelled data that integrated real measurements is used in lieu of measurement alone because measurements are made at fixed locations and cannot represent spatial variation over the potential trajectories of oil spills.

The Operational Area was divided into three sectors-inshore, central and offshore with 100 randomly located spills considered from each sector. The three hundred spill start times were then randomly selected from within the months over which much of the survey will be conducted (Nov-Mar per original start month of November) from years that occurred within the time span of the metocean dataset (2008-2012 inclusive) running for 2 weeks from the start time. This approach is intended to sample the natural distributions of wind and current conditions that occur over the area under study i.e. frequently occurring conditions should be selected more often by random selection than less usual conditions, to indicate trends. The exposure footprints of all simulations were then overlayed to map the wider area that could be exposed to oil based on a set of exposure criteria.

Should the survey continue from April to July, the winds and tides for these months were examined in comparison to those months modelled. In general, frequency and strength of the winds increase in winter with April to July stronger than winds typical in December. Winds came predominantly from the west and north west (i.e. more westerly than the months modelled). As such, all spills regardless of location, are predicted as more likely to head offshore to the east to open ocean and surface oils less likely to contact the shorelines north and west of the Operational Area. Larger seas may result in increased entrainment. The interplay of the wind and currents (Leeuwin and South Australian Current which occurs along a narrow corridor centred around the 200 m water depth) is less clear and does not give a strong indication of what would occur inshore and offshore of that zone.

Exposure potential was assessed for defined geographic areas, referred to as Sensitive Receptors. Sensitive Receptors defined subsections of the coastline, shorelines of islands, state waters, economic zones, marine parks, sanctuary zones, habitat protection zones, foraging areas and other sensitive areas. Geographic bounds followed specifications from the Australian Department of Environment and Victorian Oil Spill Response Atlas. The geographic bounds of the Shoreline receptors, Marine Parks and Protected Zones used to differentiate exposure risks are illustrated below. All receptor areas (including KEFS, state and Economic Zones etc) are shown in Appendix C.





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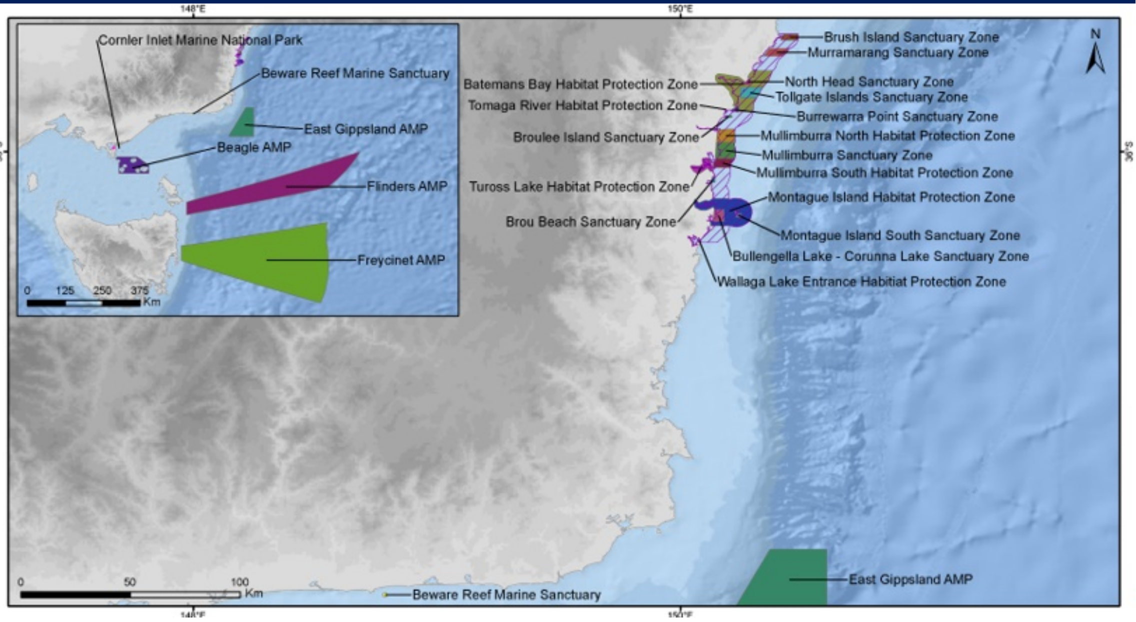

Figure 7.2 Receptor zones – shorelines (top), KEFs (centre) and Australian marine parks, NSW sanctuary/protection zones (below)

Note: The 'probabilities' forecast in the modelling and discussed below are for the arrival of oil at concentrations exceeding defined thresholds at particular areas (defined for Sensitive Receptors). The probability score provides a quantitative ranking of the potential for exposure of specific geographic areas and are calculated as the proportion of simulations (out of a hundred spill simulations) that crossed into that area at a certain concentration (e.g. >50 mg/L). Results are given for a range of threshold concentrations for multiple oil states (I.e. floating, entrained, dissolved). These scores do not indicate the probability that a single individual (for example, an individual bird or whale) would be exposed as a result of a single spill event, because this would require the coincidence of a spill occurring in the first instance and that individual and the oil at the same location within the wider receptor. In many cases the reported probabilities may be less than that reported where the result is relevant to not just 100 spill sites, but 200 or 300 random spill sites.

To undertake analysis for exposure it is necessary to define one or more threshold concentrations that define when exposure will be counted, accounting for the potential for effect of the oil at the threshold concentrations. These thresholds need to serve consideration of a wide definition of effect. Multiple thresholds were used as a guide to the gradation of possible effects. The thresholds defined in Table include a short discussion on their basis with details provided in Appendix C

Table 7.20 Thresholds used for spill impact assessment

Instantaneous surface threshold[1]	Instantaneous in-water threshold	Shoreline threshold[4]
Low 1-10 g/m² Moderate:10-25 gm² High>25 g/m²	Low: 6-50 ppb (dissolved aromatics)[2] Mod: 50 ppb (dissolved aromatics) [2] High:>400 ppb (dissolved)[2] Low:10-100 ppb (entrained)[3] Mod:100-500 ppb (entrained)[3] High:>500 ppb (entrained)[3]	Low: 10-100 g/m² (impacts to shorebirds) Mod:100-1,000 g/m² High:>1000 g/m²

1: Surface Oil

Low: 1–10g /m²: equivalent to a rainbow/metallic sheen possibly triggering temporary closures. Precautionary as 1g/m² is considered below levels that would cause environmental harm. Ecological impacts from MGO unlikely as lighter more toxic components are lost as the thin layer dissipates.

Moderate: 10–25g/m^2: 10g/m^2 is the minimum for ecological impact to seabirds (French et al. (1996), and French-McCay (2009) through oiling feathers, hypothermia, physico/chemical effect on body tissues and ingestion. Presents as a metallic sheen

High: >25g/m^2: Harmful to seabirds in contact, with possible mortality (ingestion during preening, hypothermia). Presents as a more visible metallic sheen through to discontinuous and continuous "true oil colour'.

2: Dissolved (largest contributor to toxicity)

Low: 6 ppb–50 ppb

French et al. (1999) and French-McCay (2002, 2003) presented a compilation of toxicity data. They found that 96hours of exposure to concentrations of dissolved aromatic hydrocarbons as low as 6 ppb could exert lethal effects to the most sensitive life stages of the most sensitive species exposure. At this level there may be potential for tainting commercial fish during prolonged exposures. As an instantaneous occurrence, it is considered precautionary and indicative of water quality change that may exert behavioural or sub lethal effects due to short duration. ANZECC 2000 water quality guidelines listed 7ppb as the trigger value for investigation and protection of 99% of species.

Moderate: 50 ppb–400 ppb.

An average 96 hour LC50 of 50 ppb and 400 ppb could serve as an acute lethal threshold to 5% and 50% of biota respectively. As a conservative approach this was applied as an instantaneous threshold to account for potential sub lethal effects. In the past, the ANZECC water quality guidelines sets a concentration of 50 ppb for the soluble polyaromatic hydrocarbon Naphthalene as a trigger level for investigation of effects if detected in marine waters. This trigger concentration was recommended for protection of 99% of species.

LC50 reported for PAHs (polynuclear aromatic hydrocarbons) with 96 h exposure range between 6 ppb and 410 ppb for sensitive species (2.5th percentile species) and insensitive species (97.5th percentile species) respectively, with an average of ~50 ppb (French-McCay 2002). Note that the values for LC50 increases as the time of exposure decreases, as marine organisms can typically tolerate higher concentrations of toxic hydrocarbons over short periods of time (French 2000, Pace et al.1995). Actual toxicity depends on both concentration and the duration of exposure, being a balance between acute and chronic effects.

High: >400ppb

The higher concentration of 400 ppb was chosen as an order of magnitude higher, indicating locations with higher potential for effects over the short term (NRC, 2005). The lowest concentration reported to cause lethal effects was 510 ppb (octopus hatchling mortality) with 24 hours of exposure and 390 ppb with 48 hours of exposure,

3: Entrained (soluble aromatics)

Thresholds set for short term (1 hour) exposure to entrained oil as applied in the modelling study are shown below:

Table 7.21 Thresholds used to define exposure levels – entrained hydrocarbons

Trigger level for entrained hydrocarbon concentrations (ppb)	Potential level of exposure
10	Low
100	Moderate
500	High

The most directly relevant information on the effects of entrained oil alone is presented in the Natural Resource Damage Assessment Database, compiled by NOAA, from research following the Deepwater Horizon Blowout. This includes results of toxicity tests for lethal and sublethal effects on marine organisms of dispersed oil generated from oil that had been artificially weathered to reduce soluble components, but soluble PAH fractions still remained in these test exposures.

Observable increases in abnormalities in oyster embryo exposed to the WAF generated from weathered oil were observed from 70 ppb of the non-soluble PAH frac, with 24 hours exposure. The effect concentration for 20% of the test population (EC20) was 100 ppb (moderate threshold), whereas 500 ppb (high threshold) was sufficient to result in 100% abnormality.

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In other tests, oyster embryo exhibited reduced shell development commencing at 30 ppb. The effect concentration for 10% of the test population (EC10) was 90 ppb (similar to moderate threshold). Maximum reduction was noted by 500 ppb (high threshold). Mortality to Yellowfin Tuna embryo was observable from 10 ppb (low threshold, appropriate analogue for commercial blue fin tuna in the Bass Straits), with 36 hours of exposure, the concentration lethal to 10%of the test population (LC_{10}) was 100 ppb (moderate threshold) and 500 ppb (high threshold) was lethal to 50% of the test population (LC_{50}).

Note that these tests all involved protracted exposure (24-36 hours). The adoption of concentrations of similar order for assessment over 1 hour of exposure should be conservative.

Note that locations where exposure to both dissolved and entrained oil is calculated would have the potential for combined effects to be exerted.

The above thresholds can be regarded as conservative when considering that Produced Formation Water (PFW) which has similar dispersed oil fractions, can be used as representative of entrained oil. For continuous point sources discharges in the North Sea, OSPAR predicted no effect concentrations (PNEC) for PFW as 70 ppb (median estimate at 5% of the hazardous concentration (HC_5) based on biomarker and whole organism testing to total hydrocarbons. Whole organism responses range from oxidative stress and DNA damage to impacts on growth, reproduction and survival. This PNEC could represent an acceptable long-term (i.e., chronic, >7 days) exposure concentration. As it is regarded as the maximum allowable exposure level, it could be considered as the 'low exposure threshold'.

4. Shoreline contact

Low: 10–100 g/m^2: Oil on shorelines >10 g/m^2 may be visible and could trigger social or economic impacts to other users (e.g. temporary closure of adjacent fisheries, clean up of beaches, jetties) French-McCay et al. (2005). It would equate to approximately two teaspoons of oil per square metre of shoreline contacted. The appearance is described as a stain/film. On that basis, the 10 g/m^2 shoreline contact threshold has been selected to define the zone of potential "low shoreline contact". A minimum sea surface reporting level of 0.5 g/m^2 was reported as the "visible oil" threshold for when oil is within the littoral zone. This threshold is considered the minimum level for observing oil in the marine environment by AMSA (2015) was used to and is the minimum level at which standard recovery systems would be able to effectively operate.

Moderate: 100–1000 g/m^2. Owens and Sergy (1994) define oil 'stain/film" as 100 µm, oil "coat" as 100–1,000 µm, and oil "cover" as >1,000 µm. For benthic epifaunal invertebrates living in intertidal habitats on hard substrates, a threshold of 100 µm oil thickness would be enough to coat the animal and likely impact its survival and reproductive capacity, while stain (<100 µm) would be less likely to have an effect (French-McCay 2009). Thus, 100 µm (approximately equivalent to 100 g/m^2) of oil is assumed as the lethal threshold for invertebrates on hard substrates (rocky, artificial/man-made, rip-rap, etc.) and sediments (mud, silt, sand, or gravel) in intertidal habitats.

French et al. (1996) and French-McCay (2009): defined an oil exposure threshold of concern for shorebirds and wildlife (aquatic mammals and marine reptiles) on or along the shore at 100 g/m^2, based on studies for sub-lethal and lethal impacts (APASA, 2018). Lin and Mendelssohn (1996) showed loadings > 1,000 g/m^2 of oil during the growing season may impact mangroves and marsh plants significantly.

AMSA (2015) recommends this threshold in its foreshore assessment guide as the acceptable minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone. Applicable to shoreline types such as sandy beach, boulder shorelines, pebble shorelines, rock platforms and industry facility structures.

High: >1000 g/m^2 Such loadings during the growing season of marsh plants and mangroves would impact significantly and is representative of higher level ecological impacts (i.e. ecosystem based impacts).

Key findings:

- The longest trajectory for surface oil at > 25 g/m^2 (a metallic sheen) was approximately 110 km to the north east from an inshore spill, 148 km from a spill in the central area and 180km from an offshore spill.
- Remnant oil from inshore spills could drift onto the coastline of Victoria, NSW or a Bass Strait island if spilled within the inshore zone, most likely arriving at concentrations < 25 g/m^2 after drifting and weathering for more than 43 hours (minimum time to shore). Hence, this oil would present as sheens of partially weathered MGO. Offshore spills only contact shores after a minimum of 102 hours
- There is potential for accumulation of the weathered residues over time onto the Victorian shoreline. Highest local concentrations could potentially exceed 1 kg/m^2 of shoreline. Concentrations >100 g/m^2 of shoreline could potentially be received at any part of the Victorian Coast, depending upon the release point, but all probabilities are ≤5% with Marlo, Corringle and Gabo Island being the most exposed. Shorelines of the islands around Wilsons Promontory and among the Hogan and Kent Island Groups, to the west of the Acquisition Area could also accumulate some residues if the spill scenario

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occurred immediately adjacent in the south-west corner of the Operational Area but probabilities of shoreline oil ≥100g/m^2 are ≤1%. Spills in the central and offshore areas have a low probability (≤2%) of surface oils reaching the shore at >100g/m^2. Such spills have potential for accumulation on the Victorian coastline north of the area and Kent Island Group that lie approximately 90 km south-west of the Survey Area.

- MGO is highly likely to entrain into the water column because local sea conditions are frequently energetic and MGO has low viscosity. Entrained MGO would move and disperse downstream with the prevailing current and entrained oil plumes could contact or pass through some sensitive receptor areas. Croajingolong and Point Hicks are the coastline receptors where this exposure is more likely (≤31 and 28% chance respectively at the lowest threshold of 10 ppb). The likelihood drops as higher thresholds are considered (2% at >500 ppb for these locations). Some offshore receptor areas also have the potential for exposure to entrained oil at concentrations >10 ppb such as Beware Reef and Beagle AMP (≤20 and 14% respectively for ≥10 ppb. The probability will be larger for larger receptor areas (such as East of Eden Upwelling) and those closer or within the Operational Area because that would increase the chance of plumes moving through part of these areas.
- Aromatic hydrocarbons that dissolve from surface films and entrained plumes have a low probability of contacting the coastline and offshore receptors located within or adjacent to the Operational Area. Regardless of spill location, it is highly unlikely (≤1% probability) that any receptors are unlikely to receive exposure at > 400 ppb (and ≤2% that concentrations might exceed 100 ppb within any of the receptor areas. Exceptions are those large open water areas close to or down current of the spill (e.g. Eden Upwelling has a≤ 4% probability ≥ 400 ppb and ≤11% probability ≥100 ppb).
- The probability of shoreline oil reduces for spills within the Offshore Zone. All shoreline receptors have ≤1% likelihood of exposure to oil ≥10 g/m^2, with the exception of Croajingolong West (≤2%).
- Some of the larger offshore receptors (e.g. foraging areas of some seabirds) have the potential for exposure by floating oil exceeding each of the thresholds, but at relatively low probability (e.g. albatross foraging areas have ≤7% probability of surface oil ≥10 mg/m^2
- Entrained MGO is also unlikely to reach shoreline receptors from an offshore spill, but the potential is indicated for some of the larger offshore receptors including the upwelling area to the East of Eden (4% at >500 ppb, 22% at >10 ppb) and Big Horseshoe Canyon (4% at >500 ppb, 17% at >100 ppb).
- From an offshore spill, there is a low probability that dissolved aromatics would enter any of the sensitive receptor areas at >6 ppb, the few exceptions being large open water foraging areas of some seabirds and large fishing grounds that may surround a spill.
- Predicted shoreline contacts are shown in Figure 7.3 from Nearshore, Central and Offshore spill locations. Shoreline contacts from Central and Offshore spill locations have substantially lower probabilities of shoreline contact and lower maximum loadings.

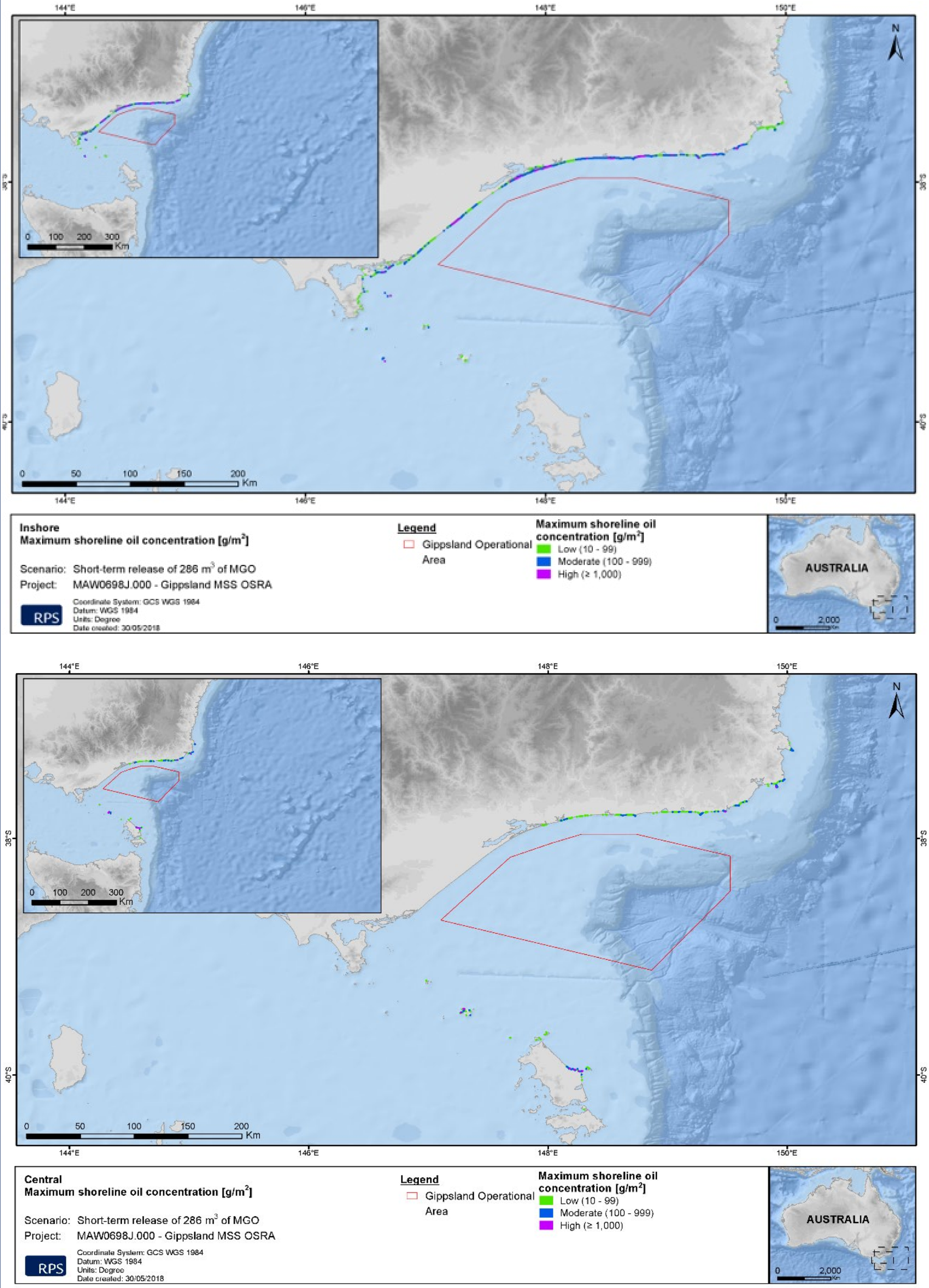

Figure 7.3 Maximum shoreline oil concentrations – nearshore (top), central (centre) and offshore (below) spill locations

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Receptors most at risk within the Oil EMBA, whether resident or migratory include plankton, fish, cetaceans, pinnipeds, sea and shorebirds and shoreline habitats. In addition, the following receptors were considered-cultural and heritage values (e.g. shipwrecks) community amenities, commercial and recreational fishing, shipping and other users. Special attention was given to sensitive biota and protected species, MNES, KEFs and threatened communities as well as state and Commonwealth Marine Reserves values including open water pelagic habitats.

The primary impact pathways have been identified as:

- the potential for toxicity and physical oiling for biological receptors and the coating of historical wrecks, public facilities (such as beaches, boat ramps, heritage sites etc.)
- potential disturbance to shoreline habitats, risk of vessel strikes etc. from post-spill response and monitoring operations (discussed in Section 7.8).

The thresholds for the impacts from hydrocarbons throughout the water column, are based on the sensitivity of the various receptors which may potentially be exposed and are graduated according to effect (low, moderate and high). Considering the likely receptors in the Oil EMBA (Existing Environment Section 4) and their sensitivities (Table 7.17), the main thresholds for the risk assessment are summarised below, with additional grades discussed in the full report (RPS, 2018) to ensure completeness of the risk assessment.

Given the short-lived nature of a spill scenario in general and the nature of MGO and its predicted weathering, the focus is on instantaneous impacts. Simulations confirm little or no opportunity for long term impacts through ongoing contamination. The table below lists the various thresholds used to define levels of exposure to potential toxicity effects and physical oiling/tainting effects.

Potential Impacts and Probability of Exposure to Sensitive Receptors

Birds

There are numerous listed threatened and/or migratory bird species likely and possible to occur foraging in the area in spite of few nesting or breeding sites bordering on the oil EMBA (Section 4.5.9). They are rated 'sensitive' receptors. Little penguin colonies are found at the Beagle Islands, Gabo and Tullaberga islands, and breeding season is Aug–Feb.

Seabirds rafting, resting, diving, preening and feeding at sea have the potential to contact surface oil at various exposure levels. If seabirds have a long duration of exposure to areas of heavy surface oiling, it is likely that some individuals may die as a result of exposure through pathways such as reduced insulation and waterproofing (leading to hypothermia dehydration, drowning or starvation), ingestion, impaired flight and navigation, food chain biomagnification and tissue damage (ITOPF, 2011; AMSA 2017). Direct oiling of nests is considered extremely unlikely given their location above the water line but plumage contamination of adults can affect hatchling success (French-McCay 2009). Penguins spend much of their time in water and if oiled rapidly lose insulation and buoyancy (Hook et al. 2016). The *Iron Baron* vessel spill (325tons bunker fuel, Tasmania,1995) is estimated to have resulted in the deaths of up to 20 000 penguins (Hook et al. 2016). Little penguins moult between Feb-April staying ashore for approx. 17 days (Phillip Island, 2018)

The large open water areas traversed by foraging albatross, petrel and shearwater have a probability of ≤8% of encountering >10g/m^2 floating surface oil which lasts typically less than 1 day under windy conditions (Figure 7.1). These vast areas have ≤20% probability of entrained oil >100 ppb and ≤10% probability of encountering dissolved aromatics >6 ppb. The BIA of all other sensitive bird species (including the foraging area for little penguin) have a maximum 2% probability of encountering >10 g/m^2 floating surface oil, ≤10% probability of entrained oil >100 ppb and ≤7% probability of encountering dissolved aromatics >6 ppb (most sensitive threshold due to early life considerations). Little penguin nest and forage at Tullaberga and at Gabo island, both with <5% probability of shoreline oil >10 g/m^2.

Given the extensive ocean foraging habitat available to such species as the albatross and petrel, the small and temporary area impacted by a spill is unlikely to limit their ability to find unaffected prey. Petrel breeding takes place in Oct–Feb in their Arctic and sub-Arctic habitat making it unlikely large numbers will be in the EMBA during the survey.

The areas with elevated entrained and dissolved hydrocarbons are single trajectories and short term. Fish species residing in or swimming through these small discontinuous zones that are prey for seabird and shorebirds will have a low probability of suffering acute or chronic toxicity effects, so birds consuming them are similarly not expected to suffer toxicity effects at a population level.

Areas of shoreline predicted to be exposed to shoreline loading of hydrocarbons that may have biological impacts to birds (100–1,000 g/m^2 or >1000 g/m^2) are widespread along the coast of the EMBA (see too '**sandy beaches**').

The coastline is largely wide sandy beaches that provide habitats for shorebird species such as hooded plovers and terns and nesting habitats for seabirds. MGO quickly permeates porous sediments (NOAA,

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	2012), limiting duration of exposure to fauna on the shoreline. Most of the shorebirds and seabird species within the EMBA have a wide geographic range, thus impacts to individuals or populations at one location will not necessarily extend to populations on a regional or global location. Shorebirds foraging for food in intertidal areas or along the high tide mark/splash zone may encounter weathered hydrocarbons that may be brought back to nests and/or ingested. Being weathered, oils transported to the sandy nests (e.g. of hooded plovers or fairy terns) is likely to permeate through the sand, limiting accumulation on the feathers of young or adults. Toxicity effects from ingestion of contaminated prey caught in the intertidal zone are unlikely as given the characteristics of MGO, the more toxic volatile components are likely to have evaporated prior to stranding. Given the characteristics of the fuel oil, (i.e. the rapid evaporation and dissipation of some toxic dissolved components and rapid dispersion of surface oil), lack of concentrated aggregations of protected species offshore, and the small percentage of the oil that persists (<5% over weeks), it is not expected that exposure to a spill would result in impacts to seabirds or shorebirds at a population level. Marine pollution is a threat identified for albatross and giant petrels (National Recovery Plan 2011-2016) requires population monitoring as the response to address marine pollution (Scientific Monitoring Plans in Section 2.2.3.3).
	Marine reptiles Three species of marine turtles listed as MNES under the EPBC Act were identified as potentially occurring in the EMBA (Section 4.1.1). All three marine turtle species are listed as both 'threatened' and 'migratory' with 'foraging, feeding or related behaviour known to occur within area'. No marine turtle BIAs (e.g. foraging, inter-nesting, mating and nesting) are recognised within the EMBA, despite having been defined for each of the listed turtle species. All species of marine turtles in Australian waters are managed under the Recovery Plan for Marine Turtles in Australia (DEE 2017g). Spilled oil may impact reptiles through oiling sensitive tissues (eyes, respiratory) and through ingestion via contaminated food or absorption through the skin causing dermal pathologies. Contamination of eggs can result in toxic impacts to embryos with decreased survival of hatchlings and increased deformities and hatchlings being impaired by shoreline oil and more prone to predation (Shigenaka 2003). Shallow water environments and possibly the Eden Upwelling (see below) are more likely habitats for individuals. Turtles are therefore vulnerable to surface oiling from an oil spill however it should be noted that adult turtles only spend 1–10% of their time at the sea surface with each dive lasting between 30–70 minutes (French-McCay 2009). In addition, there are no BIAs for reptiles within the EMBA and the low chance of encountering significant numbers of turtles in general from January to July, limits potential impacts to individuals and the risk is negligible As marine reptiles are air breathing and possess relatively impermeable skins, dissolved hydrocarbons would not be expected to result in measurable impacts. The areas which may be attractive to turtles such as shallow seagrasses near Mallacoota have a <5% probability of entrained oils >100ppb. With the areas being discontinuous and temporary. The low chance of encountering turtles in those areas means impacts are on not on a population level. Overall, given the rapid evaporation (limiting inhalation exposure to the early phase of a spill) and weathering of surface oil, the infrequent occurrence of marine turtles in the Oil EMBA, and short time turtles typically spend at the surface, the absence of nesting beaches or other BIA in the EMBA means any impacts to marine reptiles are expected only on individual basis and the risk is assessed as negligible.
	Sandy beaches A description of shoreline types within the EMBA is presented in Section 4.4.3. They tend to be regularly cleaned by wave action and have a low sediment total organic carbon, thus a low abundance of marine life (Hook et al, 2016). The low organic carbon and large particle size means shoreline oil permeates readily, the depth of penetration depending on particle size (greater penetration in coarse beach sand than in fine muds in tidal flats and estuaries). The low viscosity of MGO means it quickly penetrates, aided by burrows (e.g. worm holes) and root pores. Along the Gippsland coast, some sandy beaches (e.g. Ninety Mile Beach) are important socio economically and culturally, so a spill reaching this type of shoreline may attract attention disproportionate to its sensitivity (Hook et al, 2016). Heavy oiling (>1,000 mg/m^2 threshold) would likely result in acute toxicity and mortality of many invertebrate communities, especially where oil penetrated through animal burrows (IPIECA, 1999). However, rapid recovery is expected as components are weathered and removed from the environment and recruitment from unaffected individuals and nearby areas occurs. The results of exposure to oil may be acute (e.g. die off of amphipods and replacement by more tolerant species such as some worm species (IPIECA, 1999) or chronic (e.g. gradual accumulation of oil and genetic damage) (Hook et al 2016). After the *Sea Empress* spill off the coast of Wales in 1996, many amphipods (sandhoppers), cockles and razor shells died with mass strandings of both intertidal species (such as cockles) and shallow sub tidal

species. Populations of mud snails recovered within a few months, but some amphipod populations had not returned to normal after one year. Long term depletion of sediment fauna could have adverse effects on birds or fish that use the tidal flats as feeding grounds (IPIECA, 1999).

In 2014 a small volume of crude oil from an unidentified source washed up along a 7km stretch of sandy beach of the Victorian Gippsland as small granular balls (a few millimetres thick) reported no impacts over the course of the two months following the incident (The Gippsland Times, 2014).

The maximum length of coastline potentially at risk from high MGO shoreline loading (>1000g/m^2) is about 40 km along the East Gippsland Coast but the probability is ≤ 2% of shoreline oil >1000g/m^2). The highest probability of shoreline oil ≥ 100g/m^2 is 5% (Croajinogolong, Marlo and Corringle), elsewhere probabilities are less. This section of coastline is dominated by wide sandy beaches interspersed with rocky shores.

With the shortest time to reach to coast of 43 hours, the hydrocarbons from any spill will have started weathering. The high shoreline loading may result in acute toxicity and death to many invertebrate communities especially as the MGO will rapidly penetrates the sandy sediments. Tidal action is expected to lead to rapid weathering in the intertidal area and these given communities are well represented along the coast, recruitment from unaffected areas is expected to result in rapid re population.

Tourism, heritage and cultural values and other human uses of the beach may be impacted in the short term e.g. through temporary beach closures to protect human health and perceived unsightliness. See **'Other Users'** too.

Rocky shores

A description of shoreline types within the EMBA is presented in Section 4.4.3. They are higher energy sites regularly cleaned by wave action and incoming tides.

Oil can accumulate in cracks, crevices, rock pools, overhangs and shade areas that provide habitats for soft bodies fauna such as sea anemones, sponges and seasquirts (Hook et al. 2016). The vulnerability of these communities depends on topography, composition and position. A vertical rock face on a wave exposed coast is likely to be remain unoiled if a slick is held back by the action of the reflected wave. A gradual sloping boulder shore in a calm backwater of a sheltered inlet can trap large amounts of oil which may penetrate the substratum. The complex patterns of water movement close to rocky coastlines can concentrate oil while oil often collects on the high tide mark while lower parts may be untouched (IPIECA 1995).

The waves and tide that washed the oil onto the rocks soon starts to remove it, with the rate of weathering depending on wave exposure, weather conditions, shore characteristics etc. Gradual leaching can result in constant low-level pollution and microbial breakdown begins which is slower in cold or temperate environments. Silts and clay can assist removal by flocculation. Marine snails and other grazing fauna can remove significant amounts of oil.

As oil weathers it becomes more viscous and less toxic, often leaving little residue on shore rock. This can remain an unsightly stain for years but is unlikely to cause further ecological damage. Oil tends not to remain on wet rock or algae but likely to stick firmly if the rock is dry (IPIECA 1995).

The impact of oil on any marine organism depends on the toxicity and viscosity, amount of oil, sensitivity of the organism and length of contact. Even where the immediate damage to rocky shores from oil spills has been considerable, it is unusual to result in a long-term damage and the communities have often recovered within two or three years (IPIECA, 1995). This is because oil is not normally retained in the rocky shores in a form or quantity that causes long term impacts and also because most rocky shore species have a considerable potential for re-establishing populations.

Many rocky shore animals have also been found to withstand heavy oiling – it typically requires smothering for a few tides to fatally impact barnacles and intertidal sea anemones. Limpets, littorinid snails and other grazing molluscs are usually more susceptible. A particularly toxic oil may result in high mortality through a direct effect or through a narcotic effect where the oil causes the animals to lose their grip on the rock, become available to predators or die of desiccation (IPIECA, 1995).

The extent of the effect on susceptible organisms is strongly related to the toxicity and freshness of the oil. A weathered crude may have a very limited effect even it is present on the shore for a long period, whereas a fresh crude can cause toxic effects on molluscs and bleaching effects on red algae in the short time before it weathers away. The removal of a large number of grazers is often followed by a rapid proliferation of microalgae covering normally grazed rock in a 'green flush' which is the sign of a stressed environment but also the first stage of recovery (IPIECA, 1995).

As long as the shoreline is not further oiled, the spores of macroalgae also settle and grow resulting in an abnormally dense cover of seaweed. Simultaneously the juvenile limpets and snails which settle and develop in damp and protected sub-habitats, move out to gradually repopulate the open rock. They grow quickly on the large quantities of food and gradually reduce the seaweed cover to normal levels. The whole process may take less than 2–3 years for the shore to look 'normal' although in some cases the balance between the algae and grazers may take longer to stabilise (IPIECA, 1995). See too '**Macroalgae'**.

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Gippsland coast and offshore islands

There are isolated areas of rocky shore (intertidal shore platform and mix sand beach/shore platform) in the EMBA e.g. Salmon Rocks at Cape Conran, Corner Inlet and Wilsons Promontory. At worst, Cape Conran has ≤ 3% probability of contact though shoreline loadings of MGO >100g/m^2. Impacts to rocky shores of the EMBA should not vary significantly from those described above. Small islands in the Beagle Group, Flinders Island, Gabo Island (all ≤ 2 % probability of shoreline oil ≥ 100g/m^2) are expected to be similarly impacted. Likewise for Green Cape (Ben Boyd National Park, NSW) and the coast just north of Green Cape which are represented by the receptor “Bega Valley”. This long section of rocky coast has ≤ 4% probability of shoreline oil ≥10g/m^2 and ≤2% at >100g/m^2. All other sections of the NSW coast have very low potential exposure (<1%) to weathered hydrocarbons. Tasmanian island rocky coastlines include Flinders Island, Vansittart Island, Cape Barren, Monceur, Rodondo, Seal Island, Kent Island group, Hogan island Group and Clarke islands. All these have ≤ 2% probability of shoreline oil ≥10g/m^2 and ≤1% at >100g/m^2.

The action of reflected waves off rocky shores means it is unlikely that toxicity or smothering effects to exposed vertebrate fauna will occur on this type of shoreline. the oil is likely to be continually washed off the substrate and into the water leading to further weathering.

Benthic habitats

Acute or chronic exposure through surface contact and/or ingestion can result in toxicological risks. The presence of an exoskeleton (e.g. crustaceans) will reduce hydrocarbon absorption through the surface membrane but invertebrates with no exoskeleton and larval forms may be more vulnerable to impacts from pelagic hydrocarbons.

Marine invertebrates and larva are likewise more at risk from entrained and dissolved hydrocarbons than adults with an exoskeleton. Should localised impacts to larval stages occur, population recruitment that year can be impacted. Tissue taint of invertebrates exposed to hydrocarbons can remain for several months, although taint may eventually be lost. NOAA (2002) describes lobsters when exposed to a light hydrocarbon losing their taint after 2-5 months.

Minute oil droplets may impact aquatic biota mechanically (e.g. filter feeders) or act as a conduit for exposure to semi- soluble hydrocarbons taken up by the gills or digestive tract (McCay-French, 2009). Toxicity is primarily attributed to water soluble PAHs, especially dissolved naphthalene. NZECC/ARMCANZ (2000) identifies the 96-hr LC50 concentrations for naphthalene as 57,000 ppb for the bivalve mollusc (*Katelysia opima*) and 850 to 5,700 ppb for six species of marine crustaceans.

Dispersed and non-dispersed oil can also deplete oxygen in bottom waters through the bacterial metabolism of oil (and/or dispersants), and surface oil blocking light (NRDA, 2012).

After the Macondo well blowout (Gulf of Mexico, 2010) BP (2015) reported that less than 2% of the sediment samples tested exceeded EPA benchmarks for aquatic biota, and these were largely sampled from the area close to the wellhead (BP, 2015). Felder et al., (2014) studied offshore benthic seaweeds in water depths of 55–75 m before and after the blowout, finding a post spill die-off of seaweeds and a decrease from 60 species to 10. crabs, lobsters and prawns associated with the seaweeds and benthic substrates also declined as much as 29–42%, although other influences may have been involved so definitive links to the oil spill are not possible. Nevertheless, residual hydrocarbons may have contributed to localised deaths, decline in fertility of surviving female decapods and reduced recruitment (Felder et al., 2014).

Post-the Montara well blowout in the Timor Sea in 2009, surveys of the Barracouta and Vulcan shoals (lie about 20-30 m below the surface in surrounding deep waters greater than 150m) did not detect obvious visual signs of major disturbance (Heyward et al., 2010), Due to the lack of pre-impact data, the presence of low-level severely degraded oil at some shoals detected later could not be directly linked to the Montara spill.

Recovery of benthic habitats exposed to entrained hydrocarbons is expected within weeks to months even in cases of heavy oiling (Burns et al., 1993; Dean et al., 1998 in Committee on Oil in the Sea, 2003).

All benthic habitat receptor locations within the Oil EMBA have a <3% probability of entrained hydrocarbons above 500ppb. Most have 0-5% probabilities of exposures above 100ppb, except for the area around Point Hicks, Marlo and Corringle) which have a maximum of 17% probability of contact with entrained hydrocarbons ≥100ppb. Natural values of the Marine Park in this area includes subtidal and intertidal reefs, subtidal soft sediments and a very high diversity of fauna, including intertidal and subtidal invertebrates (see Section 5.2.9).

At the low threshold exposure, long-term toxicity impacts to benthic fauna exposed to the MDO is not likely

There is a 0-11% probability of shoreline exposure (at the low threshold of >10g/m^2) along the coast of the EMBA where intertidal benthic species may be exposed to MDO (albeit weathered).

Worms, molluscs and crustaceans may suffer lethal impacts if high and moderate hydrocarbon loadings penetrate the sediments and persist (e.g. in sheltered shorelines). As most of the shoreline of the EMBA is

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	exposed coastline, these impacts are unlikely except in isolated sections. While MDO penetrates porous sediments (such as sand) quickly, it is also washed off quickly and is weathered within sediments by waves (NOAA, 2012), thus minimising impacts to intertidal fauna. Long-term depletion of intertidal fauna could impact birds or fish using this habitat for feeding. Where oiling is heavy, impacts on nearshore benthic fauna could be significant but the small extent as areas of high exposure are small and discontinuous, and predicted to fully recover fully, resulting in a low impact.
	Plankton There have been relatively few studies conducted in the Bass Strait region on plankton, with majority of the studies conducted focused on zooplankton (Section 4.5.10). Zooplankton is vulnerable to oil due to its small size, high surface area to volume ratio and (in many cases) high lipid content (which facilitates oil uptake) (Hook etc al 2016), causing mortality, decline in egg production and swimming speed. Hydrocarbons have been shown to result in detrimental impacts to phytoplankton (González et al. 2009) but according to Vareta et al (2006) studies of planktonic communities following spills of a similar nature to that of a vessel fuel tank spill did not detect statistically significant impacts resulting from hydrocarbon exposure. Hook et al (2016) reports phytoplankton as not typically sensitive to oil impacts but does accumulate oil rapidly due to small size and high surface area, with effects on photosynthesis dependent on concentration range. Variations in the temporal scale of oceanographic processes typical of the ecosystem can have a greater influence on plankton communities than a direct spill (Volkman et al, 2004) as reproduction by survivors or migration from unaffected areas rapidly replenishes losses with field observations showing minimal or transient effects on marine plankton. Once background water quality has been re-established, communities will take weeks or months to recover allowing for seasonal influences on the assemblage characteristics (ITOPF, 2011a). Over 170 species of zooplankton have been recorded in the eastern Bass Strait, and 80 species identified between the western and central Bass Strait. Distributions of the different species of plankton are dependent on prevailing ocean currents, such as the East Australia Current, that flow into and from the Bass Strait into Southern Ocean water masses. Plankton populations in the Oil EMBA are expected to be highly variable both spatially and temporally and are likely to comprise characteristics of tropical, Bass Strait, Tasman and southern Australia populations. The east of Eden Upwelling is described as having higher densities of zooplankton (rotifers, copepods, and krill that feed on phytoplankton) important food source for fish and whales. The coastal krill, *Nyctiphanes australis*, is of particular importance to the region and along with other zooplankton provides an important link in the pygmy blue whale food chain as well as food chains supporting commercial fishing, migratory and protected/migratory birds, seals and shark etc. Plankton is found in nearshore and open waters beneath the surface and in the water column migrating vertically through the water column to feed in surface water at night (NRDA, 2012), thus possibly exposed to surface as well as entrained/dissolved oil. Should a spill occur in or near the Upwelling, the whole area has a probability of ≤8% of encountering floating surface oil >10g/m^2 floating surface oil, ≤34% probability of entrained oil >10ppb (lower threshold to account for more sensitive receptors, with ≤20% probability of encountering entrained oil ≥100ppb), and ≤8% probability of encountering dissolved aromatics >6ppb. As such plankton in the upper column may be directly impacted (e.g. smothering and ingestion) and indirectly (decreased water quality and bioaccumulation). Plankton found in the open waters of the EMBA are expected to be widely represented within waters of the greater Bass Straits region with recruitment through migration likely within weeks to months maximum. Given the expected rate at which the spill would disperse and weather, the dynamic nature of planktonic communities (Davenport et al. 1982), and the variability in plankton populations in both space and time, impacts to marine plankton are predicted to be minimal, transient and insignificant in the long term, hence the impact LOW. However, consideration must be given to the importance of coastal krill in the cetacean (e.g. blue whale) and fish food chains.
	Fish (including sharks) A description of fish in the EMBA is provided in Section 4.5.6. Pathways to exposure include direct dermal contact (e.g. oiling gills (Hook et al 2016)), ingestion (directly and through contaminated prey, see also Plankton) and inhalation (diffusion of elevated dissolved components across the gills). Impacts range including mortality, decreased size, inhibited swimming, changes in oxygen consumption, changes to reproduction, DNA damage, organ lesions and increased parasitism. Sub lethal impacts include a range of organ malfunctions, gill hyperplasia and increased infection as well as alterations in behaviours such as feeding, migration, swimming and burrowing behaviours (Kennish, 1996). Embryos, larva and juveniles are at the most sensitive life stage, with exposure potentially resulting in decreased spawning success and abnormal larval development.

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Sharks and fish are non-air breathing so less affected by surface oils. Some sygnathid species associated with nearshore reefs and rafts of floating seaweed may come into contact with surface oil. Some demersal species may be susceptible to oiled sediments particularly those that are site-restricted (e.g. to reefs and seabed features). Pelagic species in the water column are susceptible to entrained and dissolved components but tend to be highly mobile and less likely to suffer extended exposure due to patterns of movement. Adult fish kills reported after spills occur mostly in shallow water, near shore benthic species (Volman et al 2004).

Numerous commercial fish and larva could be exposed within the EMBA. As such, see too **KEFs – Eden Upwelling, Commonwealth and State Marine Parks and Commercial Fish.**

Given the widespread distributions of the great white shark (*Carcharadon carcharias*) (listed as vulnerable and migratory), shortfin mako shark (*Isurus oxyrinchus*) (migratory) and porbeagle shark (*Lamna nasus*) (migratory) it is likely that these species may traverse the EMBA. The great white shark is the most exposed given it breeds and forages within the EMBA, with the distribution area having ≤8% of encountering floating surface oil >10g/m^2 floating surface oil, ≤20% probability of entrained oil >100ppb (although in breeding areas probability drops to ≤15%), and ≤10% probability of encountering dissolved aromatics >6ppb (lower threshold as breeding grounds are included in the assessment). Modelling forecasts Corner Inlet (breeding area for great whites), the Beagle Marine Park, and Flinders Marine Park all to have a low probability of low exposures to dissolved and entrained hydrocarbons (see below).

An EPBC Act protected matters report listed the threatened freshwater fish species the Australian grayling (*Prototroctes maraena*). The grayling migrates through brackish estuaries and rivers and has therefore been considered, but it is unlikely to be encountered in the EMBA in any large numbers and is unaffected by spills other than those close to an open river mouth. The critically endangered Red handfish is considered most unlikely to be impacted by the Oil EMBA given they are largely estuarine, or shallow waters (<2m), possibly down to 200m (DEE Sprats, 2018). The Oil EMBA off Tasmania is in water depths is largely below 200m. Given the distance from the spill site, any residual hydrocarbons encountered are likely to be well weathered.

Most fish are mobile and unlikely to incur sufficient exposure over a period long enough to be impacted above harm thresholds. The majority of fish tend to remain in the mid pelagic zone, limiting contact with surface hydrocarbon. MDO/MGO spills in open water are diluted so rapidly that adult fish kills are rarely observed (NOAA, 2012) and (ITOPF, 2011). Hence impacts from surface oil is predicted to be low at population levels.

Many fish species can metabolise some toxic hydrocarbons which reduces bioaccumulation of contaminants in the food web (NRDA, 2012). Areas of elevated entrained hydrocarbons are localised and small with cells of elevated concentrations rapidly dispersing and of decreasing toxicity. As such dissolved (toxic) phase concentrations of hydrocarbon rarely reach sufficient levels for long enough to cause mortality (Hook et al 2016). The wide geographical distribution of many of the species in the Bass Straits also prevents large scale population impacts from entrained hydrocarbons – hence the consequence is ranked minor and the risk Low.

Marine mammals – pinnipeds

A description of pinnipeds (Australian fur-seal and New Zealand fur-seal) in the EMBA is provided in Section 4.5.8. The PMST report identified one threatened pinniped species, the Australian sea lion (*Neophoca cinerea*), that may potentially occur within the EMBA. This species is listed as 'vulnerable' under the EPBC Act. Although not protected under the EPBC Act as 'threatened' or 'migratory' species, the New Zealand (NZ) fur seal (*Arctocephalus forsteri*) and the Australian fur seal (*Arctocephalus pusillus doriferus*) are the most abundant pinnipeds throughout the Southern Ocean with more than 90% of their populations within Australian waters possibly present in these waters. NZ fur and Australian fur seals have breeding locations at the Skerries off Wingan Inlet and the NZ seal at Kanowna island off Wilsons Promontory. Both have known haul outs at Beware Reef and the Australian fur seal at Gabo Island. Seals may be impacted by oil spills in the following way (AMSA 2011)

As seals spend much of their time on or near the surface, they are at risk from sea surface oils through:

- direct oiling of fur seal pups can induce hypothermia by destroying their lanugo insulation. Adult fur seals have blubber but oil can still affect waterproofing qualities (other pinnipeds are less impacted)
- oil can "stick" flippers to fur seal bodies preventing escape from predators or hindering swimming
- skin, eye, respiratory irritation/damage leading to infections and starvation
- inhalation of vapours may damage the respiratory system.

Entrained and dissolved oil:

- Ingestion of oil (e.g. contaminated prey, cleaning pups etc) may damage digestive tracts, suppress immune systems or damage mucous membranes.

	Shoreline oil Seals may override their avoidance of noxious spills in order to stay near haul out areas and pups, (Geraci and St. Aubins,1988) increasing risk of exposure. Oil residues may possibly disguise scent that seal pups and mothers rely upon to identify each other leading to pup abandonment and starvation (Fogden, 1971). Engelhardt (1982) states seals have the enzyme systems necessary to convert some adsorbed hydrocarbons into polar metabolites which can be excreted in urine. Volkman et al (1994) report benzene and naphthalene ingested by seals is rapidly absorbed into the blood through the gut causing acute stress with damage to the liver considered likely, and death where large volumes are ingested. Due to the extreme philopatry of females and limited dispersal of males between breeding colonies, the removal of only a few individuals annually may increase the likelihood of decline and possible extinction of small colonies. This could further weaken genetic resilience, impacting its ability to cope with other natural or anthropogenic impacts and could reduce genetic diversity between colonies, placing small breeding colonies under pressure of survival from even low levels of anthropogenic mortality. Known haul outs, resting sites and foraging waters around breeding colonies all have ≤3% probability of >10g/m^2 floating oil (e.g. Beagle Marine Park, Cape Conran, Seal island, Kanowna Island off Wilsons Promontory (no oil contact), Skerries off Wingan Inlet, Gabo island, Beware Reef etc). All sites have a ≤8% probability of >100ppb entrained oil (except Port Hicks at ≤17%, which could result from a direct spill in the nearest part of the Operational Area) and ≤1% of dissolved aromatics >50ppb. Shoreline oils may accumulate at loadings ranging from low-high l all along the Victorian coast and at isolated spots on the NSW coast -but generally rocky haul outs self-clean rapidly (see Rocky Shores). Gabo island has the highest exposure of a 5% probability of shoreline oil. The NZ and Australian fur seals may be exposed to surface MGO while surfacing, exiting and entering the water, and depending on duration and concentration, may result in irritation to mucous membranes around the eyes and nose. Should the seal inhale volatile vapours from a fresh slick acute and/or chronic toxicity impacts could result. This would be unlikely to occur to more than several individuals at most and given the brief time spent on the surface, unlikely to result in permanent damage or mortality. Likewise, NZ and Australian fur seals may be exposed to shoreline oil and experience some degree of dermal contact. Given the areas off Port Hicks, Beware Reef, Kanowna island and Gabo Island with elevated entrained hydrocarbons are small and patchy, seals foraging in the reef areas for cephalopods off reefs may move through areas of low to high exposure, making direct toxicity from consuming affected prey unlikely but possible. Seals present in areas such as around Port Hicks MNP and Gabo Island may be affected by surface, entrained and shoreline oil, which may result in illness or mortality. Such an impact would potentially result in a serious impact on individuals of the affected species. However, the low probability of spills (especially from the central and offshore areas) reaching their haul outs and the forecast rapid dissipation and weathering of the spill and the tens of thousands of Australian fur seals resident in the Gippsland region, impacts are not likely to impact the health or viability of the regional population. Given the rocky nature of haul out sites and their ability to self-clean, heavy oiling of seals in general is not expected. As such consequences are ranked minor and the risk Low. See too **KEF – Eden Upwelling**.
	Marine mammals – cetaceans A description of the cetaceans within the EMBA is provided in Section 4.5.8. The EMBA supports internationally significant populations of numerous marine mammals. The PMST report identified 33 marine cetacean species with 12 listed as 'threatened / vulnerable' and/or 'migratory' MNES under the EPBC Act that may potentially occur within the EMBA. The National Conservation Value Atlas showed that three of these species have BIAs defined within the Oil EMBA (Section 4.5.8). The pygmy blue whale (PBW) largely forages west of the Bonney Upwelling/Kangaroo island in Nov/Dec and around the Bonney Upwelling Jan-April – about 600km west. However, the NCVA shows the area as a known foraging BIA and PBW have sometimes been sighted off Eden in October. As such, PBW may be present in the area but more likely to be en route to the Bonney Upwelling. The southern right whale usually migrates alone or with dependent calves through the shallow nearshore waters and around Corner Inlet to aggregation areas off Warrnambool. Humpbacks are largely south bound (Nov – Dec) traversing the waters from around Eden north west of the Activity area to the Antarctic. Indo-Pacific bottlenose dolphin can be found in the area all year. As mammals, (air breathing) cetacean species are vulnerable to sea surface oiling. The inhalation of oil droplets, vapours or fumes may damage mucous membranes, damage airways or may cause death depending on the extent of exposure. Some cetacean feeding methods lead to greater likelihood of ingestion. For example, baleen whales are particularly vulnerable when feeding as they filter feed by skimming the sea surface for krill. This can lead to ingesting surface oil and fouling of their baleen plates. If large quantities of zooplankton (key prey) exposed to the spill were ingested, chronic toxicity impacts to

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baleen whales may occur (see plankton) Toothed cetaceans (e.g. dolphins) feed directly on fish and squid and are less likely to ingest surface oil.

Cetaceans have mostly smooth skin with limited area of pelage (i.e. hair-covered skin) or rough surfaces (e.g. barnacles) which will cause oil adherence. Adsorption through the skin is therefore limited (low) and dissolved hydrocarbons are expected to have less impact (Geraci & St Aubin, 1988). Maternal transfer of contaminant to embryos is reported in NRDA (2012) and Hook et al (2016). Effects include hypothermia, organ dysfunction, damaged lungs and airways, gastrointestinal ulceration, eye and skin lesions, decreased body mass and stress with behaviour changes.

After the Macondo spill (2010), dolphin populations from Louisiana, USA that had been exposed to prolonged and continuous oil showed higher incidences of lung and kidney disease than those in other urbanised environments (Hook et al, 2016). The spill may have contributed to unusually high perinatal mortality in bottlenose dolphins (Hook et al 2016).

Pygmy whales and southern right have the greatest potential exposure as their larger BIAs include migration, foraging and distribution areas. Their whole foraging area within the EMBA has a ≤ 8% probability of encountering ≥10g/m^2 floating oil, ≤20% probability of encountering >100ppb entrained oil and ≤2% dissolved aromatics >50ppb. **See KEFs – Eden Upwelling**.

As a highly mobile species, in general it is unlikely cetaceans traversing and foraging within the EMBA will be constantly exposed to hydrocarbons in the water column (surface or dissolved) for long continuous durations (e.g. >96hrs) that could lead to chronic toxicity effects. However, pelagic species may continue to be attracted to specific areas for breeding or feeding (e.g. use of the area off Warrnambool as a nursery for southern rights), in spite of a tendency to avoid noxious spill. As such weathered oils may continue to present a problem to baleens by fouling their sieves.

French-McCay (2009) stated that a 10-25 g/m^2 oil threshold has the potential to impart a lethal dose on some marine species, however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface. Biological consequences of physical contact with very localised areas of low to high concentrations surface oil are unlikely to lead to any long- term impacts, with temporary skin irritation and very light fouling/matting of baleen plates likely to occur (it is unknown whether the latter would affect feeding ability). Therefore, effects at the population level on the cetaceans present in the EMBA are considered unlikely.

Given the low numbers of cetaceans foraging and transient through the area during Jan-April (relative to larger aggregations off the Bonney Upwelling and further south), the rapid dispersion of MGO and subsequent weathering of volatiles (limiting inhalation exposure to the early stage of a spill) and the relatively small, discontinuous pockets of elevated entrained and dispersed oil, impacts are not forecast at a population level, consequences are ranked minor and the risk is Low

Commercial fishing

A description of Commercial Fishing in the EMBA is provided in Section 4.8.

Lost or reduced fishing time can result if fisheries are unable to access specific fishing areas due to spill response activities, possible exclusion zones and avoidance of areas where vessels and equipment may be oiled. Temporary fisheries closures may be established by the VFA or voluntarily by the fishermen themselves because of the risk of the catch being tainted. Davis et al (2002) reported detectable tainting after a 24 hr exposure to crude concentrations of 0.1 ppm, marine fuel concentrations of 0.33 ppm and diesel concentrations of 0.25 ppm. Concentrations of petroleum in fish, crustacea and mollusc tissues can pose significant potential for adverse human health effects and until products are cleared by health authorities they could be restricted for sale and human consumption. The main potential impact of real or perceived tainting of target species is financial loss to licence holders and fishing crew, however there may also be wider economic consequences such as reduced employment in fishing services in the region.

Nevertheless, a fisheries closure as a consequence of tainting concerns is expected to be short-term. After the Montara oil spill (Timor Sea, 2009) as a precautionary measure, the WA Department of Fisheries advised commercial fishers to avoid fishing in waters affected by oil from this spill, suggesting fish were not safe for human consumption. However, testing of fish caught in the visible slick found no detectable petroleum hydrocarbon in fish muscle samples, suggesting they were safe for human consumption. Limited ill effects were detected in a small number of fish (PTTEP, 2013). No consistent effects of exposure on fish health could be detected within two weeks following the end of the well release. In addition, the majority of studies (both laboratory trials or fish collected after spills) find evidence of elimination of PAHs in fish tissue, returning to reference levels within two months of exposure (Challenger and Mauseth, 2011), (Davis et al. 2002), (Gagnon and Rawson, 2011).

The impacts to commercial fishing from a public perspective may be more significant and longer term than the ecological impacts. Decreased catches may also occur due to ecological impacts on target species within the area of the spill. Larvae of commercial species and their planktonic food sources are the most vulnerable to hydrocarbon impacts. See Plankton. Various species are likely to spawn in the area, whether in shallower shelf waters (e.g. whiting and snapper) or deeper slope waters (e.g. pink ling and blue

	grenadier) (Section 4.7). Most of these species are broadcast spawners making their larvae vulnerable to the effects of an oil spill. However in the case of those species in which the spawning period overlaps the period of the proposed seismic survey, the area of a potential oil spill is very small relative to the area over which spawning occurs, and broad-scale mixing as a result of oceanic currents is expected to minimise potential impacts of a short-term oil spill. In terms of impacts to adults, Gagnon and Rawson (2011) studied a number of fish species after the Montara blowout in the Timor Sea (light condensate) in four phases. Immediately after the blowout ceased, fish were exposed to and metabolised hydrocarbons, however, no consistent adverse effects on fish health or reproductive activity were detected. Five months after the blowout, continued exposure was indicated through the detection of elevated liver detoxification enzymes and PAH biliary metabolites in three out of four species collected, and elevated oxidative DNA damage. A year later, trends showed a return to reference levels with often (but not always) comparable biomarker levels in fish collected form reference and impacted sites. No reported studies of oil spills on cartilaginous fish (including sharks rays and sawfish) were found in the literature. It is not known how the data on bony fish would relate to cartilaginous fish. Fish assemblage recovery depends on the intensity and duration of the spill, composition of the hydrocarbon and any dispersant used and life cycle attributes e.g. abundant short lived fecund species may recover quicker than long lived less abundant species with small movement ranges. Given the forecast rapid weathering and dissipation of a spill and the relatively small area where for a short period entrained and dissolved hydrocarbons could exceed thresholds, impacts from a hydrocarbon spill are unlikely to result in measurable effects on fishery catch returns. and impacts on commercial stocks and fishermen is expected to be minor.

	Other Users – Public Amenity, Swimming and Diving Hydrocarbon presence on the sea surface may create a safety hazard to other marine users. Volatilisation of hydrocarbon lighter ends may initially create conditions at the sea surface at the time of the initial release with a resultant fire hazard potential. Safety hazards associated with the release quickly reduce with distance, and time, from the spill. As such, safety impacts to third party marine users could only be experienced within very small distance of the spill source and within a short time of release given the weathering characteristics of MGO. Recreational boating, fishing, swimming and diving is popular in summer all along the coast with communities at various coastal towns, camping spots, boat ramps and dive sites reaching from Wilsons Promontory and Corner Inlet, McLoughlins Beach, Woodside Beach, Seaspray, Golden Beach Lakes Entrance, Sydenham Inlet, Port Hicks and Cape Howe. Surface oil can coat fishing equipment/vessels especially where equipment is retrieved to the vessel. Most of the coastline (including islands) has a low or no probability of shoreline oil ≥10g/m^2 (i.e. visible oiling) from a spill originating in the Central or Offshore sections of the Activity Area. A spill in the nearshore closest to land could result in the coastline north of the Operations Area being exposed to shoreline oil. Port Hicks and the coastline of the East of Eden Upwelling down to Lakes Entrance are the most exposed with a ≤11% probability of >10g/m^2 shoreline oil (lowest threshold to reflect what could be visible staining). Corner Inlet, Sydenham Inlet, Gippsland Lakes, Marlo, Port Hicks and the coast north of Lakes Entrance may also show oiling from spills in the adjacent nearshore. Lakes Entrance and Port Hicks have the highest mean max local accumulated concentration of 38g/m^2 and 37 g/m^2 which is below the threshold for environmental impact but may lessen amenity and can result in equipment oiling. Popular beaches likewise may experience oil washing up over following days and weeks, resulting in maximum accumulated volumes of (mean) all ≤ 3m^3. Beware Reef is a popular dive location within the Beware Reef Sanctuary. Though contact with shoreline oil is not forecast, elevated hydrocarbons in the shallows have a ≤ 7% probability of encountering ≥0.5g/m^2 (lightest threshold for surface oils), ≤ 21% probability of encountering entrained hydrocarbons ≥10ppb (lowest threshold) and ≤1% of dissolved aromatics >6ppb (lowest threshold). Port Hicks as a popular tourist destination is forecast to have the highest probability of sites along the coast of ≤28% of entrained hydrocarbons ≥10ppb (lowest threshold). Other users would primarily be impacted by being displaced by the surface slick. As such, recreational fishing effort and swimming/diving would be expected to be moved outside the area of the impact of the slick. Public sensitivity is rated as High but given the intermittent nature of the coastline oiling from a single event, the spread-out nature of the coastal towns, the rapid evaporation and dissipation of MGO and temporary nature of any closures, impacts are assessed as Moderate.

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	KEFs **Eden Upwelling** comprises roughly a quarter of the Operational Area and includes shallow water habitats and coastline contacts. Exposure of phytoplankton blooms to low exposure hydrocarbons may result in direct effects (e.g. smothering, ingestion) and indirect effects (e.g. water quality and bioaccumulation), thus affecting the food chain (e.g. foraging whales such as pygmy blues and humpbacks) depending on the volumes of plankton ingested. The total area of the Upwelling has a probability of ≤8% of encountering floating surface oil >10g/m^2, ≤34% probability of entrained oil >10ppb (lower threshold to account for more sensitive receptors such as fish embryo and plankton), and ≤9% probability of encountering dissolved aromatics >6ppb (lower threshold to account for early life forms and dependent food chains). See Plankton, Fish (including sharks) and Pinnipeds However, even at these thresholds the impacts of an MGO spill are assessed as a once off event from which the habitats and affected biota will recover within a year. There is a ≤10% (5%) probability of shoreline oil occurring along the coast of the Upwelling at ≥10 (100) g/m^2 from spills originating in the adjacent inshore Operational Area, taking less than an hour to reach the shore. Maximum local accumulated mean concentrations of 32mg/m^2 (maximum 3128mg/m^2). Offshore spills have ≤1% probability of contacting the shoreline. **See too plankton.** **Big Horseshoe Canyon** is more than 1500m deep, so benthic habitats are unlikely to be impacted by surface oils. The area has a probability of ≤4% of encountering floating surface oil >10g/m^2, ≤17% probability of entrained oil >10ppb (lower threshold to account for more sensitive receptors such as fish embryo, plankton, sponge beds), and ≤7% probability of encountering dissolved aromatics >6ppb (lower threshold to account for early life forms and dependent food chains). Given both KEFs are important in the region, such impacts are notable. However, being large dynamic open ocean environments, well mixed and given the nature and behaviour of the MGO, impacts are expected to be recoverable within a year and not have any individual or cumulative consequence higher than Low. Both the Canyons on the East Continental Slope and Shelf Rocky Reefs have probabilities of ≤1 of films arriving at ≥0.5 g/m^2, shortest time to arrival ≥7 days, ≤2% probability of entrained hydrocarbons above 100 ppb and ≤1% probability of dissolved aromatics ≥6 ppb. The habitats at both KEFS are well represented regionally, open to highly diffusive open ocean currents and shortest times to arrival exceed seven days (toxic components well weathered). As such potential impacts at either KEF are predicted to be negligible.
	Macroalgal communities A description of macroalgal communities (such as Giant kelp) is provided in Sections 4.3.2, 4.3.7.1 and 4.5.4. Macroalgae are generally limited to growing on intertidal and sub tidal rocky substrata in shallow waters to 10 m water depth, so may be exposed to subsurface, entrained and dissolved hydrocarbons. However some are susceptible to surface hydrocarbons exposure more so in intertidal habitats as opposed to subtidal habitats. Blumer (1971) and Cintron et al (1981) document smothering, fouling and asphyxiation effects on marine plants. In macroalgae, oil can act as a physical barrier for the diffusion of carbon dioxide across cell walls (Obrien Dixon 1976), the impact depending largely on the degree of exposure and how much the hydrocarbon adheres to the algae which varies with oil state and stickiness. The presence of mucilage layer or fine ‘hairs’ will influence how much oil sticks. Connell et al. (1981) reviewed post spill field studies noting a wide range of variability in the level of impact, but in all instances the algae appeared to be able to recover rapidly from even heavy oiling. This was due to the fact that for most algae, new growth is produced near the base of the plant while the distal parts exposed to the oil are continually lost. French-McCay (2004) indicated that oiled kelp beds had a 90% recovery within 3–4 years of impact however full recovery to pre-spill diversity may not occur for longer periods. Intertidal macroalgal beds are more prone to oil spills than subtidal beds because although the mucous coating prevents oil adherence, oil that is trapped in the upper canopy can increase the persistence of the oil, which impacts upon site attached species. Additionally, when oil sticks to dry fronds on the shore they can become overweight and break as a result of wave action (IPIECA 2002). Hook et al (2016) on the other hand, states that kelp is typically resistant to oil though the fauna associated with it may be more sensitive. IPIECA (1995) also states that brown seaweeds are relatively insensitive to oil due to the slimy mucilage that coats all their surfaces so that even after a heavy oiling, most of the seaweeds are washed clean by the next high tide and largely remain undamaged. Edgar and Barrett (1995) studied the impacts on and the recovery of subtidal reefs affected the *Iron Baron* spill (Northern Tasmania, 1995), that the release of large quantities of fuel oil did not substantially affect

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	populations of sub tidal reef associated organisms with no significant change in numbers of species on reefs nor in the densities of the most abundant animal and plant species. Macroalgae's response to hydrocarbons depends on its life stage, with gamete, larva and zygote stages more at risk than adult growth stages (Thusby & Steele, 2003), Lewis & Pryor 2013). Toxic effects concentrations for algae exposed to hydrocarbons varied greatly amongst species with studies ranging from 0.002-10,000 ppm (Lewis & Pryor, 2013). Macrophytes including seagrasses and macroalgae require light to photosynthesise. So, in addition to the potential impacts from direct smothering exposure to entrained and dissolved hydrocarbons, the presence of entrained oil in the water column can affect the light quantities and the ability of macrophytes to photosynthesise **Gippsland kelp beds** The Giant Kelp Beds (see Threatened Ecological Communities in Section 4.3.7.1). in areas near Gabo island, Corner Inlet, the Kent group and Flinders island are unlikely to be impacted by surface oils as they are submerged below the water surface. Unknown stands along the coast north of the Operational Area may encounter raised levels of entrained hydrocarbons (e.g. Gabo island is most exposed at ≤1% probability of surface oils above 10 gm^2, ≤7% probability of entrained hydrocarbons ≥100 g/m^2, 3% probability of ≥6 ppb dissolved oils) and overlap with kelp beds depending on the location and volumes of a spill. As the concentrations of entrained and dissolved oil are low and temporary, they are unlikely to result in mortality. Corner inlet has the largest seagrass areas in Victoria. Inlets such as Mallacoota Inlet, Wingan Inlet, Tamboon inlets and Sydenham Inlet have seagrasses, some protected within the estuary (which are sometimes closed in summer or have a current that hinders tidal flooding) and others are located around the estuary. There are isolated areas of rocky shoreline (intertidal shore platform) and mix sand beach/ shore platform same area east of Marlo that may support macroalgae communities (e.g. Cape Conran) and near Corner Inlet and Wilsons Promontory. At worst, Cape Conran has ≤3% probability of contact though shoreline loadings >100 g/m^2. Impacts are likely to be similar to those described above, with hydrocarbons weathering rapidly where higher energy waves break on the rocky platforms. Given the likely high abundance of macroalgae along sections of similar coast with inter tidal shore platforms (east of Marlo) and near Corner Inlet, any mortality of macroalgae is likely to lead to rapid recruitment from nearby seed stock and the recovery is predicted in within a year (although full recovery of biodiversity may take longer). As such the impact is low.
	Places of heritage and cultural Indigenous importance, nationally important wetlands, RAMSAR wetlands and Commonwealth and state marine parks **Heritage**: A description of shipwrecks and other heritage sites is provided in Sections 4.6.4 and 4.6.3 respectively. Impacts of a spill include oiling – relevant to those that are not fully submerged and are below the high tide mark. As such, there are two wrecks, one on the shore at Golden Beach and the Clonmel lies at <5 m water depth. Golden Beach has a very low probability (≤1% of films arriving >10 g/m^2 and ≤2% probability of shoreline oil ≥10 g/m^2. Clonmel Island likewise has a low probability (≤1% of films arriving >10 g/m^2 and ≤3% probability of shoreline oil ≥10 g/m^2. Impacts on submerged wrecks are discussed sparsely in the literature. Some research (BoOEM, 2018) has shown that the abundance and diversity of bacterial communities living on wrecks, making them more habitable for marine life (such as coral, crabs and fish) has increased post-the GoM Macondo spill. No commonwealth heritage listed sites (see Section 4.7) are impacted by the Oil EMBA. Cultural Indigenous importance: No specific sites are identified as having a specific exposure to spills. General amenity and recreational use are discussed under Other Users – Public Amenity, Swimming and Diving. A number of nationally important wetlands are listed in Section 4.5, lying in both Victoria and NSW. Potential impacts to Lake King are discussed under Lakes Entrance (below) and the Benedore River wetlands addressed as part of the Croajingolong National Park. There are very low probabilities of the other wetlands being potentially impacted (e.g. the coastline near Nadgee Lake and Nelson lagoon (represented by 'Bega') has ≤2% probability of any shoreline oil>100 g/m^2) and impacts would depend on the rivers being open to the ocean and the highly weathered state of any arriving surface oil. The Tuross River wetlands is not predicted to be contacted by shoreline oil. Nargal Lake is typically closed to the Bass Strait A description of RAMSAR wetlands and marine protected areas is given in Sections 4.3.5, 4.3.2 and 4.3.3. The probability of encountering spilled oil above thresholds for potential impacts to habitats are listed below for those marine parks/sanctuaries closest to the Operational Area. The RAMSAR sites have been included below under the Park or Sanctuary within which they largely fall that has a coastline. Note all parks have a probability of ≤4% of dissolved aromatics >6 ppb. Most of the nationally important wetlands present along the coastline are only intermittently open to the sea (unlikely during summer when flows are

low) with the exception of include Lake Entrance, Snowy River, Wingan Inlet and Mallacoota. In the areas of high and moderate sea surface exposure, there are no nationally important wetlands so contact with the wetlands is forecast at low levels. Should water with low levels of hydrocarbons enter the wetlands, the absence of toxicity effects (as the lighter more toxic ends typically evaporate off within a few days) should ensure the values of the wetlands are not compromised. Potential impacts to wetland birdlife is discussed under Birds

The potentially contacted types of shorelines range from rocky beaches, sandy beaches, mud flats and estuaries. Each of these will influence the volume of oil that could be retained ashore and its thickness before saturation occurs. Sandy beaches may allow oil to infiltrate through the sediments, thus increasing its ability to hold more oil ashore over tidal cycles and various wave actions than an equivalent area of water; hence, oil can increase in thickness onshore over time.

Algae and immobile benthic animals that colonise intertidal rocky shores are vulnerable to oil spills. Filter feeders such as molluscs are especially liable to ingest oil with lethal and various sub-lethal effects. The latter include alteration in respiration rates, decreases in filter feeding activity, reduced growth rates, biochemical effects, increased predation, reproductive failure and mechanical destruction by waves due to inability to maintain hold on substrate (Ballou et al. 1989 Connell & Miller 1981).

A review by Connell and Miller (1981) of field studies conducted after spill events indicated a high degree of variability in level of impact, but in all instances, the algae appeared to be able to recover rapidly from even very heavy oiling. They attributed the rapid recovery of algae to the fact that for most algae new growth is produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are continually lost.

Laboratory tests have illustrated the sensitivity of seagrasses to both surface oil and dissolved or physically dispersed hydrocarbons (e.g. Hatcher & Larkum 1982 Baca & Getter 1984). Stress response has also been demonstrated for seagrass at low hydrocarbon concentrations similar to that expected to occur in oil spill situations (Thorhaug et al. 1991).

The susceptibility of seagrass to hydrocarbon spills will depend largely on their distribution. Deeper communities will be protected from oiling under all but the most extreme weather conditions. Shallow seagrasses are more likely to be affected by dispersed oil droplets or, in the case of emergent seagrasses, by direct oiling. Intertidal seagrass communities would theoretically be the most susceptible because the leaves and rhizomes may both be affected. See macroalgae.

Subtidal areas exposure to dissolved aromatic and entrained hydrocarbon concentrations were both predicted to be below the low exposure level, and that there is only a slight chance of a spill impacting any areas where seagrasses might occur (e.g. Corner Inlet).

Commonwealth and State Marine parks: A number of Commonwealth Marine parks are described briefly for in the table below. Table 7.24 below is a summary of the probability of exposures for a selection of marine parks (see Full report in Appendix C for additional smaller or less exposed Parks). It also lists RAMSAR sites and nationally important wetlands.

Table 7.22 Summary of probabilities of exposure – Marine Parks, RAMSAR sites and nationally important wetlands

	>10 g/m^2 floating oil	>100 ppb entrained oil	Probability of shoreline contacted >10 g/m^2	Comment
E Gippsland CMP	2	4	N/A	No shoreline. Low impacts to features of high biodiversity (e.g. Eden Upwelling), protected birds and mammals (e.g. humpbacks), plankton and management plan values
Croajingolong East and West National park	4	11	2	Low probability of impacts-Benedore River estuary, seabird and shorebird habitats, seagrasses, tourist precinct
Corner Inlet MNP (incl Corner Inlet RAMSAR site)	1	1	1	Negligible probability of exposure to marine fauna, seagrass, sandy beaches, seabirds and shorebirds, mangroves and park values

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	Cape Barren RAMSAR site	<1	2	1	Negligible probability of exposure to shore line oil, very low probability of entrained oil impacting shallow coastal lagoons.
	Beagle AMP	2	8	NC	Low impacts to southern rights, protected birds, killer whales, seals etc
	Flinders AMP	2	4	N/A	No shoreline. Low impacts to features with high biodiversity, protected birds, great white shark. Oils weathered before exposure.
	Wilsons Prom	1	1	1	Low/no impact to marine flora and fauna (seals, shorebirds), cultural sites, recreation, tourism
	Beware Reef Marine Sanctuary	1	4	N/A	Low impacts to exposed granite reefs, diverse fish and invertebrates, threatened fauna, cultural, recreational, tourism
	Lakes Entrance (incl Gippsland lakes RAMSAR site)	1	1	3	Low/no impacts to coastal lagoons, shorebirds and seabird nesting/foraging, fishing, boating
	Ninety Mile Beach MNP (represented by Golden Beach)	1	2	2	Low/no impact to diverse invertebrates (incl sponges), reefs, shore and seabirds, cultural and recreation
	Point Hicks MNP	2	17	11	Low impact to diverse habitats, marine mammals incl seals, threatened fauna, intertidal and subtidal invertebrates
	Cape Conran Coastal park	3	5	3	Low impact to rich diverse vegetation, flora, fauna, seagrass, seals and rocky platforms
	NC: No contact. NA: Not Applicable This is a selection of parks and reserves with higher exposures and/or have higher values. While some other marine parks and reserves may have coastlines that could be exposed to a spill (see Appendix C), the probability of weathered oil coming ashore above thresholds that may affect coastal habitats (>100g/m^2) is low and full recovery expected within a year). Given the low level of impact predicted, the values expressed in the Marine Park Management Plans are met and risks to cultural values are assessed as Low.				
Inherent risk	**Extent**: the maximum extent of a spill offshore with concentrations > 25 g/m^2 surface is 180km. Pollution on the surface water and/or shorelines. Injury or death to marine fauna and seabirds through ingestion or contact. **Duration:** days, weeks or months depending on level of contact, location and receptors. **Level of uncertainty of risk**: high. Spill source volumes are limited, noting modelling used a volume (286m3) in excess of the largest tank size in the likely analogue vessel (257m^3). The environmental impact of MGO is well understood, and very conservative thresholds have been selected to define the EMBA.				
	Consequence	Likelihood		Risk Ranking	
	Minor	Unlikely		Low	

7.7.4 Impact and risk treatment

7.7.4.1 Demonstration of ALARP

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are practicable – and hence not disproportionate to the sacrifice (e.g. cost) of implementation Control measures have not been adopted where the cost of implementation is disproportionate to the benefit gained.

The potential for a vessel collision leading to a spill cannot be eliminated completely. Power that could be used as a substitute (such as solar, wind or biofuels are not commercially proven in such applications. CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with accidental oil spill from refuelling to ALARP. No other controls measures have been identified that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of risk reduction.

Table 7.23 Cost benefit analysis and residual risk evaluation – oil spill

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
Compliance with specifications set by internationally recognised maritime legislation – MARPOL 73/78 Annex I	Benefits outweigh costs; Legal requirement	Yes	Yes
Vessel design such that the fuel tanks are located internally and protected by other tanks e.g. water ballast or void space. Note – the location of the fuel tanks on the analogue vessel are designed such that the water ballast tanks protect the fuel tanks	The costs of retro-fitting unprotected tanks and/or the non-availability of such vessels (hence impacts to schedule) outweighs the benefit	Yes	No.
Survey vessel will be compliant with Marine Orders Part 30: Prevention of Collisions (Issue 8) and Marine Orders Part 21: Safety of navigation and emergency procedures, Issue 8, specifically the use of standard maritime safety procedures (including radio contact, display of navigational beacons and lights)	Benefits outweigh costs; standard procedures	Yes	Yes
Refuelling and resupplying only occurs outside shipping lanes and areas of high traffic	Benefits outweigh costs, standard procedures	Yes	Yes
The Australian Hydrographic Office (AHO) advised of the survey details (survey location, timing) four weeks prior to mobilisation and following demobilisation for issue of Notice to Mariners	Benefits outweigh costs	Yes	Yes
AMSA's JRCC will be advised of the survey vessel's details (including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation and requested clearance from other vessels. This information will be notified to AMSA JRCC 24 to 48 hours before operations commence via email address (rccaus@amsa.gov.au) or phone (1800 641 792 or +61 2 6230 6811)	Benefits outweigh costs	Yes	Yes
AMSA JRCC will be notified at the end of the survey when operations have been completed (via email address (rccaus@amsa.gov.au) or phone: 1800 641 792 or +61 2 6230 6811)	Benefits outweigh costs	Yes	Yes
Support vessel(s) will undertake surveillance (during a spill) and manage interactions with other marine users' vessels transiting near the seismic vessel or streamers	Benefits outweigh costs	Yes	Yes
Vessel to maintain appropriate lighting, navigation and communication systems at all times to inform other users of the position and intentions of the survey vessel, in compliance with the Navigation Act 2012 and Chapter 5 of the SOLAS Convention	Benefits outweigh costs; legal requirement	Yes	Yes
Continuous (24 hour) survey operations, with survey team and bridge crew monitoring for other vessels at all times during seismic acquisition	Benefits outweigh costs	Yes	Yes

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Control measures	Cost benefit analysis	Risk reduction	Control adopted
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

7.7.4.2 Demonstration of acceptability

The risk of adverse effects from an accidental spill resulting from a vessel collision/grounding is therefore considered acceptable because predictions are below the defined levels of acceptability as described below.

Table 7.24 Acceptability criteria – oil spill

Acceptability Criteria	
There will be no predicted long-term unrecoverable effects on EPBC Act listed MNES, marine reserve management plan values and species conservation advice/recovery plans	Should a spill occur, the SOPEP and OPEP will be implemented to mitigate risk. • The risk of exposure at levels that may cause unrecoverable impacts to MNES is predicted to be low due to the rate of weathering, spreading out of the surface slick, and limited vertical distribution of dissolved and entrained components into surface waters. This risk is therefore considered to be acceptable because • Vessel operations are a well understood and practiced activity, with multiple barrier levels in place to mitigate risk of a vessel collision/grounding and subsequent spill. • Should there be a spill, the risk of interaction with the surface slick is low (relatively small spatial area, restricted predominantly to surface waters and the low spatial density of MNES. • MGO is a substitute for HFO for all vessels which has greater environmental impacts if spilled. Levels of MGO with potential to cause ecological harm are likely to be spatially restricted, spatially transient and not persistent. • Although there is potential for shoreline exposure, probability drops for spills from the central and Offshore Zones. The mean maximum accumulated volume of oil along the whole shoreline at known sensitive sites is Cape Conran 2m^3, Marlo 2m^3, Lakes Entrance 2m^3, Wilsons Promontory (NE, E and W) <1m^3, Croajingolong (W and E) <1m^3, Port Hicks<1m^3, Sydenham Inlet<1m^3, Gippsland lakes< 3m^3, Corner Inlet <1 m^3 and Gabo island<1m^3. These areas include shorelines of inlands, areas known for aggregations and foraging grounds for seabirds and where seals have been sighted as well as being in proximity to Threatened Communities such as Giant Kelp and RAMSAR Wetlands. • There are no residual impacts above LOW for any Marine park, MNES, KEF, TEC or protected area • The performance standards listed above and the development and implementation of a project-specific OPEP aim to prevent a spill, and where this is not possible, minimise fuel loss and impacts to sensitive receptors. • The National recovery plan for threatened albatross and giant petrels 2011-2016 (DSEWPC, 2011) lists marine pollution as a threat for albatross and giant-petrels requiring population monitoring to deal with marine pollution. The risks posed by response operations do not impact this action. The conservation advice and management plans for cetaceans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. Performance standards listed here aim to prevent and minimise such spills.
There will be no predicted long-term unrecoverable effects on fish stocks or commercial fishing	Recovery of fish populations and habitats depend on the spill volume, duration and characteristics (including any dispersants). Recovery also depends on the life cycle characteristics of the fish – those that are plentiful, short-lived and highly productive may recover quicker than the less abundant and long-lived species. The range of movement of fishes and the type of habitat will also influence the level of impact on fishes and their recovery. Hook et al (2016) suggests there are no reports of oil spills in the open ocean causing adult fish kills, possibly as some species can rapidly metabolise and excrete hydrocarbons.

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Acceptability Criteria	
No specific stakeholder concerns have been raised and are unresolved	Concerns raised regarding oil spill have been addressed in Section 9 and there are no outstanding merited concerns
Operations are compliant with maritime law and OPGGS Act relating to preventing pollution / collisions at sea, reporting and responding to spills	Operations will be compliant with nationally and internationally recognised standards and regulations: • MARPOL 73/78 Annex I (as applied in Australia under the Protection of the Sea (Prevention of Pollution from Ships) Act 1983)) • AMSA Marine Orders – Part 91 Marine Pollution Prevention – Oil) • Marine Orders Part 30: Prevention of Collisions (Issue 8) • Marine Orders Part 21: Safety of navigation and emergency procedures, Issue 8, specifically the use of standard maritime safety procedures (including radio contact, display of navigational beacons and lights). Predictions are therefore considered acceptable because these Acts and Orders provide marine pollution prevention measures to mitigate risks of spills occurring. The performance standards outlined in this EP align with the requirements of: • OPGGS Act 2006 (Cth): Section 572A-F (Polluter pays for escape of petroleum). • OPGGS Act 2010 (Vic) (if the spill moves into State waters): Section 29 (Notifying reportable incidents). • POWBONS Act 1986 (Vic): Section 10 (Duty to report certain incidents involving oil and oily mixtures) -State waters • State Environment Protection Policy (Waters of Victoria): Clause 38 (Spills, illegal discharges and dumping of waste).

7.7.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for accidental oil spill (vessel collision) are presented below in Table 7.25. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.7.4.1.

Table 7.25 Environmental performance outcomes, standards and measurement criteria for an accidental oil spill (vessel collision)

Environmental performance outcome	Environmental performance standard	Measurement criteria
Vessel crews are prepared to respond to a spill, including Vessel master initiating action to reduce fuel loss	Compliance with MARPOL 73/78 Annex I (as applied in Australia under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983)*); and AMSA Marine Orders – Part 91 Marine Pollution Prevention – Oil): • current SOPEP in place • all vessels hold a valid IOPP Certificate, where required, under vessel class	Records demonstrate the SOPEP is in place on the survey vessel Records demonstrate all vessels hold an IOPP certificate, if required under vessel class
	The SOPEP and OPEP are approved and tested prior to the survey vessel commencing acquisition (emergency response drills) and to test interfaces between the SOPEP, OPEP, NatPlan, TasPlan and VicPlan.	Records demonstrate the SOPEP and OPEP are approved, tested (desktop exercise) and available to relevant persons on the survey vessel
	Responsibilities of vessel crew under the OPEP and SOPEP are communicated to relevant personnel and included as part of the project induction	Records show that the project induction (including induction material) includes responsibilities of vessel crew for response and notification protocols under the OPEP and SOPEP

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Environmental performance outcome	Environmental performance standard	Measurement criteria
	All relevant crew trained in implementation of the OPEP and SOPEP	Training, induction and competency matrix to confirm that crew have been trained on implementation of the OPEP and SOPEP prior to commencing seismic data acquisition
	The Vessel Master/s will authorise actions in accordance with the vessel- specific SOPEP (or equivalent according to class) and the survey- specific OPEP to limit the escape of MDO.	Daily operations reports verify that the SOPEP and OPEP were implemented.
Communications to advise others of presence to prevent collision	The Australian Hydrographic Office (AHO) advised of the survey details (survey location, timing) four weeks prior to mobilisation and following demobilisation for issue of Notice to Mariners	Records of notification of survey details sent to the AHO four weeks prior to survey mobilisation and within two weeks of survey demobilisation
	AMSA's JRCC will be advised of the survey vessels ' details (including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation and requested clearance from other vessels. This information will be notified to AMSA JRCC 24 to 48 hours before operations commence via email address (rccaus@amsa.gov.au) or phone (1800 641 792 or +61 2 6230 6811)	Pre-survey notification demonstrates that AMSA JRCC have been notified of the survey vessel details and movements 24 to 48 hours prior to the start of the survey
	AMSA JRCC will be notified at the end of the survey when operations have been completed (via email address (rccaus@amsa.gov.au) or phone: 1800 641 792 or +61 2 6230 6811).	End of survey notification demonstrates that AMSA JRCC have been notified of the completion of survey operations
	Escort/support vessel(s) will undertake surveillance (during a spill) and manage interactions with other marine users and vessels transiting near the seismic vessel or streamers	Support vessel log confirms vessel is employed for the duration of the activity and manages interactions with other marine users and vessels
	All vessels to maintain appropriate lighting, navigation and communication at all times to inform other users of the position and intentions of the survey vessel, in compliance with the Navigation Act 2012 and Chapter 5 of the SOLAS Convention	Records show no failure to comply with requirements for appropriate navigation, lighting and communication during survey, in accordance with the Navigation Act 2012 and Chapter 5 of the SOLAS Convention. Any records of failure to comply are documented
	Continuous (24 hour) survey operations, with survey team and bridge crew monitoring vessel position and depth at all times during seismic acquisition	Records confirm bridge was manned continuously during survey operations, and that survey vessel crew have appropriate qualifications
No HFO spill in marine environment	Survey vessels and support/escort vessels will not use heavy fuel oil	Bunkering records demonstrate MGO or MDO used on all vessels
Avoid shipping lanes during refuelling/resupplying	Refuelling and resupplying only occurs outside shipping lanes and areas of high traffic	Records show refuelling and resupplying occurred in regions of low/no traffic
Collect operational monitoring data to support the spill response and collect scientific monitoring data to characterise environmental impacts.	CGG will undertake operational and scientific monitoring in accordance with the OSMP.	Daily operations reports and overall study reports verify that the OSMP was implemented.

7.8 Risk 7 – oil spill response

7.8.1 Identification of hazard and extent

Hazard	In the event of an oil spill, a number of potential responses may be initiated; dependent on direction from the Control Agency (AMSA, refer to Section 8.7), the location and size of the spill, the potential for sensitive environmental receptors to be impacted and the resources available. Typical responses generally involve additional vessels and may involve equipment and field survey teams. These extra activities introduce additional risks to environmental receptors, as well as increasing the likelihood of many of the risks assessed within this EP. The following response strategies have been considered for the two credible spill scenarios (representing one Level 1 and one Level 2 spill) under this EP, and are assessed with relevance to the CGG Gippsland MSS in Table 8-3: • monitor and evaluate • mechanical dispersion • containment and recovery • shoreline protection • shoreline clean-up • chemical dispersion
Extent	Oil EMBA
Duration	Duration of survey – commencing mid – January to end July

7.8.2 Levels of acceptable risk

The risk of adverse effects from oil spill response activities on environmental and socio-economic sensitive receptors will be acceptable when:

- spill response strategies have been selected following an assessment of their potential benefits and/or dis-benefits using an industry-standard approach (i.e. Net Environmental Benefit Analysis (NEBA) or Spill Impact Mitigation Assessment (SIMA))
- there will be no predicted unrecoverable effects on EPBC Act listed MNES
- operations will be undertaken by suitably-qualified personnel and are compliant with maritime law relating to spill response.

7.8.3 Risk and impact analysis and evaluation through the risk of oil spill response associated with the Gippsland MSS

Risk	The activities associated with a hydrocarbon spill response introduce additional risks to marine fauna and habitats, as well as increasing the likelihood of many of the impacts and risks already described within this EP. Examples of additional risks include: • increased risk of disturbance of seabirds/shorebirds/marine megafauna • increased risk of vessel strikes • introduction of chemical control agents into the marine environment • increased potential for toxicity in surface waters (increased water-accommodated fraction) due to application of dispersants (if the oil is amenable to dispersion) • physical damage to shallow subtidal MNES (e.g. reefs, seagrass) from anchoring of shoreline protection booms • increased risk to shallow subtidal MNES from remobilisation of intertidal hydrocarbons/dispersed hydrocarbons and/or chemical control agents applied intertidally • damage to sensitive intertidal habitats and food resources due to trampling, vehicles, cropping, removal of oiled sediment, hot water/jet washing, chemical control agents/dispersants.

Potential effects	Application of spill response strategies from vessel spills, where not adequately assessed, have the potential to significantly increase impacts to environmental sensitivities in comparison to an unmitigated spill (e.g. *Exxon Valdez*). Several of the proposed methods have the potential for increasing impacts if applied without appropriate consideration (e.g. shoreline clean-up, application of chemical control agents/dispersants). In cases where no assessment of potential risks from spill response strategies has been undertaken, the potential inherent risk is considered to be:		
Inherent risk	Consequence	Likelihood	Risk Ranking
	Major	Possible	High

7.8.4 Impact and risk treatment

7.8.4.1 Demonstration of ALARP

CGG is committed to ensuring continual risk reduction and identifying if additional control measures may be applied that are practicable – and hence not disproportionate to the sacrifice (e.g. cost) of implementation, in line with the ALARP assessment process. Control measures have not been adopted where the cost of implementation is disproportionate to the likely benefit gained.

CGG considers the adopted controls to be appropriate in reducing the environmental risks associated with accidental oil spill from refuelling to ALARP. No other controls measures have been identified that may practicably or feasibly be adopted to further reduce the risks of impacts without disproportionate costs compared to the benefit of risk reduction.

Response actions will be based on a Net Environmental Benefit Analysis (NEBA) or Spill Impact Mitigation Assessment (SIMA) approach, which will be used to consider the advantages and disadvantages of the different spill response options to determine if there would be a net environmental benefit or dis-benefit resulting from the implementation of a particular response in comparison to an unmitigated spill response strategy. NEBA/SIMA considers the hydrocarbon type, the sensitivities of the regional area of the spill, and the potential effects (positive and negative) of the proposed response strategy. The decision context focuses on the potential level of impact, spatial scale of impact and duration of impact. The method to be used will be in line with global industry best-practice (IPIECA 2015, IPIECA_API-IOGP 2017).

NEBA/SIMA is used for preliminary assessment to determine the initial spill responses required. In the actual event of a spill, the NEBA/SIMA is revisited every operational cycle as more information becomes available e.g. on actual conditions, spill trajectory path and locations of sensitive receptors; and/or where a significant change in risk has been identified. This review process allows response strategies to be dimensioned to the nature and scale of the actual incident to provide optimal results (refer to the OPEP in Section 8.7.9).

Table 7.26 Cost benefit analysis and residual risk evaluation – oil spill response

Control measures	Cost benefit analysis	Risk reduction	Control adopted
ALARP assessment technique – good practice			
In the event of an oil spill, the Survey Vessel Master will implement available controls and resources of the SOPEP	Benefits outweigh costs; legal requirement	Yes	Yes
Commercial and recreational fishers and other users in the area would be advised of any large spill and associated response activities via CGG's 24-hour 'look-ahead' correspondence	Benefits outweigh costs requirement	Yes	Yes
A hydrocarbon spill will be immediately (verbally within 2 hours) reported to ensure all notifications are provided as per Section 8.7.4	Benefits outweigh costs; regulatory requirement	Yes	Yes

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Control measures	Cost benefit analysis	Risk reduction	Control adopted
Operational monitoring will be undertaken e.g. to inform AMSA about the behaviour, likely trajectory and key sensitivities at risk from a spill (Section 8.7.10)	Benefits outweigh costs	Yes	Yes
Oil spill response training and competencies are to be maintained to avoid unplanned environmental impacts due to human error	Benefits outweigh costs	Yes	Yes
ALARP assessment technique – EIA			
Response actions will be based on a Net Environmental Benefit Analysis (NEBA) or Spill Impact Mitigation Assessment (SIMA) approach, which considers the advantages and disadvantages of the different spill response options to determine if there would be a net environmental benefit resulting from the implementation of a particular response relative to an unmitigated spill impact.	Benefits outweigh costs	Yes	Yes
Residual risk evaluation			
Residual risk	Consequence	Likelihood	Risk ranking
	Minor	Unlikely	Low

7.8.4.2 Demonstration of acceptability

This risk of adverse effects from a spill response is therefore considered acceptable because predictions are below the defined levels of acceptability as described below.

Table 7.27 Acceptability criteria – oil spill response

Acceptability criteria	
Spill response strategies will have been selected following an assessment of their potential benefits and/or dis-benefits using an industry-standard approach (i.e. NEBA or Spill Impact Mitigation Assessment (SIMA))	Spill response strategies will be assessed using NEBA/SIMA before being implemented. This allows assessment of response strategies against each other, and in comparison, to an unmitigated spill impact. The process will be continuously implemented throughout the response. NEBA and SIMA are accepted industry-standard approaches (IPIECA 2015, IPIECA_API-IOGP 2017). This risk is therefore considered to be acceptable because: • spill response strategies would have been assessed for the potential to increase risk to environmental sensitivities, in line with global industry standards • there is a process in place that allows continuous assessment and re-assessment, including following identification of a significant change in risk.
There will be no unrecoverable effects on EPBC Act listed MNES	Should a spill occur, the OPEP will be implemented to mitigate risk. The 'Monitor and Evaluate' strategy will be implemented as soon as reasonably practicable after the release (preferably within 2 h of the first report). Oil Spill Trajectory Modelling (OSTM) will reduce uncertainty in response and be used to focus response efforts. OSTM will be ground-truthed using on-site vessel and/or aerial observations. Vessel observations may be ongoing, even after implementation of an aerial observation response. On-site spill response equipment will be used to respond in the first instance (under the direction of AMSA as Control Agency), whilst other response resources are mobilised to the field. This risk is therefore considered to be acceptable because: • vessel operations are a well understood and practiced activity • each vessel has a vessel-specific SOPEP in place prior to commencement of operations • SOPEP responsibilities will have been covered in vessel inductions • the response will be managed and implemented by an experienced government response organisation specialised in vessel-based spills that has trained responders, provides spill response advice, contributes to spill response exercises, and has responded to numerous spills worldwide

Acceptability criteria	
	• 'monitor and evaluate' and operational monitoring will provide situational awareness, monitor the effectiveness and potential impacts of spill response activities, and support identification of risks and protection priorities • spill response waste will be removed from the environment and disposed of appropriately.
Operations are compliant with maritime law	Operations will be compliant with: • MARPOL 73/78 Annex I (as applied in Australia under the *Protection of the Sea* (*Prevention of Pollution from Ships*) Act 1983)) • AMSA Marine Orders – Part 91 Marine Pollution Prevention – Oil • Marine Orders Part 30: *Prevention of Collisions* (Issue 8) • Marine Orders Part 21: Safety of navigation and emergency procedures, Issue 8; specifically with respect to the use of standard maritime safety procedures (including radio contact, display of navigational beacons and lights) • Predictions are therefore considered acceptable because these Acts and Orders provide marine pollution prevention measures to mitigate risks of spills occurring.

7.8.4.3 Environmental performance outcomes, standards and measurement criteria

The environmental performance outcomes, standards and measurement criteria appropriate to measure performance of the adopted control measures for oil spill response are presented below in Table 7.28. Environmental performance standards and relevant measurement criteria have been developed for each control measure adopted in Section 7.8.4.1.

Table 7.28 Environmental performance outcomes, standards and measurement criteria for oil spill response

Environmental performance outcome	Environmental performance standard	Measurement criteria
Spill response arrangements to minimise impacts to the environment implemented in accordance with the vessel SOPEP and OPEP in this EP	For a level 1 spill, the Survey Vessel Master will implement available controls and resources of the SOPEP	Incident report verifies the SOPEP was implemented
	Depending on the nature and scale of the spill, an Incident Action plan will be prepared by the IMT Planning Officer to guide response activities	IAP is available within the first 24 hrs after a spill and daily reports verify it is implemented
	Response actions will be based on a Net Environmental Benefit Analysis/Sill Impact Mitigation Assessment (NEBA/SIMA) approach defined by AMSA	NEBA/SIMA outcomes and/or reports
	The Survey Vessel Master is responsible for notification (written and verbal) of a spill to the sea to the AMSA JRCC and subsequent reporting (as per Section 8.7.4)	Records of verbal communications and copies of marine pollution report (POLREP) report and situation reports (SITREPs) as per Section 8.7.4
	Commercial and recreational fishers and other users in the area would be advised of any large spill and associated response activities via CGG's 24-hour 'look-ahead' correspondence	Copies of stakeholder notifications and incident report(s) in the event of a spill
	Support vessels undertaking the MSS are used as vessels of opportunity to monitor the spill (operational monitoring) if safe to do (as agreed with AMSA)	Incident Report/operational monitoring reports, consultation records
	On-call Scientific monitoring response service agreement in place	Copy of service contract with Scientific Monitoring subcontractor prior to commencement of the survey

8 Implementation strategy

8.1 Introduction

CGG's implementation strategy for this EP has been developed to comply with the requirements of Regulation 14(1) of the OPGGS(E) and describes the specific measures and arrangements that will be implemented for the duration of the activity to ensure that:

- all environmental impacts and risks of the activity will be continually identified and reduced to a level that is ALARP
- control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and acceptable levels
- environmental performance outcomes and standards set out in the EP are met
- arrangements are in place to respond to, and monitor impacts of, oil pollution emergencies
- stakeholder consultation is maintained throughout the activity as appropriate.

The implementation strategy outlines a systematic approach that describes:

- the management systems by which the control measures identified in the risk assessment will be implemented (Section 8.2)
- the implementation of control measures will be monitored to ensure environmental risks continue to be managed to ALARP (Section 8.3)
- the ongoing stakeholder consultation process prior to and during the activity (Section 8.8.4)
- monitoring, auditing and reporting of environmental performance for activities carried out under the EP (Sections 8.3.2 and 8.8)
- arrangements in place to respond to, and monitor impacts of, oil pollution emergencies (Section 8.7).

8.2 CGG's HSE management system

The Gippsland MSS will be conducted under the framework of the CGG Environment and HSE Policies (Appendix A), CGG Environmental Management Procedure (Doc. GRP_HSE_GEI_07E), CGG Health, Safety, Environment and Social Responsibility Operating Management System (HSE-OMS), the survey vessel's HSE MS, and other procedures and plans described in the list at the end of this section.

The program will also operate under a project-specific HSE plan that CGG and the vessel operator will develop for the Gippsland MSS. The Project HSE Plan is a tailored document that ensures CGG's environmental management standards and intended performance outcomes are achieved at operational level throughout the activity, while identifying and enabling the selected seismic contractors' own procedures (if a contractor is used) to be utilised where appropriate; for example, for specific vessel operational controls. At all times, however, the seismic contractor will be required as a minimum to comply with all relevant requirements of CGG's HSE policies and standards. As described in CGG Environment Management Procedure (Doc. GRP_HSE_GEI_07E), the Project HSE Plan will incorporate regulatory and client environmental requirements includes procedures for the following:

- emergency response
- waste management
- hazardous materials and handling
- fuel/oil spills.

CGG and any vessel contractor (if used) will apply a tiered approach to optimising the environmental performance of the project and ensuring that CGG's environmental performance outcomes and standards are achieved. This approach involves identification of local and regional environmental sensitivities, prioritisation of risks, determination of appropriate practices and procedures to reduce those risks, and clear designation of roles and responsibilities of personnel for implementation.

The seismic contractor's vessel (if a contractor is used) HSE documentation will be reviewed for compliance with the relevant requirements described in this EP prior to the commencement of the activity. In the event of a gap between the existing plans and procedures and the requirements of this EP, a bridging document will be developed to ensure all control measures are adequately covered in the implementation of the EP and the hierarchy of control established.

CGG and seismic vessel contractor (if used) procedures and plans that will be used during the Gippsland MSS include:

- Gippsland MSS HSE Plan
- CGG Environment Management (GRP HSE GEI 07E)
- CGG Soft Start Procedure (MAR HSE PRC 012E)
- CGG Contingency Procedure for Marine Animal Event (MAR HSE PRC 014E)
- CGG Contingency Planning and Emergency Response Management (GRP_HSE_GEI_22E)
- CGG Event Management Marine (MAR QPM PRC 005E)
- CGG Event Reporting and Classification Guideline MAR HSE MNL 011E
- CGG Technical Note Drifting Streamer Recovery to Chase boat (MAR INS TEN 027E)
- CGG Escort and Support Vessel Manual (MAR MSS MNL 001E)
- CGG Chase Vessel Manual (MAR MSS MNL 002E)
- CGG Emergency Streamer Handling (MAR SEO PRC 017E)
- CGG Drifting Streamer Recovery to Chaseboat (MAR INS TEN 027E)
- CGG Severe Weather Monitoring (MAR SEA PRC 006E)
- CGG Event Management Standard Operating Procedure (MAR QPM PRC 005E)
- CGG Safe Navigation Area (MAR_SEO_PRC_004E)
- CGG Close Approach Of A Natural Obstacle (MAR_SEO_PRC_010E)
- CGG QHSE And SD Risk Management (GRP_HSE_GEI_04E)
- CGG Management Of Change – Management Of Deviation (GRP_HSE_GEI_14E)
- CGG Environmental and HSE Policies (Appendix A)
- Seismic Vessel Ship Oil Pollution Emergency Plan (e.g. Appendix G)
- Seismic Vessel Shipboard Safety Procedures Manual
- Seismic Vessel Shipboard Safety Management Manual
- Seismic Vessel Safety Operations Manual
- Seismic Vessel Ballast Water Management Plan
- Seismic Vessel Emergency Response Manual
- Seismic Vessel Garbage Management Plan
- Seismic Vessel Streamer Deployment and Recovery Procedure

- Seismic Vessel Refuelling Procedure
- Seismic Vessel Emergency Preparedness Procedure (Drills and Exercises)
- this EP.

8.2.1 Management of change (Reg 14(3))

Management of Change (MOC) is the transparent process for identifying, assessing, controlling and documenting any changes in the activity, or in the circumstances under which it is being implemented, which have the potential to increase or change the level of risk or impact, beyond those detailed in the accepted EP in force. Changes must be assessed and managed in relation to the requirements of the OPGGS(E), including whether any of the following requirements are potentially compromised or triggered:

- Regulation 7 “Operations must comply with the accepted environment plan”
- Regulation 8 “Operations must not continue if new or increased environmental risk identified”
- Regulation 17 “Revision because of a change, or proposed change, of circumstances or operations”.

In March 2016 NOPSEMA issued an Environment Alert regarding the proper application of change management processes and highlighted the need for better consideration of activity changes and more robust and better documentation of MOC procedures. CGG’s Management of Change – Management of Deviation Procedure (Doc. GRP_HSE_GEI_14E) is consistent with this requirement, and CGG will continue to implement this procedure to ensure changes are managed in a controlled manner. This includes a sound process of change identification, re-assessment of the impact or risk profile following the same risk assessment procedures as used in this EP, establishment of modified or new controls and EPS where required, and documentation of the process, rationale and outcomes of the assessment. CGG understands the importance of this process, particularly so that ALARP and acceptability can continue to be demonstrated throughout the survey and the life of the EP.

8.2.1.1 Triggers for MOC

Regulation 7 of the OPGGS(E) requires that titleholders do not act in a manner that is contrary to the EP that is in force. This means that any changes to the activity, or the conditions under which it is being enacted, must be assessed for potential divergence from the accepted EP and possible increase in the environmental impact or risk profile. If there is a predicted increase in risk in environmental impact or risk, the activity must cease (Regulation 8). If additional controls can be implemented that will allow CGG to reduce the impacts and risks to ALARP and an acceptable level, then they can be implemented, and the activity can recommence. If the risk is significantly increased, even with additional controls and the impacts and risks cannot be demonstrated to be acceptable, the activity cannot recommence, and the EP must be revised under Regulation 17(6). Similarly, if a significant modification or new stage of the activity is identified, which is not addressed in the accepted EP, the EP must be revised under Regulation 17(5).

If any of the following types of changes are identified, the MOC process will be implemented:

- new hazards or risks, e.g. stakeholder with new meritorious issues, gazetting of a new marine park
- new stage of activity required e.g. significant extension of timeline required to complete acquisition
- reduced ability to effectively implement the EP to meet its stated performance standards (e.g. MFO taken ill and demobilised)
- NOPSEMA website listing of new third-party EPs including increased petroleum exploration activity in the region with potential for increased cumulative risks or simultaneous activities in the area that may impact CGG or be impacted by CGG activities (e.g. divers working on pipelines in the area)
- legislation changes or government documents, such as changes to management plans, species recovery plans, conservation advice releases from DEE

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- new publications, research or guidelines (e.g. safe diving distances from seismic activities)
- incremental change in the activity increasing the risk of significant impact
- external audits, inspections and investigations
- CGG will undertake regular reviews of the currency of the list of relevant stakeholders and may need to initiate the MoC process if new stakeholders raise new issues which after evaluation have the potential to significantly increase the risk of interference with the stakeholder interests.

8.2.1.2 Originator of MOC

All personnel involved in the CGG Gippsland MSS, including CGG management, are required to be vigilant for potential changes to the survey activity that have potential to affect risk and impact profiles or cause deviation from this EP. Personnel in charge of work functions will be required to report any changes within their work area. For example, the Vessel Master will be required to report changes to the functionality of pollution control equipment on his vessel as he becomes aware of such changes. Similarly, the CGG Client Representative will be required to report any potential changes to the seismic activity before they are implemented. Potential MOC triggers shall be reported immediately to the CGG Technical Operations Manager. These responsibilities will be reinforced during the induction.

CGG will undertake a review of this EP to ensure that any changes to legislation, science, stakeholder requirements or other management requirements are fully accounted for and assessed every six months following approval and one month prior to commencement of the survey. This review will also ensure that the environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP.

Changes to marine park management arrangements are tracked by subscription to Commonwealth Marine Parks updates (http://www.environment.gov.au/marinereservesreview/marine-reserves-updates/subscribe). Any revision to the existing management plan, or release of a new management plan, will become law under the EPBC Act. As such, CGG will adapt to any changes by abiding with the in-force management plan.

Publication of peer reviewed, scientific findings directly relevant to the environmental impacts of offshore seismic exploration will be considered in the context of environmental impacts and risks assessed in the EP. Relevant impacts and risks will be reassessed in light of the new findings and will be adjusted accordingly if required. If new information indicates a new environmental impact or risk, or an increase to an existing environmental impact or risk, an assessment of the significance of new or increased risk will be undertaken using the impact and risk assessment methodology described in Section 5.

CGG will continue the stakeholder review process in accordance with Section 9.5 to determine if there are any new relevant persons that may be affected by the activity. In the event of identification of new relevant stakeholders, CGG will follow the process described for the ongoing consultation in Section 9.8. If new and/or existing stakeholders raise new issues that have the potential to significantly increase the risk of interference with the stakeholders' interests, CGG will trigger the MOC process described below in Section 8.2.1.3.

8.2.1.3 MOC process

Once potential changes have been identified that trigger a MOC, the following steps will be initiated and documented in accordance with CGG Management of Change – Management of Deviation:

- stop work, or delay commencement of new activity
- establish risk assessment team and advise CGG Technical Operations Manager
- initial risk and impact assessment by the EP assessment team, using the same procedures as outlined in Section 5. This will determine if the increase in risk is significant and would therefore trigger a requirement to revise and resubmit the EP under Regulation 17

- if resubmission is required, work or new activity is to be suspended until the revised EP is accepted by NOPSEMA
- if resubmission not required, conduct and document detailed risk and impact assessment
- consult stakeholders if changes may affect their activities or interests (based on previous feedback)
- develop any additional control measures required to reduce risks and impacts to ALARP and ensure they are acceptable
- update EP implementation plan/strategy as necessary
- develop EP Addendum documenting
  - the MOC process followed
  - risk and impact assessment undertaken
  - rationale for conclusions on residual risk
  - stakeholder feedback
  - additional control measures
  - demonstration of ALARP and justification for acceptability
  - revised performance standards, measurement criteria, responsibilities for each revised or new control measure
  - confirmation that all sections of EP have been checked to ensure any potential deviations from the accepted plan have been captured and addressed.

8.2.1.4 Approver of MOC outcomes

Work on new or modified activities that do not trigger a Regulation 17 resubmission will only recommence on the authority of the CGG Technical Operations Manager.

8.3 Environmental performance monitoring and evaluation (Reg 14(3))

8.3.1 Review of environmental performance (Reg 14(6))

CGG will monitor the performance of the control measures during the activity in line with the Project HSE Plan and CGG Environment Management document (GRP HSE GEI 07E). Environmental performance during the survey will be reviewed to ensure that:

- EPOs and EPS' are being met, reviewed and where necessary amended (to continue to reduce the environmental impacts and risks of the activity to ALARP).
- Potential non-conformances and opportunities for continuous improvement are identified and corrective actions implemented.
- All environmental monitoring requirements have been met before completing the activity.

The following arrangements will be established to review the environmental performance of the activity:

- Inspections of the vessels will be carried out before and during the survey to ensure that procedures and equipment for managing routine discharges and emissions are in place to enable conformance with the EP.

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- The performance of key equipment as described in this EP (i.e. oil-in-water separator) will be checked at least weekly to ensure ongoing reduction of risks and impacts to ALARP, and any potential issues (i.e. observations of poor operating condition/performance or non-conformances) are continually monitored and raised as soon as practicable.
- A summary of the EP commitments for the activity will be distributed aboard the survey vessel, and implementation of the environmental performance standards will be monitored by the CGG Client Site Representative.

Any non-conformance with the EPS outlined in this EP will be subject to investigation and follow-up action as detailed in Section 8.3.2.4.

CGG will also undertake an internal review of the environmental performance of the Gippsland MSS at the conclusion of the survey. The review will consider:

- an evaluation of conformance with the Compliance Register
- improvements to the implementation strategy included within the EP
- conformance with the Project HSE Plan, CGG's HSE MS and the seismic vessel's HSE MS as well as CGG Policies, Manuals and Procedures
- the management of any non-conformances identified during the survey, including reportable and recordable incidents
- any concerns identified by stakeholders during and after the completion of the survey, followed by appropriate liaison as required
- outcomes of any NOPSEMA audit reports and feedback.

8.3.2 Monitoring, auditing and management of non-conformance (Reg 14(6))

8.3.2.1 Monitoring and record keeping (Reg 14(7))

CGG will maintain a quantitative record of emissions and discharges as required under Regulation 14(7) of the OPGGS(E). This record will include all emissions and discharges to the air and water and can be monitored and audited against the environmental performance standards. Table 8.1 outlines the proposed monitoring, auditing and reporting program that will be implemented for the Gippsland MSS.

Table 8.1 Summary of environmental monitoring and reporting for the Gippsland MSS

Environmental aspect or activity	Monitoring	Record keeping	Reporting
Underwater noise from operation of the seismic source	Adherence to EPBC Policy Statement 2.1 Part A Standard Management Procedures and specific Part B Additional Management Procedures, as specified in Section 6.2 Application of defined precaution zones	Start-up delays, power downs or stop work procedures instigated as a result of cetacean sightings	MFO Final Report If incident breaches relevant EPO or EPS – recordable environmental incident If incident involves injury or death to EPBC listed species – reportable environmental incident Post-survey Environmental Review Report
	Marine fauna sightings	Cetacean sighting records (CSA database) Turtle sightings	MFO Final Report Post-survey Environmental Review Report

Environmental aspect or activity	Monitoring	Record keeping	Reporting
Light generation from survey vessel	Assessments of whether lighting is at minimum level required for safe operation and navigation	Records of periodic assessments by Vessel Master, or delegate	Post-survey Operations Report (internal)
Vessel and towed equipment interactions with marine fauna	Any interactions between marine fauna and seismic, support and/or escort vessels Any incidents involving turtle entanglement in tail buoys	Support vessel/towed equipment and marine fauna interaction records (bridge daily logs and MFO records)	CGG Event Reporting Management (GRP HSE GEI 17E) If incident involves injury or death to EPBC listed species – reportable environmental incident If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report
Deployment and retrieval of anchors in the event of an emergency	No planned anchoring	Bridge daily logs	CGG Event Reporting Management (GRP HSE GEI 17E) If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report
Equipment damage, dragging or loss	Impacts to seabed through damage, dragging or loss of towed seismic array Attempts to recover lost equipment	Bridge daily logs	CGG Event Reporting Management (GRP HSE GEI 17E) If incident involves loss of a streamer and associated equipment – recordable environmental incident If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report
Discharge of ballast water from survey vessel	Volumes of non-routine ballast water discharges	Ballast water record book/summary	Post-survey Operations Report (internal) If incident breaches relevant EPO or EPS – recordable environmental incident
Biofouling (IMS) of survey or support vessel hulls and other niches	Management of biofouling	IMS risk assessment report or inspection records Anti-foulant treatment records/certification for survey and support vessels Records of survey and support vessel movements immediately prior to the Gippsland MSS	If incident breaches relevant EPO or EPS – recordable environmental incident If incident involves the selected seismic vessel identified as high risk following biofouling risk assessment and commences operations within the Acquisition Area without one or more of the following being undertaken; vessel inspection, hull cleaning and/or anti-foulant application – reportable environmental incident
Discharge of sewage, grey water and putrescible wastes	Discharge location Quantities discharged Discharge parameters (vessel speed; discharge rate)	Engine room logs	Post-survey Operations Report (internal) If incident breaches relevant EPO or EPS – recordable environmental incident
Discharge of bilge water	Discharge location Quantities discharged Treatment of potentially contaminated water prior to discharge	Engine room logs	Post-survey Operations Report (internal) If incident breaches relevant EPO or EPS – recordable environmental incident
Treatment/disposal of other wastes e.g. garbage, oily sludges	Quantities of wastes incinerated aboard survey vessel or transferred to shore for treatment, recycling or disposal	Engine room logs Garbage record books Oil record books Incident reports	Post-survey Operations Report (internal) If incident breaches relevant EPO or EPS – recordable environmental incident

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Environmental aspect or activity	Monitoring	Record keeping	Reporting
Accidental discharge of hazardous materials	Discharge location Quantities and types of materials accidentally discharged Attempts to recover lost objects	Bridge daily logs Incident reports	CGG Event Reporting Management (GRP HSE GEI 17E) Release/discharge >80 L – reportable environmental incident (external – NOPSEMA; Section 8.8.2) If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report
Oil spills (refuelling or vessel collision)	Any incidents involving vessel collisions Spill location Volumes of fuel/oil spills Spill response activities Communications with other marine users in the operational area	Bridge daily logs Bunkering records Communication logs Type I Operational Monitoring records – vessel visual observations of surface slicks; GPS tracking data; RPS APASA outputs; GIS mapping Type II Scientific Monitoring records as appropriate	CGG Event Reporting Management (GRP HSE GEI 17E) Spill >80 L – reportable environmental incident If incident involves an oil spill leading to acute or chronic effects on, or smothering of, marine fauna and/or habitats – reportable environmental incident If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report Incident report (including SITREP and POLREP) to AMSA
Interaction with commercial fisheries	Any incidents involving negative interactions with commercial fishing vessels communications with other commercial fishers in the area Communications with commercial fishers in the operational area	Bridge daily logs Communication logs	CGG Event Reporting Management (GRP HSE GEI 17E) If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report If incident involves damage to commercial or recreational fishers' gear within the Acquisition Area or other negative interactions – reportable environmental incident
Interaction with shipping	Any incidents involving negative interactions with commercial shipping Communications with other marine users in the operational area	Bridge daily logs Communication logs	CGG Event Reporting Management (GRP HSE GEI 17E) If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report If incident involves damage to commercial or recreational fishers gear within the Acquisition Area or other negative interactions – reportable environmental incident
Operation of survey and support vessels within protected areas or heritage places	Any incidents involving detrimental impacts to the conservation values (e.g. Eden Upwelling, Commonwealth Marine parks (Gippsland, Beagle) or Big Horseshoe Canyon)	Bridge daily logs Communication logs with DoEE	CGG Event Reporting Management (GRP HSE GEI 17E) If incident breaches relevant EPO or EPS – recordable environmental incident Post-survey Environmental Review Report
Training	Details of crew environmental inductions	Induction attendance record sheets Induction materials	Internal Post-survey Environmental Review Report
Incident reporting	Number and details of environmental incidents	CGG HSE incident reports	Internal Post-survey Environmental Review Report
Conformance reporting	Conformance with EPOs, EPS' and commitments listed on the Environmental Commitments Register	Completed environmental inspection/audit check sheet	Internal Post-survey Environmental Review Report

In accordance with Regulation 27 and 28 of the OPGGS(E), CGG will store and maintain all versions of the EP and documents or records relevant to the EP implementation for a period of five years. These will be stored and managed on CGG's computer server and made available to regulatory authorities on request. Table 8.2 consolidates the list of records that will be kept for each impact or risk assessed in Sections 6 and 7.

Table 8.1 Summary of records

Records retained by CGG	Records retained by vessel master
Post-survey Environmental Review Report (PERR)	Fuel consumption records
Stakeholder consultation/communications records and log	Garbage record book
Biofouling Risk Assessment Tool records	Oil record book
Daily progress reports	Oily water separator calibration records
Personnel training and induction records	IOPP/IAPP/ISPP certificates
Incident register	MSDS for all hazardous chemicals
Incident reports	International Anti-fouling System Certificate
Marine fauna sighting datasheets	SOPEP
Records of written notifications to the Secretary of the DoEE in the event of death or injury of a threatened, migratory or listed cetacean species	POLREP (Oil pollution reports)/SITREPS (Situation reports)
EP induction register	Emergency/oil spill response exercise records
Compliance register	Incident register
OPEP	Incident investigation reports
Financial assurance	Waste management plan
Action Tracking Register	Vessel induction records
	Training records
	Signed QPAR
	Ballast water record book/summary
	Operational procedure for deployment and retrieval of towed equipment

8.3.2.2 Audits and inspections

CGG will maintain a Conformance Register that will serve as an audit tool during the Gippsland MSS. The register will be sufficiently detailed to demonstrate that the environmental performance outcomes and standards included in this EP have been met. The register will detail:

- the EPO and EPS for the Gippsland MSS
- measurement criteria to enable an auditor to determine if the Gippsland MSS has complied with the relevant performance standards
- the person/party responsible for implementing management measures to meet the environmental performance objective.

Prior to the survey, CGG will undertake:

- a vessel audit/inspection (in accordance with CGG Escort & Support Vessel Operation Manual (doc. MAR MSS MNL 001E)) to confirm that the vessel management systems are consistent with the environmental management controls detailed in this EP. This will ensure that procedures and equipment for managing routine discharges and emissions are in place to enable conformance with the EP. The audit will be documented, and any corrective actions closed out.
- a review of the risk of IMS, potentially including an inspection to confirm that the vessel does not pose an unacceptable risk of IMS
- an audit of the on-board spill response capability of the seismic vessel against its SOPEP and relevant controls in this EP, to verify spill preparedness.

Conformance will be monitored on a regular basis by the client site representative, or delegate, via mechanisms including fortnightly audits during the activity. Conformance auditing or inspection during the Gippsland MSS will be based on the Conformance Register and will target the following

- conformance with regulatory requirements detailed in this EP
- management strategies and procedures to ensure EPOs and EPS' are being implemented, monitored, measured and evaluated
- emissions and discharges are being monitored, measured and documented.

Any non-conformance with the EPS outlined in this EP will be subject to investigation and follow-up action as detailed in Section 8.3.2.4.

The findings and recommendations of audits/inspections will be documented and distributed to relevant personnel for comments. It is likely that inspections and audits will result in recommendations for improvement opportunities. The audit or inspection may also identify breaches in environmental performance. Any non-conformance is noted and communicated immediately to the Client Site Representative and the Party Chief, as well as being documented in the audit or inspection report.

HSE performance of the survey will be discussed within CGG during daily management phone calls between the vessel and head office, and weekly during on-board HSE meetings.

The environmental inspection results will be included with the PERR submitted to NOPSEMA after completion of the survey.

8.3.2.3 Management of non-conformance

All breaches of this EP are considered non-conformances (non-compliance). Non-conformances may be identified during an audit, inspection, crew observation or as a consequence of an incident.

In accordance with CGG Event Reporting, Recording and Classification (doc. MAR HSE MNL 011E) all events and non-conformances must be reported, assessed and classified. All EP non-conformance issues will be communicated immediately to appropriate offshore and onshore management personnel. This expectation will be reinforced at inductions, daily toolbox meetings and weekly HSE meetings. Any EP non-conformances will be investigated as per the survey contractor's and CGG investigation procedures (CGG Event Management in Marine (doc. MAR_QPM_PRC_005E). Following an investigation, remedial actions will be developed to prevent recurrence and these actions will be tracked to completion as described below, and as per CGG Event Management in Marine.

'PRISM' is the CGG IT application which supports the implementation of the CGG HSE-OMS. A non-conformance report is issued by the auditor or Client (or CGG) Site Representative to the Party Manager (PM), who drafts an event report in PRISM comprised of action points (APs) that are assigned to a party responsible for their completion (by the PM and Vessel Master). The corrective action will specify the remedial action required to fix the breach and prevent its re-occurrence, and is delegated to the person deemed most appropriate to fulfil the corrective action and within an agreed timeframe. The corrective action is closed in PRISM when the remedial action has been verified by the Party Manager.

Non-conformances and associated lessons learnt are communicated to the offshore crew during daily toolbox meetings before each shift and at weekly HSE meetings on board the vessel and implemented if appropriate. Information may also be dispatched using CGG Marine Alerts or bulletin templates.

CGG will carry forward any non-conformance identified during the project for consideration in future marine campaigns to assist with continuous improvement in development of appropriate control measures and environmental performance outcomes and standards. When planning future activities, CGG will also review the reportable and recordable incidents (Section 8.8.2) that have occurred previously to incorporate any lessons learned as part of CGG's continual improvement process.

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At all times during the survey the CGG Client Site Representative will be on board the survey vessel. The CGG representative has the authority to stop work at any time. Survey operations will be suspended if there is a non-conformance that increases the risk of significant negative impacts to the environment and the CGG representative (or other authorised person) is not satisfied that measures are in place to avoid a repeat of the incident. Survey operations may also be stopped where the CGG representative or other authorised person considers there is a legitimate risk of an HSE incident, a breach of legislative requirements or a breach of this EP. This may require a review of the EP (see Section 8.8).

8.3.3 Evaluation and management of impacts to fish and fisheries

Based on the assessment of impacts described in Section 6 and advice from the Gippsland MSS Scientific Advisory Committee (SAC; Section 9.4.3), CGG is developing two research studies aimed at evaluating impacts of key concern to fisheries stakeholders:

- assessment of the impact of seismic sound from the Gippsland MSS on octopus, and catch and effort of octopus fishers
- assessment of the impact of seismic sound from the Gippsland MSS on catch and effort of Danish seine fishers.

These studies are described below in Sections 8.3.3.1 and 8.3.3.2. They are still in development and a final decision by CGG on the choice and scope of them will depend on various factors including the timing of EP approval, survey start dates, and a cost-benefit analysis. Outcomes of the studies will be of broader interest and where possible made available to the public. These outcomes will also enable re-assessment of MSS impact profiles and establishment of modified or new controls and EPS, if required, during the second year of surveys via the management of change process described in Section 8.2.1.

The Fisheries Displacement Mitigation Plan (Plan) is described below in Section 8.3.3.3. The purpose of the plan is to provide a mechanism for licensed individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG’s survey activities.

8.3.3.1 Potential impacts of the seismic survey on octopus and octopus catches

There is limited information on the hearing sensitivity of octopus to sound stimuli and it is not known how octopuses respond behaviourally to seismic sound (Section 6.1.4). The area actively fished by fishers who target octopus also falls entirely within the MSS Acquisition Area, and the fishing equipment they use is left on the seabed for a considerable period (about three weeks) and is not easily moved (Section 4.6.5.2.3). During the initial Lakes Entrance stakeholder meeting it was determined that there was potential for significant impacts of the MSS on target octopus species and the octopus fishers. The SAC was therefore asked to develop a collaborative field-based project with the University of Tasmania (UTas) and octopus fishers to assess impacts to octopus and the fishery. Specific objectives of the proposal developed by UTas are:

1. Determine the impact of commercial seismic sound on adult pale octopus (*Octopus pallidus*).
2. Determine the impact of commercial seismic sound on the development of eggs, hatching rates and competency of the resultant hatchlings.
3. Outline threshold distances for potential impacts of seismic surveying.
4. Determine the impact of commercial seismic sound on pale octopus (*Octopus pallidus*) catch.

The methods for this study are still being developed and are dependent on the survey start date.

Previous catch data will be examined to determine a six-month period for which the catches in a region of the seismic survey area are relatively consistent for that period and thus comparable. Once this region and period have been chosen, the area will not have the seismic survey undertaken in it for the first three months and catch data will be collected during this period. The survey will then take place in the region, with catch data then collected for the next three months. Three months pre and post survey is considered sufficient given this is a short-lived species. At the completion of the six months, the pre and post survey data will be compared to determine if there is a statistically significant impact of the survey on catch. Note that this component of the project will be undertaken by Dr Bradley Moore, a fishery assessment scientist, who currently undertakes the octopus assessment for Tasmania and is the lead author for the pale octopus chapter in the FRDC Status of Australian Fish Stocks.

Costs for this project are considerable and additional funding support has been sought from the Oil and Gas Industry and also from the Commonwealth Fisheries Research and Development Corporation (FRDC). Construction of purpose-built fishing pots, development of field methods suitable to operations of fishers involved in the study and other specifics such as use of sound loggers require considerable attention, and it is intended to begin collecting field data in February prior to commencement of MSS activities.

8.3.3.2 Potential impacts of the seismic survey on Danish seine catches

Danish seine fishers are managed within the Southern and Eastern Scalefish and Shark Fishery (SESSF) which dominates fishing activities in the Gippsland marine area (Section 4.6.5.1.1). Fishing equipment used within the SESSF is set for short periods (about seventy minutes for Danish seiners) and fishers are more mobile and have broader fishing areas compared to octopus fishers. However, unlike other sectors within the SESSF, the amount of overlap between the area actively fished by Danish seine fishers and the Gippsland MSS Acquisition Area is considerable (63%; Section 6.1.4.3.1).

During the initial SAC meeting it was determined that potential impacts of the MSS on Danish seine fishers could be significant and that a project to assess changes in catch and effort data as a consequence of the survey should be developed by CGG. Two approaches were envisaged:

(1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and

(2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.

8.3.3.3 Development of a Fisheries Displacement Mitigation Plan

Stakeholder feedback has identified loss of catch and income through displacement during and after the MSS as a key concern to fishers. The SAC therefore suggested during the initial SAC meeting that CGG should develop an ‘appeals process’ as a means by which fishers can seek to recover costs from displacement from traditional fishing areas. A Fisheries Displacement Mitigation Plan based on industry best practice was subsequently developed by CGG to provide a mechanism for individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and revenue due to displacement that may arise from CGG’s activities. The plan sets out the decision rules to deal with payments for verified claims. A draft was distributed to the SAC for comments on Tuesday 15th January and an initial phone meeting held on Monday 21st January to discuss it. Comments from the SAC will be taken into consideration as the plan is finalised.

8.4 Roles and responsibilities (Reg 14(4))

Key roles and responsibilities for CGG and contractor (if used) personnel in relation to implementation, management and review of this EP are described below. It is ultimately CGG’s responsibility to ensure all employees and contractors (if used) comply with the requirements of the CGG corporate HSE Policy and that the personnel are suitably trained and competent in their respective roles. Roles and responsibilities for environmental management during the activity are a combination of generic/standard professional duties, such as complying with shipboard garbage procedures, complemented by project-specific requirements arising from this EP, such as regulator-specific reporting arrangements. CGG will ensure that all employees and contractors associated with the Gippsland MSS are inducted into the requirements of the corporate Environment Policy (Appendix A), particularly regarding the responsibilities associated with each role. CGG will further ensure that all personnel are suitably trained and competent in their respective roles.

8.4.1 Chain of command

A clear chain of command for the shore-based and vessel-based roles relating to the Gippsland MSS is provided in Figure 8.1.

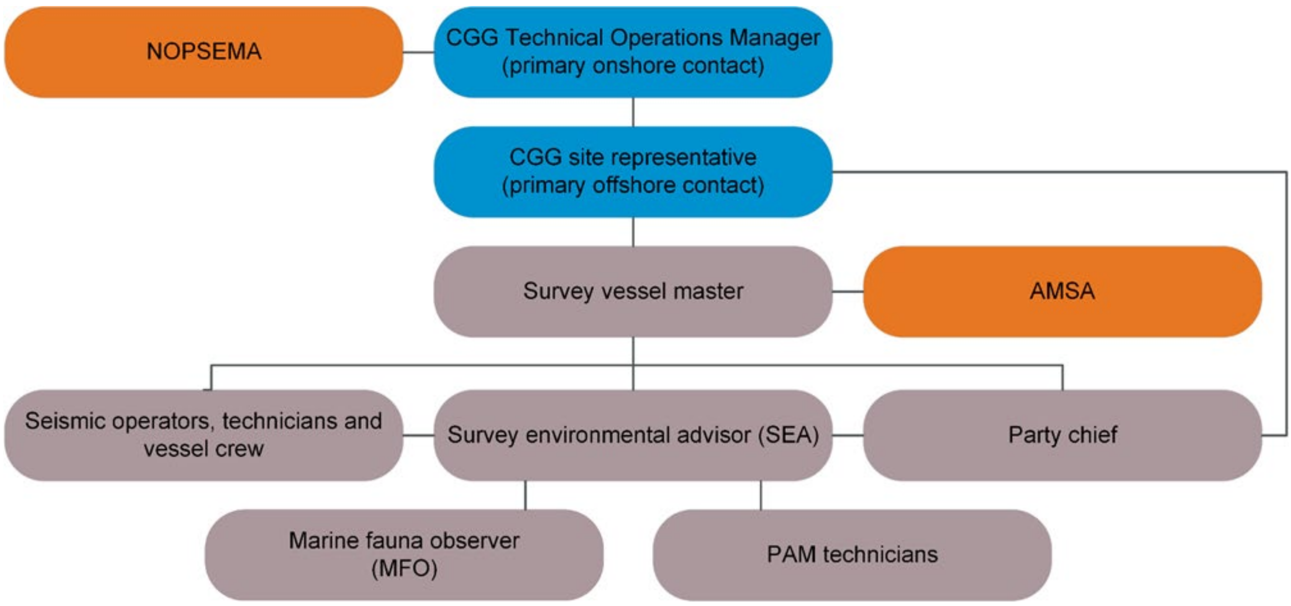

Figure 8.1 CGG Gippsland MSS chain of command

8.4.2 Shore-based personnel

8.4.2.1 Technical operations manager (primary onshore contact)

CGG's Technical Operations Manager is CGG's primary onshore contact for the Gippsland MSS, on matters related to stakeholder management, government relations and seismic operations in general. The Technical Operations Manager's responsibilities include:

- Ensure the activity is undertaken as per the performance outcomes of the EP.
- Provide sufficient resources to implement management measures to achieve the performance outcomes of the EP.
- Manage change requests for the activity and notifying the Survey Environmental Adviser (SEA) of any scope changes in a timely manner.
- Liaise with regulatory authorities as required.
- With the support of the SEA, ensure that ongoing monitoring for potential changes that may have a bearing on the EP are undertaken (as described in Section 8.2.1).
- Review the EP as necessary and manage change requests (as described in Section 8.2.1).
- Ensure environmental incident reporting meets regulatory requirements.
- Monitor and close out corrective actions raised from environmental inspections/audits or incidents.

- Commit resources to facilitate an emergency response strategy in the event of an incident.
- Manage the CGG emergency response strategy in the event of an incident.
- Review results of conformance audits conducted during the program and make recommendations where required.
- Ensure that all reportable incidents are reported to NOPSEMA within 3 days of the incident occurring.
- Ensure that all recordable incidents are reported to NOPSEMA as soon as practicable after the end of the calendar month, and not later than 15 days after the end of the calendar month.
- Notify NOPSEMA of any spills in Commonwealth waters.
- Ensure that a full briefing to all project personnel is provided, including details of the environmental sensitivities of the Acquisition Area and environmental management procedures and performance outcomes detailed in this EP.
- Preparation of the Post-survey Environmental Review Report (PERR – see Section 8.8.1) and submission to NOPSEMA.

8.4.2.2 Seismic vessel and chase/supply vessel managers (CGG or contractor company)

- Vessel Quality, Health, Safety and Environmental (QHSE) performance (qualitative and quantitative) including but not limited to
  - leadership by personal example and visible commitment to instil excellent QHSE behaviour and culture aboard
  - establishing and reviewing the annual QHSE plan for the vessel
  - ensuring the vessel's conformance with all company standards, policies and procedures
  - ensuring major incidents (Lost Time Injury and/or Hi-Potential or above) are thoroughly investigated, root cause analyses performed, corrective actions completed, logged and closed out
  - participation in key audits
  - ownership of the vessel's HSE statistics, leading and lagging indicators and overall HSE performance
  - ensuring that all relevant QHSE documentation is in place for the vessel, according to the company's QHSE Management System requirements.

8.4.3 Vessel-based personnel

8.4.3.1 Survey and escort/supply vessel masters

The Survey and escort/supply Vessel Master has overall responsibility for HSE management aboard the survey/supply/escort vessel, implements the seismic vessel company's HSE policies and procedures, and motivates employees in support of the company's HSE policies and procedures. The Survey/Supply/escort Vessel Master complies with all requirements of maritime law and the rules and regulations as defined by national and international authorities. The Survey/Supply/escort Vessel Master has ultimate responsibility for ensuring the safe execution of all vessel operations including:

- ensure the safe execution of all operations of the survey/supply/escort vessel
- overall responsibility for HSE management aboard the survey/supply/escort vessel
- ensure vessel operations are being conducted in accordance with the legislative requirements and this EP, including waste management, refuelling and emergency/oil spill response

- ensure vessel audits, inspections, emergency drills, training, HSE and inductions are undertaken
- ensure maintenance of equipment and records meet statutory requirements
- implement the vessel's SOPEP and OPEP procedures in the event of an oil spill (Section 8.7), including first response to an incident using the resources immediately available to the vessel
- immediately notify the Client Site Representative of any incidents/activities arising from vessel operations that are likely to have a negative impact on the performance outcomes detailed in this EP
- support the Client Site Representative in ensuring that all relevant HSE documents are understood and adhered to
- report hydrocarbon or other chemical spillage to the Party Chief
- establish and maintain radio contact with other vessels in the Gippsland MSS operational area and adjacent waters
- notify AMSA, the CGG Technical Operations Manager and the Vessel Manager in the event of a notifiable oil spill.

8.4.3.2 Party chief

- Ensure safe execution of all operations carried out by the seismic crew aboard the survey vessel.
- Ensure that the following documents are in place and aboard
  - CGG Gippsland HSE Plan
  - Emergency Response Procedures
  - HSE Management Procedures
  - Hazard Management Procedures
  - SOPEP and OPEP
  - this EP.
- Ensure the seismic operations are conducted in accordance with
  - the CGG Environment Policy
  - Bridging Document between CGG, this EP and the seismic vessel contractor, if required
  - CGG plans, procedures and work instructions
  - relevant environmental legislative requirements or regulatory conditions
  - this EP.
- Ensure the control measures adopted within this EP relating to operation of the seismic source are implemented to minimise potential environmental impacts resulting from seismic acquisition (e.g. pre-watch, soft-start procedures, stop-work procedures
- Ensure equipment used on site is inspected before use and as required during the work on site.
- With assistance from others, inspect and maintain equipment, including safety equipment.
- Maintain all statutory test and inspection documentation for the marine equipment.
- Provide a daily log of activities and environmental incidents to the Client Site Representative.
- Ensure compliance with all aspects of HSE reporting and for investigations of all incidents and near misses.
- Immediately notify the Client Site Representative of any incidents/activities arising from seismic operations that are likely to have a negative impact on the performance outcomes detailed in this EP.

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8.4.3.3 CGG/client site representative (primary offshore contact)

The Client Site Representative is CGG's point of contact on board the vessel and is responsible for ensuring survey operations are undertaken in a manner consistent with the environmental performance outcomes and standards described within this EP. The Client Site Representative has direct contact with the Technical Operations Manager, the Party Chief and the Vessel Master. The Client Site Representative's responsibilities include:

- ensure that the following documents are understood and adhered to
  - project HSE Plan and CGG HSE Plan
  - Emergency Response Procedures including survey vessel SOPEP
  - HSE Management Procedures
  - Hazard Management Procedures
  - Environmental Management Procedures
  - this EP
- facilitate clear communications between the Perth office, the CGG Technical Operations Manager, Vessel Manager and the survey vessel personnel
- ensuring all personnel have received a program environmental induction and the induction includes environmental sensitivities, control measures, specific roles and responsibilities of all vessel crew members
- ensuring day-to-day activities are monitored for conformance against this EP and the outcomes are reported to the Technical Operations Manager
- immediately alerting the Technical Operations Manager of any changes in operations which could impact negatively on environmental performance or for changes in operation which alter the environmental risk profile of the activity
- ensuring vessel inspections are undertaken in accordance with the requirements of this EP, CGG's procedures and the seismic vessel's procedures
- ensuring survey operations are carried out in accordance with the control measures and environmental performance standards adopted within this EP
- monitoring and reporting on the conformance of all EP commitments through observations and assessments of performance against the measurement criteria
- assisting with review, investigation and reporting all environmental incidents are reported to the Technical Operations Manager, appropriate levels of incident investigation are undertaken and corrective actions from incidents are tracked to completion on behalf of CGG
- ensuring incidents are fully investigated and corrective actions monitored to close-out
- facilitating clear communications between the Perth office, the Technical Operations Manager, Vessel Manager and the survey vessel crew
- ensuring data and records are collected for the Post-survey Environmental Performance Report (PEPR)
- assisting the Technical Operations Manager in the preparation of the PEPR
- collating information for monthly recordable incident report and providing information to the Technical Operations Manager
- liaising with the Technical Operations Manager in the event of a change in the activity and updates the EP in accordance with the requirements of the OPGGS(E) Regulations
- performing MFO duties when the dedicated MFO is unable to, such as during short break periods.

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8.4.3.4 Survey environmental advisor

- Prepare environmental induction and vessel inspection information.
- Provide a briefing to project personnel and survey vessel crew members of the environmental sensitivities of the Acquisition Area, environmental management strategies, EPO, and EPS detailed in the EP as part of the environmental induction process.
- Ensure all relevant personnel have received and understood the spatial and temporal exclusions provided in the EP in relation to charts.
- Assist with review, investigation and reporting of environmental incidents.
- Ensure environmental inspections/audits are undertaken as per the requirements of the EP.
- Maintain and advise Operations manager of the status of the Corrective Action Register
- Monitor and provide evidence of conformance to the environmental commitments as outlined in this EP and ensure the Conformance Register is updated.
- Assist in preparation of external regulatory reports required for the survey, in line with environmental approval requirements and the CGG HSE incident reporting procedures.
- Prepare a report of the overall environmental performance upon completion of the survey, including the results of audits and any incidents, and forward to the Project Manager.
- Collate data for and assist in the preparation of the PERR.

8.4.3.5 Marine fauna observers

The role of the MFO is to coordinate marine fauna monitoring efforts during the survey operation (through seismic personnel and vessel bridge crew), conduct visual observations for marine fauna during the activity, and to record evidence that the requirements for environmental performance and conformance are met during the activity. CGG will appoint an MFO on board the vessel for the duration of the activity. The MFO responsibilities are:

- Ensure conformance with the relevant environmental performance requirements under this EP, including inspections and adequate fauna watch and implementation of EPBC Policy Statement 2.1 Part A and Part B management measures adopted for the survey (Section 6.2).
- Record any non-conformances with EPBC Act Policy Statement 2.1 management measures adopted for the survey (Section 6.2).
- Maintain and distribute records of marine mammal sightings and other species of concern and submitting daily and final survey sighting reports to the Client Site Representative and CGG Technical Operations Manager.
- Submit notification of any incidents involving vessel collision and/or equipment entanglement with marine fauna, in accordance with the EPBC Regulations.
- Provide environmental inductions for survey personnel (where relevant), including details of the environmental sensitivities of the Acquisition Area, control measures and performance outcomes and standards detailed within this EP.
- Preparation of the MFO Report.

8.4.3.6 Passive acoustic monitoring (PAM) operator

Due to the possible presence of low frequency cetaceans (as defined in Section 4.5.7.1.8), e.g. pygmy blue the Gippsland MSS will include a suitably qualified PAM /Quietsea Operator who will be present for the full duration of the seismic survey. Responsibilities will include:

- Ensure conformance with the relevant EPS' implemented under EPBC Policy Statement 2.1 Part B PAM specific management measures adopted for the survey (Section 6.2).
- Record any non-conformances with EPBC Act Policy Statement 2.1 Part B PAM specific management measures adopted for the survey (Section 6.2).
- Assist in the preparation of the MFO Report.

8.4.3.7 Seismic operators, technicians and vessel crew including escort/supply vessel crews

The seismic vessel crew includes seismic operators, technicians and general crew members; the latter are responsible for application of non-seismic vessel operating procedures. Seismic and supply/escort vessel crew include personnel responsible for the repair and maintenance of vessel plant and equipment, food and accommodation for all crew, watch keeping and vessel navigation and compliance with local and international laws of the sea. Responsibilities include:

- Conduct activities in a professional and safe manner with attention to good housekeeping procedures and work practices.
- Immediately report any incidents to the Survey Vessel Master and Party Chief.
- Encourage improvement in environmental performance wherever possible.
- Immediately report any environmental incidents or spillages (hydrocarbons or other chemicals) to the Survey Vessel Master and Party Chief.

8.5 Training and competencies (Reg 14(5))

8.5.1 Training and inductions

All personnel involved with the Gippsland MSS will be given a project-specific environmental induction prior to commencing work. This induction will cover environmental responsibilities relevant to the duties and responsibilities of the roles described in Section 8.4 including:

- environmental sensitivities and conservation values in the Acquisition Area and surrounding waters
- environmental and risks and potential impacts associated with the activity
- waste management and chemical management procedures (including the vessel GMP)
- emergency response and spill management procedures outlined in the OPEP and vessel SOPEP
- procedures for marine fauna interactions (including MMO duties and obligations)
- roles and environmental responsibilities of key personnel on board the survey vessel
- the importance of following procedures and using company processes (JSAs etc.) to identify environmental risks and mitigation measures
- environmental performance outcomes, standards and measurement criteria to be complied with under the EP
- procedures for reporting environmental hazards, incidents, near misses and opportunities for improvement
- opportunities for employee communication and participation
- relevant plans and procedures (CGG and seismic/supply/escort vessel contractor owned), including where they can be obtained on board the vessel.

A record of the induction will be retained by CGG's Technical Operations Manager with the endorsement of personnel who attended. All personnel are required to sign an attendance sheet to confirm their participation in and understanding of the induction. If a contractor is used, they will conduct their own company and vessel-specific inductions independently and in addition to of the project-specific HSE induction.

RPS

8.5.2 Competency and ongoing awareness

CGG or the seismic vessel contractor (if used) will provide marine crew who are trained and competent to undertake their respective activities on board the vessel. All marine personnel will be qualified in accordance with the International Convention on Standards of Training Certification and Watch Keeping for Seafarers (STCW95). All marine fauna detection personnel will be familiarized with relevant EP commitments and their responsibilities for implementing them.

Only appropriately experienced MFOs (as determined by a review of their CVs) will be utilised for the Gippsland MSS. Evidence of experience includes, but is not limited to

- completion of an approved MFO/marine mammal observer (MMO) training course (including distance estimation training)
- the lead MFO will have served a minimum of five full seismic survey campaigns in Australia or New Zealand and had the responsibility to
  - apply the EPBC Act PS 2.1 Part A and parts of Part B
  - establish robust communications protocol between MFO/PAM Operator and the seismic operator, navigators or gun crew
  - train or supervise junior MFOs
  - write the compliance and sightings report at the completion of survey
- time as a marine fauna conservation guide, participation in paid or voluntary cetacean research surveys
- work at sea where marine mammal identification experience was achieved – with seismic MMO experience preferred
- visual distance estimation experience/ability including “calibration” through the help of the marine bridge crew to provide distances to objects measured via the radar
- thermal imaging equipment familiarity – esp. in recognizing marine mammals
- all marine fauna detection personnel will be familiarized with relevant EP commitments, knowledge of the measures contained in EPBC Act PS 2.1 and their responsibilities for implementing them

The MMOs will provide an information session to control room operators and other essential personnel at the start of the survey regarding their fauna observation duties and the communication protocols required with the control room operators to ensure shut downs and power downs occur efficiently.

The following activities will serve to reinforce and maintain ongoing environmental awareness of vessel personnel for the Gippsland MSS. Records will be produced for each of these meetings:

- Project kick-off meeting: Held at the start of the activity and reviews the contractual and HSE specifications for the activity, the scope of work, vessel-specific HSE plans, environmental outcomes, performance standards and measurement criteria within this EP.
- Daily progress meetings (on board): Review all survey operations and incidents of the previous day, actions are recorded within the daily progress report.
- Toolbox meetings: Attended by all personnel involved in a specific operation (i.e. operations involving major hazards and/or involving more than one person). This meeting reviews the activity and reinforces the adoption of control measures within this EP to prevent adverse environmental and safety impacts. Recorded within the daily progress report.

Only appropriately experienced PAM Operators (as determined by a review of their CVs) will be utilised for the Gippsland MSS. Evidence of experience includes, but is not limited to

- general understanding of PAM techniques and methods of detecting and ranging calls and clicks made by cetaceans

- experience in application the measures described in EPBC Act PS 2.1 Part A and Part B
- proven ability and established experience to operate PAM and knowledge of characteristics of echolocation and call signatures of whale species likely to be detected in the Gippsland Basin, including but not limited to PBWs, HBWs, SRWs and sperm whales
- ability to operate QuietSea/Sentinel software
- understand visual display from software with regards range to call or echolocation, amplitudes as displayed in real time with shut-down zones indicated and ability to distinguish between detections from LF and MF cetaceans including those from smaller dolphins
- adequately experienced to differentiate between strong call or echolocation and level of confidence in range estimation
- employee communication and participation.

All personnel will be encouraged to communicate any concerns, suggest improvements to the control measures implemented for any particular task or operation during the activity and comment on any proposed changes to equipment, systems, or methods of operation of equipment, where these may have HSE implications. Opportunities for personnel (including management, relevant contractors and MMOs) to participate in improving the management of environmental risks during the activity include:

- at the time of the induction
- during daily toolbox and pre-start meetings at the commencement of each shift and prior to commencing a new task (e.g. recovery of streamer)
- identification of hazards based on incident and near miss reporting
- providing suggestions for improvements to the Client Site Representative at any time.

CGG crew and contractors (including all vessel personnel) will be provided information on employee communication and participation during the project environmental induction prior to commencing the activity.

8.6 Emergency response (Reg 14(4))

CGG's emergency preparedness and response arrangements are documented within the Crisis Management Procedure (GRP_HSE_GEI_06E) and will be included within the Project HSE Plan. In addition, the seismic vessel will be expected to have a vessel-specific Emergency Response Plan (ERP) and SOPEP. These documents will be reviewed by CGG to ensure they meet the requirements for emergency and oil spill response specified within this EP. As the Gippsland MSS is vessel-based, it is considered appropriate that operational response to an emergency would be handled by CGG using their existing emergency response procedures and the vessel-specific ERP and SOPEP. The ERP, SOPEP and OPEP will be tested prior to the commencement of the survey (Section 8.7).

CGG reviews specific activities, equipment and workplaces to identify possible emergency situations that may arise. CGG would ensure that any subcontracted vessel operator has established systems to ensure emergency plans are developed, implemented and maintained and that these plans address those incidents that are reasonably foreseeable. Information that is considered when identifying potential emergency situations include the following:

- results of hazard identification and impact/risk assessments
- legal requirements
- previous incident (including accident) and emergency experience
- emergency situations known to have occurred in similar organisations
- information related to accident and/or incident investigations posted on the websites of regulators or emergency response agencies.

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The Project HSE Plan contains instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification and contact information to ensure that:

- all potential emergencies are identified
- emergency response plans are documented, accessible and clearly communicated
- roles and responsibilities are clearly defined
- adequate equipment, facilities and trained personnel are available to respond to emergency situations to mitigate adverse consequences
- inspection and testing of critical emergency equipment is performed
- emergency drills and exercises are conducted to assess emergency response capacity and capabilities
- lessons learned are communicated to the appropriate people
- adequate treatment and medical management are available for injured employees.

8.6.1 Emergency response initiation

In the event of an emergency, in the first instance the Survey Vessel Master will assume overall on-site command and act as the Emergency Response Coordinator (ERC). In the event of a Level 2 release or above, AMSA will take over control of the response in their role as Control Agency and provide direction to the ERC. All persons on board the vessel will be required to act under the ERC's directions. The Survey Vessel Master will maintain communications with the Vessel Manager and CGG Technical Operations Manager and/or other emergency services in the event of an emergency.

When an emergency occurs, the initial alert will usually be made from the emergency location itself, such as from the Vessel Master or Client Site Representative, to the Crisis Management Team (CMT) or equivalent department of the vessel operator, as well as to relevant Commonwealth and State Agencies (such as AMSA). The CMT will be mobilised upon initial contact and emergency response will be initiated. This will be carried out by working directly with the established emergency services operating in the area. The survey and support vessel(s) will have equipment on board for responding to emergencies including, but not limited to, medical equipment, fire-fighting equipment and oil spill response equipment.

Upon receiving notification of an emergency, the vessel marine crew will respond in accordance with its CGG's Crisis Management Procedure, which details the responsibilities for each of the CMT roles. The ERC will maintain the direct link between the vessel and the CMT The vessel Emergency Response Plan (ERP) would also be implemented.

In the event of an emergency, the Survey Vessel Master will notify the onshore duty manager (and CGG Technical Operations Manager), who will activate the CMT. CGG will, if necessary, be ready to provide technical and tactical resources to the emergency response. The CGG Technical Operations Manager will liaise with the CMT, provide support to the response as required and provide regular reports until the response is terminated.

Notifications to relevant Commonwealth and State Agencies will be made as defined in Section 8.8.

8.6.2 Adverse weather procedures

It is the duty of the Vessel Master to act as the focal point for all actions and communications with regards to any emergency, including response to adverse weather or sea state, to safeguard his vessel, all personnel on board and environment.

During adverse weather the Survey Vessel Master is responsible for:

- ensuring the safety of all personnel on board
- monitoring all available weather forecasts and predictions

- initiating the vessel safety management system, vessel HSE procedures and/or vessel ERP
- keeping the Party Chief and Client Site Representative fully informed of the prevailing situation and intended action to be taken
- assessing and maintaining security, watertight integrity and stability of vessel
- proceeding to identified shelter location(s) as appropriate.

Other appropriate responsibilities shall be taken into consideration as dictated by the situation.

In addition to in-vessel VHF Marine Radio Weather Services, daily weather forecasting from a designated weather forecast will be provided (if available) to monitor weather within the operational area over the duration of the survey.

Should poor/bad weather be imminent/encountered, the Vessel Master shall implement weather monitoring to assess conditions on site. The amount of monitoring and subsequent action would be dependent on the severity of the bad weather front and resulting actions will comply with CGG internal procedure MAR_SEO_PRC_006E Severe Weather Monitoring.

The CGG Technical Operations Manager shall ensure adequate weather forecasting is available on an escalated frequency as the severity escalates.

8.7 Oil pollution emergency plan (Reg 14(8))

The development of an Oil Pollution Emergency Plan is required by Regulation 14(8) of the OPGGS(E) Regulations. This OPEP for the Gippsland MSS comprises relevant components of the CGG seismic vessel or contractor's SOPEP and the National Plan for Maritime Environmental Emergencies (NATPLAN) (AMSA 2014). An example SOPEP for the M/V Geo Coral is provided in Appendix E. Once contracting has been finalised, the SOPEP for the vessel selected for the activity will be incorporated into the OPEP arrangements for this EP. The vessel's SOPEP and response arrangements will be tested prior to the commencement of the survey, and in line with Section 8.7.6.

NATPLAN applies to all spills from vessels in Commonwealth waters. The SOPEP recognises the divisions of responsibility to provide effective response to marine pollution incidents, as defined under NATPLAN. The SOPEP is the principal response document that will be implemented in the event of a marine oil spill, which provides specifics and provision for guiding management response to mitigate oil spills from vessels. Examples of emergency procedures that are defined in SOPEPs include steps to control:

- collisions
- hull damage
- tank failure
- vapour release
- fire and explosions
- bunkering spills
- sinking.

8.7.1 First points of contact following a spill

8.7.1.1 AMSA

In the event of a hydrocarbon release, the first point of contact is the Australian Maritime Safety Authority AMSA Rescue Co-ordination Centre Australia (JRCC Australia) via

Phone: 02 6230 6811, 1800 641 792 (24 hours), http://www.amsa.gov.au/contact-us/

RPS

Facsimile: 02 6230 6868

Telex: 62349

Free call: 1800 641 792

AFTN: YSARYCYX

If the spill is in state waters, or likely to move into state waters, the spill must be reported using the contact details below. If the spill occurs outside port jurisdictions, relevant port authorities will be notified as defined in the relevant State response plan.

8.7.1.2 Victoria

Control Agency: In the case of a Level 1 release within the Gippsland Ports jurisdiction (state waters from SE point of Wilson's Promontory to New South Wales Border), Gippsland Ports will be the Control Agency. Note vessel transit is not included in this EP. For a Level 2 or 3 spill, or where a spill originates in Commonwealth waters and is likely to enter State waters (and where AMSA hand over Control Agency role), DEDJTR will be the Control Agency.

Website: https://www.Gippslandports.vic.gov.au/contact-us/report-an-incident/

Reporting (24-hour)

- Gippsland Ports 0400 605 645 (alternative 0429 174 606).

The following information should be provided with the report wherever possible

- name and contact details
- where and when the spill occurred
- a description of the pollutant
- the size of the area where the oil is visible
- the source of the spill including vessel registration numbers if known
- any photographs of the incident.

General marine oil spill enquiries can be made via the following number (available 9am to 5pm): (03) 9655 9797.

8.7.1.3 Tasmania

Jurisdictional authority: Department of Primary Industries, Parks, Water and Environment (DPIPWE)

Control Agency: Level 2 or 3 spill: Tasmanian Environment Protection Authority (EPA)

Tasmanian Marine Pollution Controller (TMPC)

Ship's masters, owners, charterers and agents must provide notification in accordance with statutory requirements (under Regulation 5 of the Pollution of Waters by Oil and Noxious Substances Regulations 2017)

Telephone: Control Officer (SOPCA): +61 (0)3 6165 4599 or 1800 005 171 (within Tasmania only)

Radio: TasPorts Vessel Traffic Services

VHF radio channel 16/14/12, Call sign “relevant port name VTS" (e.g. Grassy VTS)

Email: incidentresponse@epa.tas.gov.au

EPA: Pollution Incidents: 1800 005 171

General enquiries: +61 3 6165 4599 enquiries@epa.tas.gov.au

Whale Hotline (spill of any size): +61 427 942 537

The name, IMO number and radio call sign of the vessel must be provided, along with a written report commencing with the code letters "POLREP". The report must include key basic information, including location, nature and scale of the spill, and contact details. A detailed written report may also be required. Notify the relevant party when injured/oiled wildlife is confirmed or could potentially occur: Department of Primary Industries

8.7.1.4 New South Wales

Reports of marine pollution events may come from industry, vessel operators or members of the public and may be made to

- Maritime NSW +61 13 12 36 (Department of Transport (Roads and Maritime Services))
- NSW Police: Urgent: 000 (24 hours)

Water Police: 1800 658 784 (24 hours).

Notify the NSW Department of Primary Industries when injured/oiled wildlife is confirmed or could potentially occur in Commonwealth or state jurisdiction.

8.7.1.5 Port authorities

In the event of a spill in one of the Victorian ports to be used by the Gippsland MSS seismic vessels, the relevant Port Authority must be notified immediately.

8.7.1.5.1 Gippsland Ports (Victoria)

97 Main Street

PO Box 388

Bairnsdale, Victoria 3875

Australia

General enquiries: Phone: (03) 5150 0500 Fax: (03) 5150 0501

Email: https://www.Gippslandports.vic.gov.au/contact-us/feedback-and-enquiries/

After hours and emergencies:

Reportable marine incidents: 0427 610 025 (alternative 0418 104 474)

Marine pollution: 0400 605 645 (alternative 0429 174 606)

8.7.2 NATPLAN

NATPLAN is the framework that integrates Commonwealth and State Government(s) response, facilitating an effective response to marine pollution incidents via Australian Emergency Management Arrangements. AMSA manages NATPLAN and is the control agency for vessel spills in Commonwealth waters. As such, AMSA works with State Governments, emergency services and relevant industries (shipping, oil and gas, exploration and chemical industries) to maximise Australia's response capability.

NATPLAN applies to Commonwealth waters seaward of the boundary of State Waters (3 NM offshore) and integrates with State response plans. NATPLAN identifies a number of the roles that are fulfilled by State agencies as defined in the relevant State contingency plan:

- Jurisdictional Authority (JA): a statutory responsibility required to ensure that an adequate spill response plan has been prepared. In the event of a spill, the JA also ensures that a satisfactory response can be implemented by the Control Agency. In Commonwealth waters, the JA for petroleum activities is NOPSEMA, and AMSA for vessel spills.

- Control Agency (CA): is responsible for operational control and response to an oil spill in the marine environment. The Commonwealth waters CA for the Gippsland MSS is AMSA. AMSA may request that State CAs assume the lead CA role, even where the spill has occurred in Commonwealth waters (but where there is a likelihood that spill hydrocarbons may impact State resources/shorelines).

National Plan response equipment and resources are managed and controlled by AMSA's Marine Environment Protection (MEP) Division, and include:

- Maritime Emergency Response Commander (MERCOM)
- Oil spill response equipment managed via the Marine Oil Spill Equipment System (MOSES)
- Oil Spill Response Atlas (OSRA) which identified sensitive receptors (e.g. marine and shoreline ecosystems and biological resources)
- Oil Spill Trajectory Modelling (OSTM).

In addition, the Australian Marine Oil Spill centre (AMOSC) is an oil spill response organization funded by industry membership fees that can be contracted as an oil spill response agent.

8.7.3 State waters

If a hydrocarbon release occurs in state waters (or if it is likely to move into State waters), the following relevant state oil spill contingency plans will apply:

- The Victoria state plan is the State Maritime Emergencies (non-search and rescue) Plan (Emergency Management Victoria 2016). The State Jurisdictional Authority (JA) and Control Agency (CA) is the Department of Economic Development, Jobs, Transport and Resources (DEDJTR).
- The Tasmania state plan is the Tasmanian Marine Oil Spill Contingency Plan (TASPLAN) (DPIPWE 2011). The State JA is the Department of Primary Industries, Parks, Water and Environment (DPIPWE), and the State CA is the Tasmanian Environment Protection Authority (EPA) Tasmanian Marine Pollution Controller (TMPC).
- The relevant NSW plans are the NSW State Emergency Management Plan (EMPLAN) and the NSW State Waters Marine Oil and Chemical Spill Contingency Plan which is a sub-plan of the EMPLAN. The NSW State Waters Marine Oil and Chemical Spill Contingency Plan can be accessed from the Emergency New South Wales website at: https://www.emergency.nsw.gov.au/Pages/publications/plans/sub-plans/state-waters-marine-oil-and-chemical-spill-contingency-plan.aspx.

The deployment of state resources in Commonwealth waters will be requested and coordinated by AMSA.

8.7.4 Roles and responsibilities

AMSA is the Control Agency and hence responsible for managing response to all oil spills in Commonwealth waters under NATPLAN. Both MARPOL 73/78 and the vessel's SOPEP require the vessel master to report to the nearest State whenever there is an incident involving actual or probably discharge. The vessel SOPEP is implemented to initiate clean up resources and control discharges.

The following roles will also provide key support

- The Seismic Survey Vessel Master will be responsible for notifications and reporting all spills to the sea to the AMSA JRCC, via a POLREP form included in the vessel SOPEP (see Section 8.8 for reporting requirements). Further reports will be sent at regular intervals to inform relevant stakeholders and agencies (AMSA, NOPSEMA, CGG, survey contractors, etc.).
- The CGG Client Site Representative on board the vessel is responsible for reporting directly to CGG. The CGG Technical Operations Manager (shore-based) is then responsible for notifying NOPSEMA of any spills in Commonwealth waters.

AMSA will appoint the MERCOM, who is supported by statutory powers under the Protection of the Sea (Powers of Intervention) Act 1981. The responsibilities of the MERCOM include the management of emergency intervention issues during a response to maritime casualty incidents where there is a real (or even potential) risk of significant pollution.

8.7.5 Assessment of spill scenarios

The level of hydrocarbon release is used to identify the level of resources required to respond to the spill. This approach allows scaling of response in line with the evolving nature and scale of the incident. Incident classification (Levels 1 to 3) are defined in NATPLAN as follows:

- Level 1 incidents with a release of 0 to 10 m3, and where sensitive species or habitats are not at risk. These incidents are generally resolved through a First Strike response (i.e. local or initial resources only)
- Level 2 (10 to 1000 m3) incidents may require deployment of jurisdictional resources supplementary to the initial response due to the more complex size/duration/resource management/risks involved. A Level 1 release may be escalated to a Level 2 where sensitive environmental/socio-economic receptors may be at risk
- Level 3 incidents (>1,000 m3) may require national and international resources, and where the incident controller must delegate all management functions and focus on strategic leadership and response coordination. A Level 2 release may be escalated to a Level 2 where sensitive environmental/socio-economic receptors may be at risk.

The following spill scenarios have been identified for the Gippsland MSS:

- Level 1 (<125 L): The complete loss of hydrocarbons from a transfer hose during refueling operations (Section 7.6)
- Level 2 (286 m^3 of Marine Gas Oil (MGO)): The complete loss of inventory from the largest fuel tank of an example wide-tow capable survey vessel (the M/V Geo Coral) resulting from collision or grounding (Section 7.8). Note that should a release of this volume pose a significant risk to key sensitive receptors, then escalation to Level 3 may be triggered.

8.7.5.1 Environment that may be affected (EMBA)

The Environment That May Be Affected (EMBA) is the sea surface area, water column, sea bed and any relevant shorelines that could be impacted by oil spilled from a petroleum activity. The EMBA for a Level 1 bunkering incident is expected to be limited to the immediate vicinity of the release point due to rapid spreading, evaporation and dilution of the spilled MGO and the actions taken under the vessel SOPEP.

The EMBA for a Level 2 spill is based on the outcomes of weathering modelling in SIMAPs for 286m3 MGO (see Section 7.7. for further details and Appendix C for the Oil Spill Risk Assessment (RPS, 2018)).

8.7.5.2 Protection priorities within the EMBA

The NATPLAN protection priority hierarchy has been used to define protection priorities and response objectives within the EMBA:

- PRIORITY 1: protection of human health and safety
  - remove marine users and any potential casualties from areas considered to be a safety hazard
- PRIORITY 2: protection of habitat and cultural resources
- PRIORITY 3: protection of rare and/or endangered fauna
  - prevention of oil exposure to threatened fauna that are or may be present in (or in close proximity to) the operational area

- PRIORITY 4: protection of commercial resources
  - prevent exposure to commercial fisheries in (or in close proximity to) the operational area.

8.7.6 Spill response preparedness

Prior to commencement of the survey

- the Survey Vessel Master will ensure that all relevant personnel have
  - undergone relevant inductions
  - are familiar with the SOPEP (and oil spill response arrangements therein)
  - are appropriately trained to undertake their responsibilities under the SOPEP.
- the CGG Technical Operations Manager and Survey Vessel Master will ensure that notifications have been made to relevant stakeholders and agencies (see Section 8.7.4).

8.7.7 OPEP testing arrangements

The OPEP will be tested prior to commencing the Gippsland MSS. The schedule for testing of response arrangements will include:

- testing when response arrangements are introduced
- testing if/when response arrangements are significantly amended
- testing not later than 12 months after the most recent test
- testing for any new location(s) for the activity as soon as practicable after they have been added to the EP (if added after the most recent test, and before the next test is conducted).

Regulation (8A) requires testing of the objectives to ensure that they are appropriate to the nature and scale of the activity and that the response arrangements can be effectively implemented. Following testing, CGG will review the outcome of the test, identify any non-conformances and opportunities for improvement, and track corrective actions to completion using CGG's Incident Reporting Procedure (Section 8.8.2). CGG will carry any non-conformances identified during the survey forward for consideration in future surveys as part of a continuous improvement in control measures and performance standards.

Once the seismic vessel has been confirmed, CGG will make arrangements for testing of the vessel's SOPEP (including response arrangements) prior to the commencement of the survey. All personnel on board the vessel will be trained and inducted in the application of the vessel's SOPEP and in compliance with MARPOL Annex 1 Reg 37 (e.g. quarterly for vessels above 400GT). Regular drills and exercises will be carried out to maintain the crew's currency in response equipment use and in incident response procedures, as dictated by the SOPEP. These drills will include (but will not be limited to):

- spill response
- collision
- fire and explosion.

All drills will be documented, debriefings undertaken, and corrective actions identified (including any revisions to the SOPEP) and tracked to completion by the Survey Vessel Master.

8.7.8 Oil spill resources

Typical oil spill resources expected to be carried onboard the survey vessel are listed in the vessel's SOPEP. The vessel will carry spill containment and recovery kits with sufficient absorbent booms and materials to contain small to medium-scale deck spills. The Survey Vessel Master will be responsible for ensuring that these kits are serviced and in-date (where relevant), and appropriately stocked at all times. Minor spills will

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be managed through good housekeeping practices and the use of absorbent materials. Deck spills will not be discharged into the ocean. Spill clean-up materials will be retained on board the survey vessel and stored in covered containers for subsequent disposal at an appropriate onshore facility.

8.7.9 Proposed spill response strategies

Spill response strategies and tactics were considered for the credible scenarios identified in Section 8.7.5 (<125 L and 268 m3 MGO) are presented in

Table 8.3. In the unlikely event of a spill, the potential use of each spill response strategy/tactic would be assessed for feasibility/practicability and human health and safety, with the recommended responses subject to Net Environmental Benefit Analysis (NEBA) or Spill Impact Mitigation Assessment (SIMA) by the CA (e.g. AMSA in Commonwealth waters) to demonstrate reduction of risk to ALARP prior to implementation.

Given the location of the proposed Gippsland MSS, the preferred strategy for MGO spills will be to allow small spills to disperse and evaporate naturally, and to monitor and evaluate the position and trajectory of any surface slicks. Physical break up of surface slicks through using propeller wash from the support vessels or use of vessel fire hoses may be considered as a response measure (to aid in dispersion, dilution and evaporation of hydrocarbons). However, this tactic has potential human health and safety risks, and therefore would need to be considered carefully in discussion with AMSA. The potential for further entrainment of spilled hydrocarbons will also be considered in deciding whether to enhance physical mixing. In addition, dispersants would not be used as they are unlikely to be effective on an MGO spill (CSIRO 2016), could potentially increase environmental risk, and may reduce the effectiveness of natural degradation processes. This passive response and reliance on natural processes greatly reduces the potential for impacts associated with spill response activities.

For Level 1 fuel spills in Commonwealth waters, initial actions will be undertaken by the survey vessel in accordance with the vessel SOPEP, with subsequent actions determined in consultation with AMSA (under NATPLAN). In such situations, the Survey Vessel Master (or delegate) will monitor the spill and notify AMSA of the situation status. AMSA will monitor and continue to assess this level of spill.

For Level 2 spills, the Survey Vessel Master will notify AMSA (Section 8.7.1). AMSA is the responsible CA for oil spills from vessels within the Commonwealth jurisdiction and will respond in accordance with its Marine Pollution Response Plan, as approved by the AMSA Executive. Upon notification of an incident, AMSA will assume control of the incident (AMSA 2014). CGG will support the response as required. After ensuring the safety of the crew and fire prevention (and notifying AMSA), the Survey Vessel Master will implement the SOPEP and consider relevant actions (e.g. tank lightering) to reduce the oil volume released to the environment. AMSA will determine the appropriate response strategies depending upon the protection priorities at risk within the EMBA. AMSA will determine the potential need for oil spill trajectory modelling (OSTM) and possible sea/aerial surveillance to confirm/inform trajectory predictions, depending on the location, prevailing weather conditions, available vessel responses and volume released. All selected response strategies will be in accordance with NATPLAN. Recognising that there is potential for impacts associated with spill response activities, these risks would be assessed as part of any NEBA/SIMA coordinated by AMSA, to which CGG would contribute if requested by AMSA.

The NEBA/SIMA process requires a number of data and information inputs to allow a robust and transparent assessment. AMSA will require CGG to provide this information in a timely manner. Data/information requirements will comprise:

- information from the activity-specific EP, including available modelling
- data/information obtained immediately prior to and following the spill, such as any monitoring to support situational awareness and capability/logistical information to support spill response
- any available baseline data.

Where hydrocarbons from the spill are likely to cross from Commonwealth to State waters, AMSA will undertake the NEBA/SIMA in conjunction with representatives from the relevant State CAs.

The Survey Vessel Master will continue to provide situation reports (SITREPs) throughout the response activity, at the direction of AMSA. AMSA will maintain the response until relevant termination criteria are achieved.

Priority actions in the event of a large fuel spill are to make the area safe (protect human life) and to stop the leak to prevent further spillage, for example by transferring fuel to another tank.

If AMSA identify that an oiled wildlife response is required in Commonwealth waters, this will be based on the Oiled Wildlife Response Plan (AMSA 2017). Responses in State waters will be implemented by or under the direction of State CAs and align with current State oiled wildlife response plans. The accumulation of hydrocarbons on shorelines is considered unlikely based on the modelling and the credible scenarios; however, to allow for an adaptable response, consideration will be given to migratory shorebird feeding and roosting sites/nesting colonies and any seal colonies in and adjacent to the EMBA. In addition, species protected under Part 3 of the EPBC Act will be given particular attention, with consideration of information provided in relevant plans, guidelines and policies (e.g. NOPSEMA 2016a).

Commercial and recreational fishers and other users that operate in the area would be advised of any large spill and associated response activities via CGG's 24-hour 'look-ahead' correspondence. This would minimise the potential for interaction with their activities or unnecessary risks to personnel or property.

For spills in Commonwealth waters, initial actions will be undertaken by the survey vessel in accordance with its SOPEP and the survey OPEP. Under the OPEP, Type 1 operational monitoring will be carried out, which would be coordinated by AMSA and CGG as required. Type II scientific monitoring would be led by CGG if contact with sensitive receptors is expected (see Section 8.7.10 for further information).

Subsequent actions will be determined in consultation with the Control Agency and regulatory authorities (AMSA and NOPSEMA) under NATPLAN, with regards to the low potential for impacts posed by the spill. AMSA has indicated that it does not require titleholders to directly consult on OPEPs for seismic surveys or those addressing the operations of offshore supply vessels (AMSA 2014). Such operations are already covered by existing NATPLAN arrangements.

Given the low risk of adverse environmental impacts from a fuel spill in the Acquisition Area, and the negligible risk of shoreline contact meaning that active response and clean-up are unlikely to be required, there is little likely environmental benefit to be gained from implementing additional controls beyond those described in Error! Reference source not found. (Section Error! Reference source not found.). The risks of impacts from a fuel spill and response activities are considered to be at ALARP and acceptable (see section 7.8).

A fuel spill requiring active clean-up response is not considered a credible scenario and it is highly unlikely that sensitive receptors will be impacted in the short time during which concentrations of MGO are present at potentially ecotoxic levels around the spill location. The vessel's SOPEP and the OPEP would be implemented, and the risk is considered to be low. A NEBA or SIMA would be undertaken shortly after the time of the spill to ensure environmental impacts arising from the response strategy are minimised. Full recovery of water quality and any affected biological assemblages or areas of shallow reef is expected. CGG therefore considers the risk of potential impacts from the spill response to be acceptable.

Any reportable fuel or oil spills will be reported using CGG's Event Reporting Management Procedure (GRP_HSE_GEI_17E) described in Section 8.8.

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Table 8.3 Spill response strategies for the Gippsland MSS

Monitor and evaluate	Mechanical dispersion	Containment and recovery	Shoreline protection	Shoreline clean-up	Chemical dispersion
Relevance: relevant to all spills *Mobilisation*: Vessel observation is the most likely practicable option available for Level 1 *Efficacy*: Information gathering for spills is critical for situational awareness and supporting a co-ordinated spill response for all spills *Issues*: Visual operations of surface hydrocarbons are limited to daylight. Understanding of entrained or dissolved hydrocarbons distribution is limited to spot-point water column sampling using suitable equipment (e.g. fluorometer). *Summary*: This response will be implemented, with the scale of response determine by the CA appropriate to the nature and scale of the spill	*Relevance*: Can be considered for use on surface hydrocarbons *Mobilisation*: Undamaged vessel(s) in area may be used for this purpose if available (e.g. not undertaking other response operations, such as transfer of personnel or fuel from ruptured tanks, or securing damaged vessel) *Efficacy*: Limited and localised entrainment via propeller wash or through use of vessel's fire suppression hoses *Issues*: Potential human health and safety risks from e.g. VOCs. Optimal weathering will occur at the surface – entrainment increases persistence of hydrocarbons in the environment *Summary*: Not likely to reduce risk, therefore not recommended at this stage	*Relevance*: Can be considered for use on surface hydrocarbons, but not usually for an offshore spill of this nature *Mobilisation*: No surface booms/equipment will be on survey and/or support vessel (only sufficient for small- to medium-scale deck spills). Vessels would not be mobilised from port for this scenario as most hydrocarbon would have weathered and spread too thin during period to allow an effective response *Efficacy*: Unlikely to be effective on MGO hydrocarbons, due to type (MGO) and thickness of slick. Limited effectiveness in offshore environments due to limitations of use (wind/sea conditions) *Issues*: Potential human health risks from VOCs *Summary*: Unlikely to be effective or practicable. Not recommended at this stage	*Relevance*: Low risk of shoreline exposure above 10 g/m^2 *Mobilisation*: Unlikely *Efficacy*: Not considered effective for diesel or MGO spills that are likely to have undergone substantial weathering or for thin surface films – such as offshore spills of this nature Issues: Potential for causing localised damage to shallow subtidal sensitive habitats (e.g. seagrasses, macroalgal communities, sponge beds) from anchoring of protection booms *Summary*: Not recommended at this stage as unlikely to be effective and no shorelines are predicted to be sufficiently exposed to spill hydrocarbons	*Relevance*: Low risk of shoreline exposure above 10 g/m^2 *Mobilisation*: Unlikely *Efficacy*: N/A *Issues*: The impacts of shoreline clean-up are related to the method(s) used. For example, mechanical clean-up involves removal of large volumes of contaminated beach sediment, which can affect shoreline profiles/coastal processes and remove feeding habitat of shorebirds; chemical clean-up involves use of chemical dispersants and control agents to remove hydrocarbons in situ, which can then wash into adjacent (potentially sensitive) environments; cropping removes saltmarsh foliage, which can e.g. impact saltmarsh recovery and disturb/damage/destroy nesting areas *Summary*: Not recommended at this stage as shorelines are unlikely to be exposed to spill hydrocarbons at levels sufficient to pose a risk of chronic or acute impacts, and hence response may cause more impacts than spill exposure	*Relevance*: Can be considered for use on surface (and sub-surface) releases *Mobilisation*: Vessel-based (localised) dispersant application only if dispersants/equipment are on survey and/or support vessel. Airborne dispersant application would not be mobilised for this scenario *Efficacy*: Dispersants may be considered for spills in unconfined waters where allowed by regulatory authorities. However, most of the spill will be removed by natural degradation (weathering) before a co-ordinated response could be implemented. Remaining MGO may not be amenable to dispersants (e.g. spread too thin or with a patchy surface distribution). Additionally, optimal weathering occurs at the surface, so entrainment will increase persistence of hydrocarbons *Issues*: Dispersants and other oil spill control agents (OSCA) can have a certain inherent toxicity to different organisms. The increased water accommodated fraction of dispersed hydrocarbons can be more toxic to biota than either dispersants or hydrocarbons alone. Therefore, this response poses a potential increase in environmental risk due to potential for additional toxic impacts *Summary*: Not recommended at this stage

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8.7.10 Operational and scientific monitoring plan (OSMP)

The specific operational and scientific monitoring program undertaken following an oil spill would be developed based on the following information:

- location of the spill
- nature and scale of the spill, and likely evolution
- types of values and assets within the EMBA
- potential for impact upon sensitive resources
- review of available baseline data. An assessment of gaps in available baseline data and potential/requirements for post-spill/pre-exposure baseline data collection will be considerations in the monitoring design.

CGG will provide immediate on-site first strike response and AMSA as the CA will direct and lead any ongoing spill response arrangements and monitoring requirements in the event of an oil spill, supported by CGG.

All monitoring personnel will be suitably experienced and qualified for their role. A pre-mobilisation assessment of experience and certifications will be used to allocate specific roles to personnel. Multiple personnel will be allocated to monitoring roles to allow for shift rotations (where multiple shifts per day are required) or survey rotations (where staff are rotated from the field as part of effective fatigue management planning). The availability of personnel with in-date certificates (e.g. offshore medical, TBOSIET and MSIC) will then identify which personnel will support immediate mobilisation or comprise the second rotation.

8.7.10.1 Operational monitoring

In the event of a hydrocarbon release, CGG would implement Operational (Type I) Monitoring in consultation with AMSA, and where appropriate, relevant State agencies. This monitoring will be implemented to;

- determine the extent and character of a spill
- track the movement and trajectory of surface MGO slicks
- identify areas/ resources potentially affected by surface slicks
- determine sea conditions/ other constraints
- identify the efficacy and potential impacts of spill response strategies and tactics (to inform any remediation activities and any subsequent NEBA assessments).

Oil Spill Trajectory Modelling (OSTM), used in conjunction with water quality monitoring, will help determine the potential extent and direction of travel of the plume of entrained MGO, and to determine the risk of hydrocarbon toxicity impacts to sensitive receptor locations.

This monitoring instigated by AMSA, will enable CGG to provide the necessary information to AMSA, to assist in planning appropriate response actions under NATPLAN.

Specific monitoring and data collection would include aspects of the following, as agreed with AMSA:

- immediate monitoring (approximately 0 to 6 hours):
- estimate of sea state
- estimates of wind direction and speed
- characteristics of the surface MGO slicks (thickness and areal extent)
- GIS mapping
- OSTM triggered for a Level 2 spill or greater.

Modelling if triggered, will be used in conjunction with other field observation/monitoring data to identify the likely direction, spread and potential speed of the slick. This will be used as a guide to support the planning for other operational monitoring scopes (e.g. water quality, sampling and fluorometers). This information will allow initial identification sites for sampling, which may also provide information on the subsurface distribution of hydrocarbons via vertical profiling of the water column (should sufficient levels of hydrocarbons remain to be detectable). Water column profiling data will be used to identify the sites and depths at which water samples will then be taken for laboratory analysis. Water sampling for hydrocarbons should be undertaken using suitable equipment by personnel trained in the relevant procedures. “Improvised” approaches will not be used as the samples obtained may result in inaccurate results or a failure or a delay in confirming the credible source of the spill (as described in NOPSEMA 2017c).

To be mobilised (>6 hours):

- aerial surveillance for Level 2+ spills (if aircraft available offshore)
- GPS tracking using satellite drifter buoys (if available)
- measuring concentrations of entrained hydrocarbons through the water column (e.g. from water samples or using fluorometers calibrated to an appropriate hydrocarbon type)
- stochastic modelling predictions for Level 2+ spills (requires up to two weeks to receive results).

For potential additional consideration:

- remote sensing (e.g. satellite-based optical imagery and Synthetic-Aperture Radar (SAR)) where available and practicable.

Field-based operational monitoring will be restricted to daylight hours only, when surface slicks will be visible from either vessels or via aerial surveillance. Where available and practicable, remote sensing (e.g. using satellite-mounted optical imagery and Synthetic Aperture Radar (SAR)) may be used to provide situational awareness of the spatial distribution of the surface slick(s) during daylight, at night, or during overcast days.

The information gathered from this monitoring will be passed on to AMSA, but also via ongoing SITREP reports following the initial spill notification to JRCC Australia.

Where GPS tracking using satellite drifter buoys, real-time spill modelling, aerial surveillance, water quality sampling and/or visual slick estimation is required, CGG can engage RPS under existing contractual arrangements to provide urgent specialist response services. Should there be the need to implement field response activities using external parties, a response logistics plan would be developed and initiated immediately on notification of the spill. The plan would detail logistics, equipment personnel and detailed OSMP plans.

CGG will implement, assist with, or contribute to (including funding if required) any other operational or scientific monitoring as directed by AMSA or outlined in this EP.

8.7.10.2 Scientific monitoring

Scientific (Type II) Monitoring would be triggered and implemented if there is a reasonable expectation that there may be adverse impacts to marine biota or habitats in the area. The key receptors for which scientific monitoring studies would be considered are;

- benthic sediments (particularly soft sediments able to retain hydrocarbons, infauna)
- subtidal marine benthos (filter-feeders, macroalgae)
- seabird populations (foraging individuals)
- non-avian marine wildlife (cetaceans, marine reptiles and fish).

To allow for a flexible and adaptable scientific monitoring approach, additional receptors may also be considered should the nature and scale of the actual spill result in potential hydrocarbon exposure to shorelines or fisheries:

- intertidal sediments and habitats
- fisheries and aquaculture operations.

8.7.10.2.1 Initiation of scientific monitoring

After the Vessel Master provides notification to AMSA, CGG would implement scientific monitoring in the event of a Level 2 spill (or greater), in accordance with initiation criteria described in Table 8.4. A detailed OSMP Implementation Plan based on commonly-used, scientifically-robust and easily-accessible methods would be developed to ensure an efficient and technically-defensible response. This approach builds time efficiencies into development of the OSMP as existing RPS documentation (e.g. Health and Safety Plans) can be adapted to meet the requirements of the OSMP. Potential suppliers of available survey equipment would be identified as a priority, with a preference for those with existing contracts.

Relevant permit applications (e.g. for sediment/biota sampling) will be identified and submitted as soon as reasonably practicable. This approach does not work from the base assumption that permit requirements will be waived by relevant authorities in order to minimise potential delays in mobilisation and permit approval should permit requirements not be waived.

The OSMP Implementation Plan would detail the equipment required for each study, travel and freight arrangements, notifications, vessel support, HSE planning, and the sampling and analysis plan. Within 12 hours of RPS being notified, a teleconference will be held between the CGG, AMSA, the nominated scientific personnel and the Vessel Master to finalise the requirements for implementation. Scientific teams can be on site within 48 to 72 hours of the implementation plan and budget being approved (and where permits are not required or have been approved). It is recognised that MGO is only likely to remain measurable on the water surface for a few days, and that realistically a response team would not be on site until it had dispersed. Given the extremely low probability of a catastrophic spill and MGO subsequently contacting sensitive biota, and the rapid weathering and likely dispersal of spill hydrocarbons before a response team could be mobilised, CGG considers the costs associated with pre-emptive development of the Implementation Plan and full assembly and preparation of the response team to be grossly disproportionate to the benefit of a more rapid response; therefore this control has not been adopted.

The area of potential impact to be targeted in the scientific monitoring plan would be based on observations of the slick trajectory, water quality data collected during the operational phase, and available modelling. Due to the nature of the spill, potential for spread/dispersion, constrained spatial area of the EMBA, and likely field team mobilisation period, it is considered that post-spill pre-impact baseline data collection will likely not be feasible (but will remain a consideration for planning purposes).

Scientific monitoring would focus on determining potential short and long-term environmental impacts of the spill and response actions, and subsequent recovery). Scientific monitoring may continue for some time following the termination of the operational monitoring response (NOPSEMA 2016c).

8.7.10.2.2 Scientific monitoring team

In the event of the requirement to undertake scientific monitoring, CGG would engage a specialist subcontractor such as RPS to rapidly finalise response plans and to deploy the required resources to undertake the monitoring activities. Primary scientific monitoring studies could include some, or all, of the elements described in Table 8.4 depending on the size, timing and location of the spill.

An adaptable scientific monitoring response must allow for the potential for operational monitoring or situational awareness obtained during a spill to indicate exposure to additional sensitive receptor types, depending on the nature and scale of the actual release. Where such an occurrence is identified, additional optional SMPs may be implemented, following agreement with AMSA Table 8.5)

RPS

Table 8.2 Primary scientific monitoring core study objectives, key receptors and implementation and termination triggers

Scientific monitoring study objective	Key receptors	Implementation triggers	Termination triggers
<u>SMP1: Monitoring for Hydrocarbons in Benthic Sediments</u> **Aim:** To understand the characteristics, persistence and fate of hydrocarbons in sediments to provide data for the assessment of potential impacts on sea bed sediments. To understand the effect of hydrocarbon concentrations on infaunal macrobiota. **Objectives:** • quantify hydrocarbon concentrations at locations within the EMBA • quantify change in sediment hydrocarbon concentrations at sampling locations over time (considering seasonal and inter-annual change) • provide sediment hydrocarbon data to support determination of potential cause-effect relationships between spill hydrocarbons and changes in benthic communities • identify potential areas of benthic impact based on sediment hydrocarbon concentrations and impacts to benthic macroinfaunal assemblages.	Subtidal sediments within the Oil EMBA, with particular focus on sensitive locations	Level 2 spill or greater **and** where modelling and/or operational monitoring (e.g. water quality) indicates likely exposure to benthic sediments	The results of the monitoring tasks achieved the objectives **and** appropriate, meaningful and scientifically-defensible results have been achieved **and** sediment contamination results showed recovery to a point where hydrocarbon concentrations are no longer demonstrated to be a primary driver of infauna assemblage composition
SMP2: Monitoring and Surveys of Shoreline and Intertidal Benthos to Determine Impacts of Oil Spill and Recovery Aim: To determine and monitor the impact of the spill, dispersants or response activities and potential subsequent recovery for intertidal benthos at both individual (species) and community (habitat) levels. Objectives: • the monitoring of the spill and spill management operations on intertidal marine coastal habitats (like tidal seagrass, tidal mud flats, mangroves, intertidal saltmarsh and saltpans) • monitoring associated organisms (like fishes, crustaceans, arboreal mangrove biota, microphytobenthos, macroalgae, mangrove/saltmarsh plants, seagrass) • establish necessary responses • quantify the biological and ecological effects of the spill and response activities.	Invertebrates, Intertidal habitats, Seagrasses, Mangroves, Shorelines	Level 2 spill or greater and If modelling predicts possible shoreline/intertidal contact. or Any reports of shoreline/intertidal contact	Appropriate, meaningful and defensible scientific monitoring results for intertidal benthos have been achieved and All reasonable and practical measures have been taken to assess the impact of the spill on intertidal benthos and Affected intertidal benthos has returned to baseline (or reference site) conditions and Oil pollution impacts on critical intertidal benthos species and taxa are no longer identifiable.

Scientific monitoring study objective	Key receptors	Implementation triggers	Termination triggers
SMP3: Monitoring of Subtidal Marine Benthos to Determine Impacts of Oil Spill and Recovery **Aim:** To enable assessment of impacts and potential for subsequent recovery of benthic marine habitats (soft and hard substrate habitats) and associated macro-epibenthic organisms (e.g. macroalgae, seagrass, sponges and other filter feeders, motile invertebrates and associated fishes) in response to a spill event and associated response activities. Monitoring to document recovery of affected biota and habitats. **Objectives:** • characterise and quantify habitat composition and coverage/abundance of macro-epibenthic organisms and site-associated demersal fish • allow comparison with historical (baseline) data and seasonal/inter-annual surveys • define recovery in macro-benthic and demersal populations and recovery/change in habitat type.	Filter feeders, benthic primary producers, demersal fishes, invertebrates (e.g. commercially important rock lobsters, scallops) – with particular focus on sensitive locations	Level 2 spill or greater **and** where modelling and/or operational monitoring (e.g. water quality) indicates likely exposure to benthic habitats **or** any reports of contact	Reasonable and practicable scientifically-robust measures have been taken to assess the effects or impact of the spill on benthic habitats / communities **and** oil pollution effects / impacts on benthos are no longer detectable, or impacts shown to be within accepted protection limits (to be defined in Sampling and Analysis Plan) **and** when a trend towards post-impact recovery or alternate developmental trajectory has been demonstrated (in comparison with control/reference sites) at sites that were exposed to elevated concentrations of hydrocarbons
SMP4: Undertaking Wildlife Surveys to Determine Impact of Oil Spill on Seabird and Shorebird Populations and Recovery **Aim:** To assess any short-term or longer-term environmental effects on seabird and shorebird populations within the study area that may have resulted from the oil spill (i.e. damage extent and recovery). Monitoring to document recovery of affected biota and habitats. **Objectives:** • quantify foraging seabird and shorebird populations • quantify foraging, nesting or breeding shorebird populations • quantify records of oiled birds and bird mortalities • allow comparison of changes in populations over time (seasonal and inter-annual)	Foraging seabird and coastal shorebird populations	Level 2 spill or greater **and** where post-spill observations indicate possible contact with foraging seabird populations **and/or** any reports of oiled or dead seabirds **and/or** shoreline oil indicates possible contact with shoreline bird habitats or populations	The extent of damage and rate of recovery of key seabird/shorebird behaviour and breeding activities has been quantified using scientifically-robust methods **and** The affected environment or natural resource has returned to baseline conditions (taking into account natural variability) in terms of breeding population (for seabirds) or counts (for shorebirds), with regard to reference sites and/or baseline data **and** oil pollution effects/impacts on critical species and taxa are no longer detectable
SMP5: Desk study and survey: Occurrences of Oiled/Mortalities of Non-Avian Marine Wildlife to Determine Impacts of Oil Spill and Recovery **Aim:** To assess any short-term or longer-term environmental effects on non-avian marine wildlife that may have resulted from the oil spill (i.e. damage extent and recovery). Monitoring to document recovery of affected biota and habitats. **Objectives** • quantify records of sightings of dead or oiled marine wildlife • allow seasonal or inter-annual comparison of records of dead or oiled wildlife	Marine mammals, sharks, rays, bony fishes, marine turtles	Level 2 spill or greater **and** where modelling indicates possible contact with populations **and/or** any reports of oiled or dead non-avian marine wildlife	Reasonable and practical measures have been taken to assess the effects or impact of the spill on non-avian marine wildlife **and** restoration or resumption of key biological processes (e.g. abundance, distribution, breeding) necessary to ensure post-impact recovery have been identified **and** oil pollution impacts on non-avian marine wildlife are no longer detectable

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Table 8.3 Optional Secondary Scientific Monitoring Study Objectives, Key Receptors and Initiation and Termination Triggers

Scientific monitoring study objective	Key receptors	Initiation triggers	Termination triggers
SMP5: Monitoring of Intertidal Receptors to Determine Impacts of Spill Hydrocarbons and Recovery **Aim:** To understand the behaviour, persistence and fate of hydrocarbons in intertidal sediments, and enable assessment of potential impacts and recovery to intertidal habitats. To identify the potential implications of changes in intertidal communities to other biota (e.g. shorebirds). **Objectives:** • quantify hydrocarbon concentrations at locations within the EMBA • characterise and quantify habitat composition and coverage/abundance of epibenthic and infaunal organisms • quantify change at sampling locations over time (considering seasonal and inter-annual change) • define recovery/change in habitat type and epibenthic and infaunal organisms • provide sediment hydrocarbon data to support determination of potential cause-effect relationships between spill hydrocarbons and changes in benthic communities.	Intertidal sediments, infaunal communities and epibiota, with particular focus on shorelines that have been observed to be, or are predicted to have been, exposed to spill hydrocarbons	Level 2 spill or greater **and** where modelling and/or operational monitoring indicates likely exposure to intertidal habitats.	The results of the monitoring tasks achieved the objectives **and** appropriate, meaningful and defensible scientific monitoring results have been achieved **and** sediment contamination results have shown recovery to a point where hydrocarbon concentrations are no longer demonstrated to be a primary driver of habitat composition.
SMP6: Impacts to Fisheries and Aquaculture **Aim:** To understand the potential short and long-term impacts and recovery of fisheries (should they be closed), and aquaculture facility/operation that have been exposed to spill hydrocarbons **Objectives:** • quantify hydrocarbons in tissue of organisms targeted by fisheries or aquaculture • determine potential effects on population size/structure • identify potential impacts to organism health • determine potential risks to human health.	Target areas or species of Fisheries or Aquaculture interest, with particular focus on shorelines that have been observed to be, or are predicted to have been, exposed to spill hydrocarbons	Level 2 spill or greater **and** where fisheries have been closed in response to a hydrocarbon spill **and/or** where modelling and/or operational monitoring indicates likely exposure to aquaculture operations or key broodstock collection locations.	The results of the monitoring tasks achieved the objectives **and** appropriate, meaningful and defensible scientific monitoring results have been achieved **and** sediment contamination results have shown recovery to a point where risks to human health are understood **and** data on population structure have shown that recovery is possible through retention of sexually-mature adults and demonstrated recruitment of juveniles.

For each SMP described in Table 8.4 a detailed study template would be developed following implementation. This is summarised in Table 8.4. This template would also be applied to any of the optional SMPs described in Table 8.5 in the event they are required.

Table 8.4 Scientific monitoring studies template

Study heading	Description
Monitoring Objective and Rationale	Details the monitoring objectives for the study to focus sampling design
Natural Resource Description and/or Importance	Provides background information relevant to the context of the study; distribution, temporal patterns, life-stages present, critical habitats and processes
Activation Trigger for Monitoring Tasks	Criteria to initiate the scientific monitoring study, based on likely exposure to harmful concentrations (acute and/or chronic)
Potential Sensitivity to Spilled MGO at Exposure Levels	General context of possible impacts associated with the spill, exposure pathways and effects concentrations. Range of measurable responses
Spatial awareness	Outcomes of operational monitoring that support survey design
Monitoring methods / sampling and analysis plan	
Overview of the Monitoring Method	Provides a scientific and practical context for the monitoring methods to be used. Includes consideration of statistical methods and sampling effort required to achieve the monitoring objectives
Details of the Survey Design, Methods, Standards and Techniques to be Utilised	Provides the information required to collect samples in a defined geographic area (based on operational monitoring data) as part of a robust scientific study program. Includes relevant specifications, standards and requirements of the study
Permits	Details any permit requirements and/or exemptions
Data Collection, Analysis and Reporting Requirements	Provides details on the necessary data requirements including baseline information, analytical parameters and detection limits, and metadata. Details the deliverables from the study
Personnel Resourcing Requirements, Qualifications and Skills	Provides minimum skill/experience, qualifications/certifications and resourcing requirements to deliver the study safely and robustly Considers shifts and survey rotations for effective fatigue management Includes contingency resource planning
Field Equipment, Survey Platforms and Logistics	Details equipment and logistics requirements to fulfil the study requirements
Recommended Procedures for Data Collection, Sampling, Storage, Transport and Analysis	Provides the necessary sampling and analytical techniques, and standards to ensure data quality and ensure consistency throughout the study (including Chain of Custody (CoC) forms)
Risk Assessment, Occupational Health and Safety Considerations	Describes the risks and mitigation controls associated with undertaking the study
Data Management, QA/QC, Transmittal and Archiving	Provides QA / QC requirements for all data obtained as part of the study
Supporting Documents, Standards and References	Identifies the relevant guidelines and high-level references required to implement the study
Reporting Requirements	Provides description of reporting of the scientific outcomes of the survey(s), including identification and qualification/quantification of potential impacts and subsequent recovery Each survey report identifies the need for any further scientific monitoring based on the survey outcomes
Termination criteria	
Criteria for the Terminating the Monitoring Activity	Completion criteria to be met to demonstrate that study objectives have been achieved to terminate the study

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8.8 Reporting (Regs 14(2) and 26c)

8.8.1 Environmental performance reporting

The outcomes of the review of environmental performance during the survey (Section 8.3) will be summarised in the Post-survey Environmental Review Report (PERR). The outcomes of the review will be incorporated into environmental management measures applied to future activities to further improve CGG's environmental performance. The requirements for reporting and recording environmental performance are outlined in Table 8.5.

Table 8.5 Environmental performance reporting

Requirements	Timing
Submit an end-of-survey Post-survey Environmental Review Report (PERR) to NOPSEMA, in accordance with Regulation 14(2) and 26(C) of the OPGGS(E). This reports conformance against each of the performance outcomes and standards as outlined in Section 6 of this EP and: • a summary of all reportable and reportable incidents (if any), investigation details, corrective actions determined and actioned • monitoring records • details of all cetacean sightings (if any) • a copy of the completed Conformance Register for the activity, including all supporting records • inspection/audit outcomes • summary of the survey operations conducted.	Submit to NOPSEMA within 3 months of seismic survey completion. In the event the survey recommences in (or after) January 2020 a second Review Report will be submitted to NOPSEMA within 3 months of completion, but not later than 12 months after the first Review report,. In the event that the EP exceeds a period of 12 months the interval between reports will not be more than 12 months. Provide marine fauna observation data to DoEE within 3 months of survey completion. Upload information via the online Cetacean sightings application at https://data. marinemammals.gov.au/csa

8.8.2 Environment incident reporting (Reg 16c and 26)

Under Regulation 16(c) and 26 of the OPGGS(E), CGG is required to notify NOPSEMA of any reportable and recordable incident within a specified timeframe. Environmental incidents will be reported to the relevant government agency by the Client Site Representative. The requirements for reporting and recording incidents are outlined in Table 8.6.

Following any recordable or reportable incident, CGG will undertake an incident investigation and this information will be communicated to all relevant personnel. All recordable and reportable incidents will be documented in the PERR by the CGG Technical Operations Manager, and including details of the event, immediate action taken to control the situation, and corrective actions to prevent reoccurrence. The CGG Technical Operations Manager and Client Site Representative will follow up actions taken to ensure that the corrective actions have been taken to close it out. When planning future activities, CGG will review the reportable and recordable incidents that have occurred previously to incorporate any lessons learned as part of CGG's continual improvement process.

Table 8.6 Routine and incident reporting requirements

Requirements	Timing
Recordable incident reporting	
Legislative Definition: A "recordable incident" means "a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity that is not a reportable incident."	Submit to NOPSEMA as soon as practicable after the end of the calendar month, and in any case not later than 15 days after the end of the calendar month. Email: submissions@nopsema.gov.au.

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Requirements	Timing
As a minimum, the written incident report must include a description of: • a record of all recordable incidents that occurred during the calendar month • all material facts and circumstances concerning the recordable incidents • any actions taken to avoid or mitigate any adverse environmental impacts of the recordable incidents • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident • the action that has been taken, or is proposed be taken, to prevent similar incidents occurring in the future.	
Reportable incident – verbal notification	
Legislative Definition: A ”reportable incident” means “an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage.” Based on the risk assessments undertaken in Sections 6 and 7, CGG considers environmental incidents that have an inherent consequence of moderate or higher to be consistent with the moderate to significant environmental damage/consequence defined in the OPGGS(E). These are the risk of environmental impacts relating to the following reportable incidents: • mortality or physical injury of protected marine fauna caused by underwater noise from seismic operation • impacts of underwater sound to swimmers or divers • collision with large marine fauna (cetaceans, pinnipeds, marine turtles) causing injury or death • introduction of invasive marine species • release of solid hazardous and non-hazardous wastes • release of oily wastes and chemical spills • hydrocarbon spill (Level 1 and Level 2). Verbal notification of reportable incident must be given to NOPSEMA as soon as practicable (not later than 2 hours) after the occurrence of the reportable incident/after the time CGG becomes aware of the reportable incident. The verbal notification must include the following information: • all material facts and circumstances concerning the incident that the titleholder knows, or is able, by reasonable search or enquiry, to find out • any actions taken to avoid or mitigate any adverse environmental impacts of the reportable incident • the corrective action that have been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.	NOPSEMA: as soon as practical and no later than 2 hours. Ph 08 6461 7090 submissions@nopsema.gov.au Verbal notifications must also be given as soon as is practicable to AMSA and State Agencies **AMSA** First contact in the event of a Level 1 or Level 2 hydrocarbon spill: AMSA: 02 6230 6811 (24 hrs) or 1800 641 792 (refer to Section 8.7 for details of oil spill notification and reporting requirements). IMS or ballast water non- conformance **Designated State Control Agencies:** Victorian Department of Economic Development, Jobs, Transport and Resources (VIC DEDJTR) Gippsland region: +61 3 5150 0500 (24 hrs) Gippsland Ports: 0400 605 645 or 0429 174 606 TAS EPA Division – as soon as practicable on: 1800 005 171 South Australia Department of Planning, Transport and Infrastructure (DPTI – verbally as soon as practicable to the on: (08) 8248 3505 or Radio Channel 12 Transport Safety Victoria (TSV): 0409 858 715 (24 hrs) – State waters Maritime New South Wales on +61 13 12 36
Notify the Victorian Department of Environment, Land, Water and Planning (DELWP) if any previously unrecorded shipwrecks are found	Within 24 hours Download the ‘Wreck reporting form’ at: http://www.dtpli.vic.gov.au/herit age/shipwrecks-and- maritime/shipwrecks-forms- and-guidelines and email to heritage.victoria@delwp.vic.go v.au

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Requirements	Timing
Request assistance of Wildlife Victoria for treatment of injured animals. If there a possibility of oiled wildlife response in other State water this will be coordinated through the State designated control agency, applying relevant State oiled wildlife response plans.	As soon as practical. ph 1300 094 535.
Notify DELWP in the event of oiled wildlife. Notify DELWP of any incidents of injury or death to native wildlife If there a possibility of oiled wildlife response in other State water this will be coordinated through the State designated control agency, applying relevant State oiled wildlife response plans	Within 2 hrs of becoming aware of the incident 1300 134 444 (24 hrs). Whale & Dolphin Emergency Hotline: 1300 136 017. Seals, penguins or turtles 136 186 (Mon-Fri 8am to 6pm) or AGL Marine Response Unit 1300 245 678
Reportable incident – written notification	
As per Reg 26(6) of the OPGGS(E), as soon as practicable after the verbal notification (and no later than 3 days after the first occurrence of the reportable incident), a written record of the notification must be provided to: • NOPSEMA • NOPTA • the Department of the responsible State Minister (TAS, VIC or NSW) • ERR (Victorian waters)	As soon as practicable following verbal notification to NOPSEMA Email NOPSEMA: submissions@nopsema.gov.au Email TAS State Department (EPA): incidentresponse@epa.tas.gov.au (no email address available for SA operational.report@ecodev. vic.gov.au ERR: Not later than 3 days after the first occurrence of the incident Email NOPTA: info@nopta.gov.au
As per Reg 26A(4) of the OPGGS(E), this initial notification to NOPSEMA must be followed up by a written report. As a minimum, the written incident report will include: • all material facts and circumstances concerning the incident that the titleholder knows, or is able, by reasonable search or enquiry, to find out • any actions taken to avoid or mitigate any adverse environmental impacts of the reportable incident • the corrective action that have been taken, or is proposed to be taken, to stop, control or remedy the reportable incident • the action that has been taken, or is proposed to be taken, to prevent similar recordable incidents occurring in the future.	As soon as practicable, and not later than 3 days following the first occurrence of the incident Email NOPSEMA: submissions@nopsema.gov.au
As per Reg 26A(5) of the OPGGS(E), within 7 days after giving a written report of a reportable incident to NOPSEMA, the titleholder must give a copy of the report to: • NOPTA • the Department of the responsible State Minister (TAS, VIC or NSW).	Within 7 days of providing a written report to NOPSEMA Email NOPTA: info@nopta.gov.au Email TAS EPA: incidentresponse@epa.tas.gov.au ERR: operational.report@ ecodev.vic.gov.au
Notify the DoEE of any impacts to MNES specifically injury to or death of EPBC Act listed species	Within 7 days of the incdent protected.species@ environment.gov.au or compliance@environment.gov.au
Notify the DoEE of a vessel strike with a cetacean	Within 72 hours of the incident. Upload information to: https://data.marinemammals.g ov.au/report/shipstrike

8.8.3 Other reporting

8.8.3.1 Oil pollution emergency plan reporting

In the event of implementation of the OPEP, CGG will also provide any required reports to oil spill response agencies as described in (Section 8.7).

8.8.3.2 Marine fauna reporting

In accordance with the EPBC Act Policy Statement 2.1 a record of marine fauna interaction procedures employed during operations will be maintained. The Marine Fauna Observers (MFO) Report on the conduct of the survey, and any marine fauna sightings/interactions (including any whale-instigated shut-downs of the acoustic source) will be provided to DoEE within two months of the completion of the survey. The report will contain:

- the location, date and start-up time of the survey
- name, qualifications and experience of any MFO/Passive Acoustic Monitoring (PAM) operator involved in the survey
- the location/times/reasons when observations were hampered by poor visibility, low light conditions or high winds
- the location and time any start-up delays, power downs or stop work procedures instigated as a result of whale sightings
- the location, time and distance of any cetacean, pinniped and turtle sightings
- details of PAM operations and associated power downs or stop work events
- the date and time of completion of the survey.

The following procedures will be implemented during the survey to ensure all marine fauna sightings are properly recorded and reported:

- detailed reports of all cetacean sightings will be recorded using the DoEE Cetacean Sightings Application (CSA – Version 3 – BETA) (http://data.marinemammals.gov.au/portal/csa/).
- at the completion of the survey, a copy of the report generated by the CSA will be provided to DoEE as part of the MFO Report.

In the event of a collision with a whale, this will be reported to the DoEE national ship strike database, located at https://data.marinemammals.gov.au/report/shipstrike. This report will occur as soon as practicable, however no more than 7 days upon becoming aware of the incident.

8.8.3.3 AMSA reporting

In accordance with the *Navigation Act 2012*, AMSA's JRCC will be immediately notified i.e.(within 1 hour),by the Survey Vessel master (via the national 24-hour emergency hotline) by the Survey Vessel Master in the event of:

- any oil pollution incident in Commonwealth waters (Level 1 or 2 spill)
- any spill greater than $10m^3$ (10 tonnes) in Commonwealth waters (Level 2 spill)
- the vessel sustaining or causing an accident, occasioning loss of life or serious injury
- the vessel receiving damage or defect which affects its seaworthiness
- serious danger to navigation (e.g. a sizable piece of equipment overboard likely to float, creating a shipping hazard).

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8.8.4 Other notifications

Regulation 11A of the OPGGS(E) specify that consultation with relevant authorities, persons and organisations must take place. This consultation includes an implicit obligation to report on the progress of the survey. The routine reporting obligations that CGG will undertake with external organisations are outlined in Table 8.7.

Table 8.7 Other EP Notifications

Requirements	Timing and Method
Routine reporting	
If survey commences > 4 months after EP approval: Ensure any new stakeholders are identified Once the schedule has been determined, notify all stakeholders of the dates, seeking feedback regarding fishing areas/activity with respect to timing Identify alternative operating arrangements in response to feedback (and update stakeholders if required).	Four months following EP approval. If the program is re-started in the following season (mid-January 2020), CGG will undertake a review four months prior to re-start. Methods used to identify and communicate with stakeholders are described in Sections 9.4.1. and 9.5.
Send update and reminder to all relevant stakeholders of survey including commencement date and duration, survey line plan layout, vessel communication details and protocols and contact details for further stakeholder feedback. Identify alternative operating arrangements in response to feedback (and update stakeholders if required).	One month prior to activity starting or re-starting the second season.
Reminder to fisheries and fishing stakeholders of survey details and contact information for fishers to provide information on planned fishing activity.	7-10 day lookahead prior to survey commencement and on re-start (if survey is suspended) using communication methods described in Section 9.4.1.
Notify fisheries and fishing stakeholders on halting (i.e. suspension) and on completion of survey	Using communication methods described in Section 9.4.1.
Notify all relevant stakeholders in the area of operation of the survey vessel location and planned movements over the next 24 hours	Broadcast twice daily bulletins during the survey by radio, AIS and email.
Notify the Australian Hydrographic Office (AHO) of the survey commencement date and duration to enable a Notice to Mariners to be issued.	Email the AHO four weeks prior to the confirmed survey start date at: datacentre@hydro.gov.au
Notify the Australian Hydrographic Office (AHO) of altered information during the survey to enable a Notice to Mariners to be issued.	Email the AHO fortnightly (if required) to report altered information at: datacentre@hydro.gov.au
Notify the Australian Hydrographic Office (AHO) on halting (i.e. suspension) and on completion of the survey.	Email the AHO on completion of demobilisation from the operational area at: datacentre@hydro.gov.au
Notify NOPSEMA of the start date of the survey in accordance with Reg 29(1) of the OPGGS(E).	Email NOPSEMA (submissions@nopsema.gov.au) at least 10 days prior to the survey starting.
Notify NOPSEMA of the end date of the survey in accordance with Reg 29(2) of the OPGGS(E).	Email NOPSEMA (submissions@nopsema.gov.au) within 10 days of completion of the survey.
Notify regulators at the end of the operation of the EP.	Within one month of survey completion. Email: submissions@nopsema.gov.au mail to: operational.report@ecodev.vic.gov.au
Notify AMSA prior to survey commencement with vessel details (including name, call sign and Maritime MMSI), satellite communications details (including INMARSAT-C and satellite telephone), area of operation and requested clearance from other vessels.	Email AMSA's JRCC 24-48 hours prior to survey commencement at: rccaus@amsa.gov.au or phone 1800 641 792 or +61 2 6230 6811)

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Requirements	Timing and Method
Notify AMSA in order to start and cease daily AusCoast warnings.	Email AMSA's JRCC within 24 hours of the start and completion of the survey at: rccaus@amsa.gov.au.
Notify AMSA on halting (i.e. suspension) and on completion of the survey with vessel details (including name, callsign and Maritime MMSI), satellite communications details (including INMARSAT-C and satellite telephone), area of operation and halting and/or requested clearance from other vessels suspension of activities.	Email AMSA's JRCC at: rccaus@amsa.gov.au or phone 1800 641 792 or +61 2 6230 6811)
Ballast water non-conformances and queries	Victorian EPA: 03-9695 2547 (24 hrs) ballast.water@epa.vic.gov.au

9 Stakeholder consultation

9.1 Stakeholder engagement and consultation process

CGG conducted stakeholder engagement and consultation according to the process summarised in Figure 9 1 and described in the sections that follow. The ongoing consultation process is covered in Section 9.8.

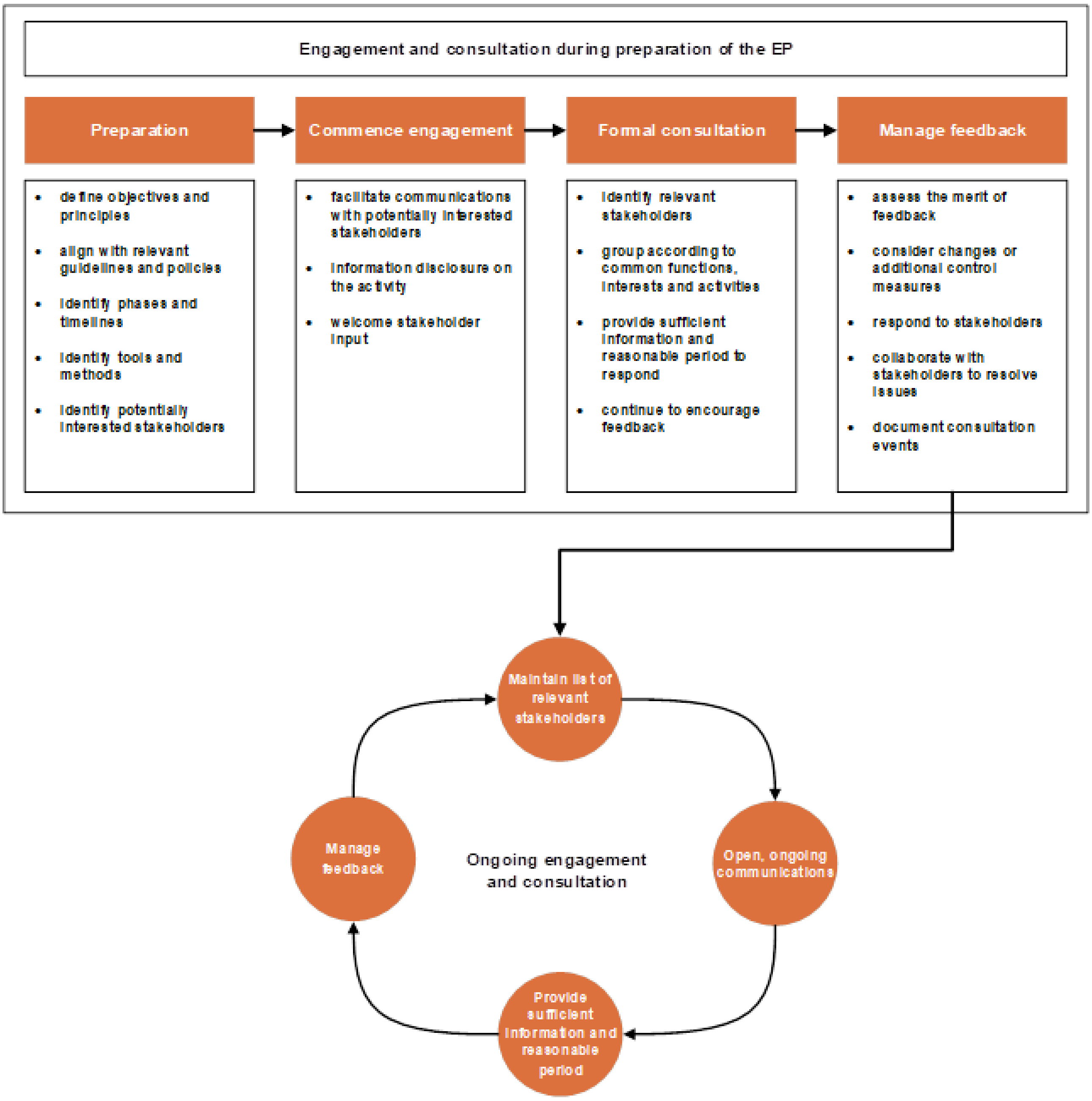

Figure 9.1 Process of engagement and consultation with stakeholders

9.2 Objectives and principles

CGG is committed to transparent, ongoing and effective engagement with the communities in which it operates and recognises that it is critical to project success.

The objectives of consultation for the Gippsland MSS are:

- to maximise transparency and to ensure that the rights of stakeholders are upheld and appropriately considered throughout the planning, permissioning and execution stages of the survey
- to ensure that relevant stakeholders are provided with an adequate opportunity to consider and provide feedback on the potential impacts and risks of the survey relevant to their functions, interests or activities
- to meet the consultation requirements of the OPGGS(E) Regulations.

In order to meet the objectives above, the following key principles were adopted for CGG's consultation process for the Gippsland MSS:

- communication is open and effective
- consultation is collaborative, inclusive and transparent
- sufficient information is provided to stakeholders to allow them to identify potential impacts on their functions, interests and activities
- consultation is timely, allowing stakeholders a reasonable period to identify and communicate any claims or objections
- the impact and risk assessment and control measures are informed by stakeholder feedback
- trust is built and maintained with stakeholders and the local community.

9.3 Guidelines and policies

The following guidelines and policies were considered and during consultation for the Gippsland MSS and the development of this EP:

- NOPSEMA (2016) Guidance note (N04750-GN1344): Environment plan content requirements
- NOPSEMA (2017) Guideline (N-04750-GL1721): Environment plan decision making guideline
- NOPSEMA (2014) Information Paper (N-04750-IP1411): Consultation requirements under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
- NOPSEMA (2018) Requirements for consultation and public comment on petroleum activities in Commonwealth waters
- APPEA (2017) Stakeholder Consultation and Engagement Principles and Methodology
- Department of Industry, Innovation and Science (DIIS) (2016) Australian Government Guidance (A529633): Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government Agencies with Responsibilities in the Commonwealth Marine Area
- AFMA Petroleum industry consultation with the commercial fishing industry (https://www.afma.gov.au/sustainability-environment/petroleum-industry-consultation)
- VFA (Spetember 2017) Policy for Victorian Fisheries: Undertaking Seismic Surveys in Victorian Managed Waters.

9.4 Tools and methods

9.4.1 General

A variety of consultation methods were selected to meet the different needs and preferences of stakeholders. Two-way communication and written forms of communication were prioritised as recommended in Information Paper (N-04750-IP1411) (NOPSEMA 2014). Records of all consultation with relevant stakeholders are provided in Appendix I.

The methods used to communicate with stakeholders during the preparation of this EP were emails, phone calls, text messages, face-to-face meetings, conference calls, post, formal letters, online articles, a media release, an advertisement in the Gippsland Times and a Scientific Advisory Committee. A dedicated project email address and phone number were set up to make it easy for stakeholders to provide feedback. These were prominently located on all consultation materials sent to stakeholders to encourage questions and feedback.

An article was reported in the Gippsland Times in June 2018 (http://www.gippslandtimes.com.au/story/5502012/new-search-for-offshore-oil-gas/) and an article was also posted on the CGG website (https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information). Updated summary information on the activity was advertised in the Gippsland Times in September 2018. CGG also proposed posting public notices near jetties or boat launches in Lakes Entrance but did not follow through with this based on feedback from local representative body LEFCOL.

Formal stakeholder consultation letters have been disseminated to stakeholders. These letters were developed to serve as primary information sources for stakeholders and enable them to raise questions, objections, claims, or to request further information. Where appropriate, the content and scope of the letters was tailored to the specific interests of different stakeholder groups and were also based on information that had been requested by groups of stakeholders.

9.4.2 Face-to-face meetings

Stakeholders were offered face-to-face meetings with CGG representatives, with video/audio conference calls offered as an alternative where suitable arrangements could not be made. The face-to-face meetings served to confirm the stakeholder's functions, activities and interests in the project, provide information on CGG and the proposed activities, discuss their issues and concerns, and provide them with an opportunity to ask questions. Table 9.1 summarises the face-to-face meetings that have been held to date. Records of meetings are in Appendix I.

Table 9.1 Face-to-face meetings with stakeholders

Date	Stakeholder(s)	Topics
25 July 2018	Johnathan Davey, representing SIV	SIV/TSIC Policy, activity overview, SIV's key concerns with the activity.
25 July 2018	REDACTED representing SETFIA, SPFIA, SSIA and the VRLA (Eastern Zone)	SETFIA draft report, consultation with SETFIA, SSIA and SPFIA.
26 July 2018	REDACTED representing LEFCOL, commercial fishers, charter operators and other fishers	Activity overview, fishers concerns with the activity.
26 July 2018	Andrew Moore, on behalf of Tim Bull, Member for Gippsland East	Activity overview, regulatory agency and process for EP approval, outcomes of meetings with fishing industry.
25 September 2018	Fishers representing Commonwealth and Victorian fisheries	Changes made to survey area (zoning approach) and fishers concerns with the activity.
2 November 2018	Fishers representing Commonwealth and Victorian fisheries	Changes made to survey area (zoning approach) and timing, proposed Scientific Advisory Committee, proposed octopus study, notes on scallops, CSIRO review.
9 November 2018	AMSA	Project vessels, shipping lanes and vessel movements, navigation warnings, Notice to Mariners, virtual AIS system.
13 November 2018 (SETFIA members meeting)	SETFIA members	Scientific Advisory Committee, monitoring programs being considered for the survey, compensation.

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9.4.3 Scientific advisory committee

A Scientific Advisory Committee (SAC) was established in November 2018 to advise CGG on key fisheries concerns and options for addressing these concerns. The members of the Committee are:

- REDACTED – Committee Chairman and Director of NMAC (SA) Pty Ltd
- REDACTED – Executive Officer of the South East Trawl Fishing Industry Association (SETFIA)
- REDACTED – Manager of the Lakes Entrance Fishermen's Co-operative (LEFCOL)
- REDACTED – Director of Fishwell Consulting
- REDACTED – Associate Professor at the University of Tasmania (UTas)
- REDACTED – Executive Officer of the Sustainable Shark Fishing Association
- REDACTED – Fisheries Liaison Officer – RPS/CGG Gippsland MSS Project
- REDACTED – Regional Geoscience Manager CGG.

The following Subject Matter Experts are also involved in the SAC:

- REDACTED – Octopus and charter fisher based in Lakes Entrance
- REDACTED – Scallop, Danish seine, squid fisher based in Lakes Entrance.

Meetings held by the SAC are minuted, and the outcomes of SAC initiatives, including research proposals described in Section 8.3.3, will be communicated to relevant stakeholders via stakeholder updates. For example, description of the SAC and the research studies and key stakeholder concerns discussed at SAC meetings was included in the Gippsland MSS Stakeholder Update distributed to relevant stakeholders in November 2018.

The SAC has met four times up to 23 January 2019. The initial meeting was held in Melbourne on 23 November 2018. This meeting established the specific function of the SAC, which is to advise CGG on concerns of fishing stakeholders, identify actions required by CGG to address key stakeholder concerns, and to approve and help develop research proposals previously identified by CGG in response to stakeholder feedback. Three action items were approved by the SAC at the conclusion of the initial meeting:

Item 1

Develop two research studies:

- Experimental assessment of physiology and behavioural impacts of MSS noise, and analysis of catch data before and after the MSS. UTas to develop a proposal for this.
- Analysis of shark and finfish catch and effort data from the Commonwealth Danish seine fishery before and after the MSS. Fishwell Consulting to develop a proposal for this, based on a preliminary power analysis.

Item 2

Develop an appeals process through which fishing industry members can seek compensation due to catch/revenue losses as a consequence of the MSS. REDACTED to develop a plan for this.

Item 3

Analysis of fisheries data to determine the order for surveying zones that minimises the impact on the commercial fishing industry. Fishwell Consulting to develop a proposal for this.

The research studies (Action item 1) are described in Section 8.3.3 because of their use in evaluating and managing the environmental performance of the MSS. The studies are still in development and a final decision by CGG on the choice and scope of them will depend on various factors including the timing of EP approval, survey start dates, and a cost-benefit analysis. Outcomes of the studies will be of broader interest and where possible made available to the public. They will also enable re-assessment of MSS impact profiles and establishment of modified or new controls and EPS, if required, during the second year of surveys via the management of change process described in Section 8.2.1.

The Fisheries Displacement Mitigation Plan (Plan; Action item 2) is also described in Section 8.3.3. The purpose of the plan is to provide a mechanism for licensed individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG's activities. The plan sets out the decision rules to deal with payments for verified claims.

The analysis of fisheries data to determine the order for surveying zones (Action item 3) is described in Section 6.1.5 (Impact treatment for seismic sound) since outcomes of this analysis will be available prior to commencement of the survey and enable CGG to plan accordingly so that impacts to fisheries are minimised.

Items 1 – 3 have been the main agenda items during subsequent SAC meetings and via email correspondence between SAC members (Appendix H). The SAC will continue to meet via video and phone conference and face to face meetings in Melbourne, as required for the duration of the survey, and as determined by ongoing discussions between the SAC and CGG. Meeting agenda, meeting minutes and relevant materials/information are distributed via email by the committee chair REDACTED CGG will ensure that advice provided by the SAC is prioritised within the broader impact and risk assessment framework.

9.4.4 Consultation Manager

Consultation Manager is used to document all stakeholder engagement activities and ensure that the consultation process is managed effectively on an ongoing basis. Consultation Manager is a cloud-based software platform designed specifically for stakeholder consultation. The Gippsland MSS project in Consultation Manager is a 'live' database and records of consultation will be maintained for the duration of the activity. The information recorded in Consultation Manager for the Gippsland MSS includes:

- the available contact details for all stakeholders
- the stakeholder group (e.g. government agencies and authorities, fisheries and fishers, tourism and recreation) for each stakeholder
- copies of consultation materials provided to stakeholders
- copies of incoming and outgoing correspondence (e.g. letters, emails, phone calls) and meeting minutes, media releases, etc.
- a summary of stakeholder feedback and CGG's response
- issues and concerns raised in stakeholder feedback (separated into categories)
- tracking data and statistics (e.g. delivery receipts, read receipts and the number of times stakeholders have opened emails sent from Consultation Manager)
- actions related to consultation events, when they are due and who is responsible for completing them.

9.5 Stakeholder identification

9.5.1 Relevant persons

As required by Regulation 11A(1) of the OPGGS(E) Regulations, CGG has identified "relevant persons" (relevant stakeholders). For the purposes of this EP, CGG considers relevant stakeholders to be:

- each Commonwealth department or agency to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- each state department or agency to which the to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- the department of the responsible State Minister for the offshore petroleum or energy resources sector

- persons or organisations whose functions, interests or activities may be affected by the activity under this EP, or the revision of the EP
- any other relevant person or organisation that CGG considers relevant.

Potentially relevant stakeholders were identified by:

- reviewing the organisations, groups and individuals with functions, interests or activities within the Operational Area
- obtaining information from AFMA on Commonwealth fisheries in the Operational Area
- engaging REDACTED from the South East Trawl Fishing Industry Association (SETFIA) to prepare a report on the Commonwealth and Victorian fisheries active in the Operational Area. The report is provided in Appendix H and includes a list of key fisheries associations and individual fishers most likely to be affected by the survey
- online searches for local businesses and operators
- recommendations and referrals from relevant stakeholders (for other stakeholders that CGG should contact).

Once identified, potentially relevant stakeholders were notified of the planned activities and their feedback assessed in order to determine whether they are a relevant stakeholder. In addition to the list above, the following factors were considered in determining relevant stakeholders while consultation was in progress:

- if their functions, interests and activities could be affected by the activity
- if they had a reasonable connection or relationship to the activity
- if a stakeholder confirmed they were not affected by the activity and did not wish to receive updates were removed from the relevant stakeholder list
- if a stakeholder did not make any objections or claims but requested to be kept updated on the activity, they were kept on the relevant stakeholder list
- if a stakeholder raised relevant objections or claims they were kept on the relevant stakeholder list
- if CGG considered the stakeholder relevant, regardless of their response, or lack of response, they were kept on the relevant stakeholder list.

CGG used the following definitions for functions, interests and activities as recommended in NOPSEMA (2018):

- functions are a person or organisation’s power, duty, authority or responsibilities
- activities are a thing or things that a person or group does or has done
- interests are a person or organisation’s rights, advantages, duties, and liabilities; or a group or organisation having a common concern.

Following identification, relevant stakeholders were grouped according to their common functions, interests and activities:

- government agencies, authorities and representatives (other than fisheries agencies)
- government agencies – fisheries
- fisheries associations
- fishing companies and fishers
- tourism and recreation
- research
- industry operators.

The outcomes of the stakeholder identification process (i.e. list of all stakeholders consulted, list of relevant stakeholders and their stakeholder groups are provided in the Relevant Stakeholders Consultation Report in Appendix H.

9.5.2 Identification of relevant fisheries stakeholders

The Operational Area overlaps the jurisdictional boundaries of several Commonwealth and Victorian-managed fisheries, and operators within these fisheries were identified as those stakeholders within the Operational Area most likely to be affected by survey activities. As described in Appendix E, not all of these fisheries are expected to be active within the Operational Area. Guidance and advice from fisheries management authorities (the AFMA and the Victorian Fisheries Authority (VFA)) assisted in identifying and contacting commercial fishing industry associations, individual license holders and vessel operators who were potentially relevant stakeholders. Specialist industry advice on the Commonwealth and Victorian fisheries, including their historic, current and potential future level of activity within the Operational Area, was also obtained (SETFIA 2018) in order to understand each fishery and to inform the consultation process.

Charter operators and recreational fishers that were active in the Operational Area were identified via online web searches and past stakeholder lists for the area.

9.6 Stakeholder consultation

9.6.1 Provision of sufficient information

CGG has undertaken reasonable efforts to provided stakeholders with sufficient information to assess the potential impacts of the survey on their interests, activities and functions because:

- CGG established a dedicated survey webpage on its website to promote awareness of the survey, provide background information and provide details for concerned parties to make contact (https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information).
- CGG also provided information on the survey via face-to-face meetings, conference calls, a media release, and an advertisement in the Gippsland Times.
- An initial formal stakeholder consultation letter containing background information on the proposed survey, the consultation process and contact details for stakeholders to communicate any issues or concerns or to receive further information, was provided to both representative bodies for dissemination and individual stakeholders as they were identified (Appendix I).
- As stakeholder objections and claims were identified, a second and third formal stakeholder consultation letters were distributed (Appendix I). The second and third information packages covered changes made to the proposed survey in response to stakeholder feedback. They also contained information on the outcomes of the impact assessment, noise modelling and a summary of the control measures adopted by CGG to reduce potential impacts.
- Information in the second stakeholder consultation letter was tailored to the particular stakeholder group they were sent to.
- If relevant stakeholders requested further information that was not covered in the formal stakeholder consultation letters, it was provided to them.
- Stakeholders were also responded to individually, and responses were tailored to the functions, interests and activities of the stakeholder.
- CGG used a variety of means to contact stakeholders on multiple occasions to confirm they had received information that had been sent out and to prompt or encourage direct feedback on their objections and concerns.

The Relevant Stakeholders Consultation Report in Appendix H demonstrates how sufficient information has been provided for each relevant stakeholder.

9.6.2 Reasonable period to respond

CGG has provided reasonable time for relevant stakeholders to assess information on the proposed survey, and respond with any objections and concerns with the activity because:

- The first formal stakeholder consultation letter was initially distributed to stakeholders in May 2018. It was sent again in June and August 2018 as further groups of relevant stakeholders were identified.
- Stakeholders were reached via representative bodies (Table 9.2) to ensure fishing stakeholders received information in a timely manner.
  - The organisations listed in Table 9.2 all received the initial formal stakeholder consultation letter on 28 May 2018 (six months prior to submission of this EP).
  - The same letter was provided to VFA (on 13 June 2018, five months prior to submission of this EP) to forward to all relevant Victorian licence holders (which they confirmed they did on 21 June 2018).
- Individual fishers were also contacted directly, to give them opportunity to provide feedback directly to CGG, either via email, letter or over the phone without having to provide a written response (if that was their preference).
- The second formal stakeholder consultation letter containing detailed information on the potential impacts and risks of the activity (relevant to stakeholders) and control measures, was distributed to relevant stakeholders in September 2018, two months prior to submission of this EP.
- Face-to-face meetings have been held with key relevant stakeholders in July 2018, September 2018 and November 2018; four months, two months and one month prior to submission of this EP.
- If relevant stakeholders had still not responded, CGG made reasonable effort to engage with the stakeholders and provide them with an opportunity to raise concerns, including following up with additional emails, phone calls and text messages (if phone numbers were available).

A third stakeholder consultation letter was distributed to all relevant stakeholders on 22 November 2018. This letter contained information on changes made to the proposed activity to address stakeholder objections and claims raised following the first two consultation letters and during face-to-face meetings.

The Relevant Stakeholders Consultation Report in Appendix H demonstrates how a reasonable period has been provided for each relevant stakeholder.

9.6.3 Consulting with relevant fisheries stakeholders

CGG made reasonable efforts to identify and reach all relevant fishing industry stakeholders within the fisheries sectors potentially affected by the activity. However, representative bodies expressed different preferences for consultation. Some recommended consulting directly with individual fishers as well as going via the relevant associations (e.g. SETFIA). Others stated their preference was for information to be disseminated by the relevant associations and that contacting individual fishers was not appropriate (e.g. LEFCOL, SIV). Some initially agreed to disseminate information to licence holders and then advised they were not able to do this on an ongoing basis (e.g. VFA). Others did not respond at all to CGG consultation.

CGG made best efforts to accommodate the preferred consultation arrangements of the different representative bodies, whilst also meeting the requirement to demonstrate that as many relevant fishing industry stakeholders were identified and consulted as possible.

Table 9.2 summarises the affected fisheries and the key representative bodies and contact person(s) that CGG consulted with. There are other associations that are not listed in the table but were also contacted. For fisheries that did not have a representative body CGG consulted with licence holders and fishers directly. All relevant agencies, representative bodies and individual licence holders that have been consulted are listed in the Relevant Stakeholders Consultation Report Appendix H.

Table 9.2 Summary of key contacts for Commonwealth and Victorian fisheries

Fishery	Sector/ subsector	Representative body	Key contact
Commonwealth fisheries			
Bass Strait Central Zone Scallop Fishery	NA	Victorian Scallop Fisherman's Association (VSFA)	Steve Mellisakis
Southern and Eastern Scalefish and Shark Fishery	Commonwealth Trawl Fishery	SETFIA	REDACTED
	Shark Gillnet Hook and Trap	SETFIA and Southern Shark Industry Alliance (SSIA)	REDACTED
		Sustainable Shark Fishing Association (SSFA)	REDACTED
		LEFCOL	REDACTED
	Scalefish Hook	SETFIA	REDACTED
Southern Squid Jig Fishery	NA	No representative body	NA
Victorian fisheries			
Abalone Fishery	NA	Victorian Abalone Council	Sue Alcock
		Victorian Abalone Divers Association	Sean Buck
		Seafood Industry Victoria (SIV)	Johnathon Davey
Inshore Trawl Fishery	NA	SIV	Johnathon Davey
Ocean (General) Fishery	NA	SIV	Johnathon Davey
Purse seine (Ocean) Fishery	NA	SIV	Johnathon Davey
Rock Lobster Fishery	NA	Victorian Rock Lobster Association	Marcus Nolle
		Southern Rock Lobster Limited	Tim Cosentino
		SIV	Johnathon Davey
	Eastern Zone	EastRock	REDACTED
Scallop (Ocean) Fishery	NA	Victorian Scallop Fishermen's Association	Steve Melissakis
		SIV	Johnathon Davey
Charter operators*	NA	VRFish	Mike Burgess
Recreational fishers	NA	VRFish	Mike Burgess

*Note that charter operators consulted generally also stated that they hold a commercial fishing licence of some kind.

9.7 Manage and respond to stakeholder feedback

9.7.1 Stakeholder feedback, assessment of merit and CGG response

The Relevant Stakeholders Consultation Report is provided in Appendix H. In accordance with Regulation 16(b)(i)-(iii) and NOPSEMA guidance, the Report includes a section covering relevant stakeholder feedback, CGG's assessment of merit and CGG's response. For each relevant stakeholder the following information is provided:

- dates and methods of all consultation events with that stakeholder
- a summary of the key feedback received from that stakeholder for each event
- an assessment of the merits of any objections or claims raised for each event

- a statement of CGG's response, or proposed response, as a result of the consultation (where appropriate)
- an explanation of how the requirements for sufficient information and reasonable period were met for that stakeholder
- a summary of the arrangement for ongoing consultation with that stakeholder.

CGG adopted the following approach to assessing the merit of stakeholder feedback:

1. Identify if any objections or claims were raised.
2. Identify if any issues, concerns or requests were raised.
3. Assess whether the objection, claim, concern, etc was relevant to their functions, interests or activities.
4. For objections, claims, concerns, etc. that were relevant to their functions, interests or activities, identify if the stakeholder provided evidence to support their claims and to allow CGG to assess and address their claims.
5. Determine any actions (for CGG) to respond to the feedback, and to address and resolve claims where possible (e.g. provide additional information, review the impact assessment in the EP to ensure the claim is adequately addressed, identify if additional control measures are required, etc.).

CGG carried out the identified actions and responded to the stakeholder's objections, claims, concerns, etc. in writing, noting any changes that CGG subsequently made in response to their feedback.

9.7.2 Resolving objections and claims

Many relevant stakeholders raised similar objections and claims during consultation to date. The objections and claims that have been raised are generally the same as those raised for other seismic activities in the area (e.g. CarbonNet and Spectrum). Therefore, CGG is confident that all of the key relevant issues have been identified and that CGG's response is adequate.

A summary of the most common objections and claims raised by relevant stakeholders, and CGG's responses is provided in Table 9.3.

Table 9.3 Common objections and claims raised by relevant stakeholders

Stakeholder objection or claim	CGG response
Fisheries associations, fishing companies and fishers	
Number of seismic surveys conducted within the area and potential cumulative impacts on catch	CGG informed fishers that they reprocessed the existing seismic data in the basin and identified a number of issues that prevent a more accurate and high-resolution set of maps being produced. CGG explained that conducting the proposed activity over the entire area and using methods that obtain more accurate and higher-resolution data will reduce the need for future surveys and associated cumulative impacts.
Displacement of fishers from the area	CGG confirmed with fishing stakeholders that there will be no ban on fishing within the survey area during the activity. CGG advised that there would be an exclusion zone around the survey vessel when acquiring survey data that will apply to any vessels. Fishing stakeholders were also informed that the survey vessels will only occupy a small part of the survey area at any one time, and the rest of the area would be available for fishing operations. In response to stakeholder feedback, CGG made the following changes/adopted the following control measures to minimise impacts on fishing operations: • reduced the Operational Area and the Acquisition Area to reduce overlap with an important nearshore scallop bed and fishing habitat targeted by Danish seine fishers

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Stakeholder objection or claim	CGG response
	• divided the Operational Area and the Acquisition Area into zones within which the seismic vessel will operate for no longer than one month, allowing fishers to plan their operations ahead depending on where the vessel will be • changed the timing of the survey to occur from January to the end of July to alleviate concerns over the potential impacts on the operations of charter fishers and seafood suppliers during the Christmas holiday period. Note that this change was also adopted to reduce impacts to humpback whales transiting through the area in November and December. The order in which zones are completed will be determined following analysis of commercial catch and effort data (as advised by the SAC; Section 9.4.3). • adopted several communications measures to ensure that marine users are aware of the location of the survey vessel on a monthly, weekly and daily basis, to enable fishers to plan their activities and reduce disruption to their operations. These changes were communicated to stakeholders in the third formal stakeholder consultation letter sent in November 2018.
Impacts of seismic sound on fisheries species resulting in reduced catch	CGG informed stakeholders that the potential environmental impacts and risks associated with the Gippsland MSS have been assessed, including the impacts of seismic noise on fisheries species. CGG explained that underwater sound modelling had been used to predict the area over which impacts to fisheries species could occur and included the area along the borders of the survey area where sound would extend beyond that area. It was also noted that the impact assessment considered the spawning periods for commercial species (minimising activity during peak spawning periods and reducing activity near known spawning areas to reduce impacts to these species). A stakeholder consultation letter with details on the noise impact assessment and the control measures adopted was provided to all relevant fishing stakeholders. In response to stakeholder feedback, CGG made the following changes/adopted the following control measures to minimise impacts on fishing operations: • reducing the power setting of the airguns to <150 in^3 (compared to 3000 in^3) over South East Reef • implementing a buffer area of 500 m around South East Reef • seismic activity over South East Reef will be completed during March-April when sensitivity during spawning for commercially important species is at its lowest • there will be no undershooting of the four existing platforms over or in the vicinity of South East Reef, i.e. Fortescue, Halibut A, Cobia A and Mackerel A • adjacent sail (survey) lines will not be shot during the main survey over a period of <24 hours to allow recovery of fish species. The undershoot areas may need lines to be acquired closer than 24 hours but only a very small area will be affected by this. These changes were communicated to stakeholders in the second formal stakeholder consultation letter sent in September 2018 and in the third formal consultation letter sent in November 2018.
Impact of reduced catch on income and the viability of fishing related businesses	CGG responded to concerns related to the potential financial or social impacts that reduced catch rates could have in a similar manner to the rows above. CGG explained how (a) sound impacts on commercial species and (b) displacement of fishers from their fishing grounds, had been impact assessed, what the impact assessment was based on and the control measures adopted to reduce the impacts to ALARP. The changes made in response to stakeholder feedback, that were communicated to stakeholders are those summarised above. An additional control measure that CGG adopted was to replace fishing gear or equipment that was damaged as a direct result of the Gippsland MSS. To further progress consultation in this area, CGG has tasked the Scientific Advisory Committee with discussing compensation issues to identify any further arrangements that could be implemented to mitigate the impacts of the survey on fishing catch rates and the potential socioeconomic effects of that.
Uncertainty on the impacts of seismic sound on fish	CGG acknowledged to stakeholders that there are gaps in the scientific understanding of how underwater sound affects marine life, including commercially fished species. CGG acknowledged CarbonNet's efforts in funding research to help address gaps in understanding, and stated that the findings of that study would be assessed when they are released publicly. Stakeholders were also made aware that since the CarbonNet initiative, the Bruce et al (2018) research has been released which supports CGG's assessment of likely impacts to fish and fisheries in the Gippsland Basin area. CGG also noted (to stakeholders) that all available literature on the impacts of seismic surveys on fisheries has been reviewed and the environmental impact assessment has taken this into account.

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Stakeholder objection or claim	CGG response
	Where there is scientific uncertainty in the assessment, whether it be in relation to modelling, effect thresholds, species sensitivities or occurrence and behaviour, CGG adopted a conservative approach. A stakeholder consultation letter with details on the noise impact assessment and the control measures adopted was provided to all relevant fishing stakeholders. In response to stakeholder feedback on scientific uncertainty, CGG set up the Scientific Advisory Committee to provide advice on scientific matters and to oversee the monitoring programs that CGG is proposing and consulting with fishers on.
Dissatisfaction with the consultation undertaken	In response to feedback that stakeholders were not satisfied with the consultation process, CGG continually apologised, thanked stakeholders for their feedback, affirmed CGG's commitment to undertaking meaningful consultation and encouraged further feedback or requests for information. Each stakeholder consultation letter sent to stakeholders reiterated CGG's commitment to consultation process and included contact details via which concerns could be raised. CGG also made the following adjustments to the consultation approach in response to such feedback: • clarifying consultation preferences with individuals (e.g. did they want information direct from CGG or via an industry body? What was their preferred contact method?) • proposing and testing different methods of contact with stakeholders (e.g. sending text messages to fishers who may be offshore and unable to respond to emails and phone calls, posting public notices – which LEFCOL advised against) • holding further face-to-face meetings (e.g. with fishers) • setting up a Scientific Advisory Committee comprised of scientists, fishing representatives and CGG members.
Industry operators	
SIMOPs planning and communications	In response to SIMOPs concerns, CGG responded to industry operators that: • it will provide operators with ongoing updates on the proposed activity. • it will participate in SIMOPs workshops with relevant operators, to identify and mitigate SIMOPs issues and hazards, agree communications protocols, operating zones and buffer distances, etc. • it will develop a SIMOPs Plan for the Gippsland MSS to implement the commitments made in SIMOPs workshops.

9.8 Ongoing consultation

9.8.1 Process for ongoing consultation

CGG's consultation process will continue for duration of the activity and be undertaken in accordance with the process summarised in Figure 9 2. A list of relevant stakeholders will be maintained and updated to add new persons or remove those who are no longer considered relevant (e.g. if their functions, interests or activities change). The process of determining if new stakeholders are relevant or not will follow the parameters outlined in Section 9.5.

If the activity needs to continue in 2020, then CGG will undertake a full review of relevant stakeholders and ensure they are consulted and notified prior to mobilisation. Relevant stakeholders will be consulted on an ongoing basis. CGG will continue to meet the requirements for providing sufficient information to relevant stakeholders and a reasonable period to respond.

If new objections or claims are raised either prior to or during the activity, CGG will assess the merit of the objection or claim and respond, following the approach in Section 9.7. If their objections or claims indicate a new or increased environmental impact or risk, an assessment of the significance of the new or increased risk will be undertaken in accordance with the Management of Change process outlined in the Implementation Strategy. Where deemed necessary, CGG will adopt additional control measures to ensure impacts and risks remain ALARP and acceptable.

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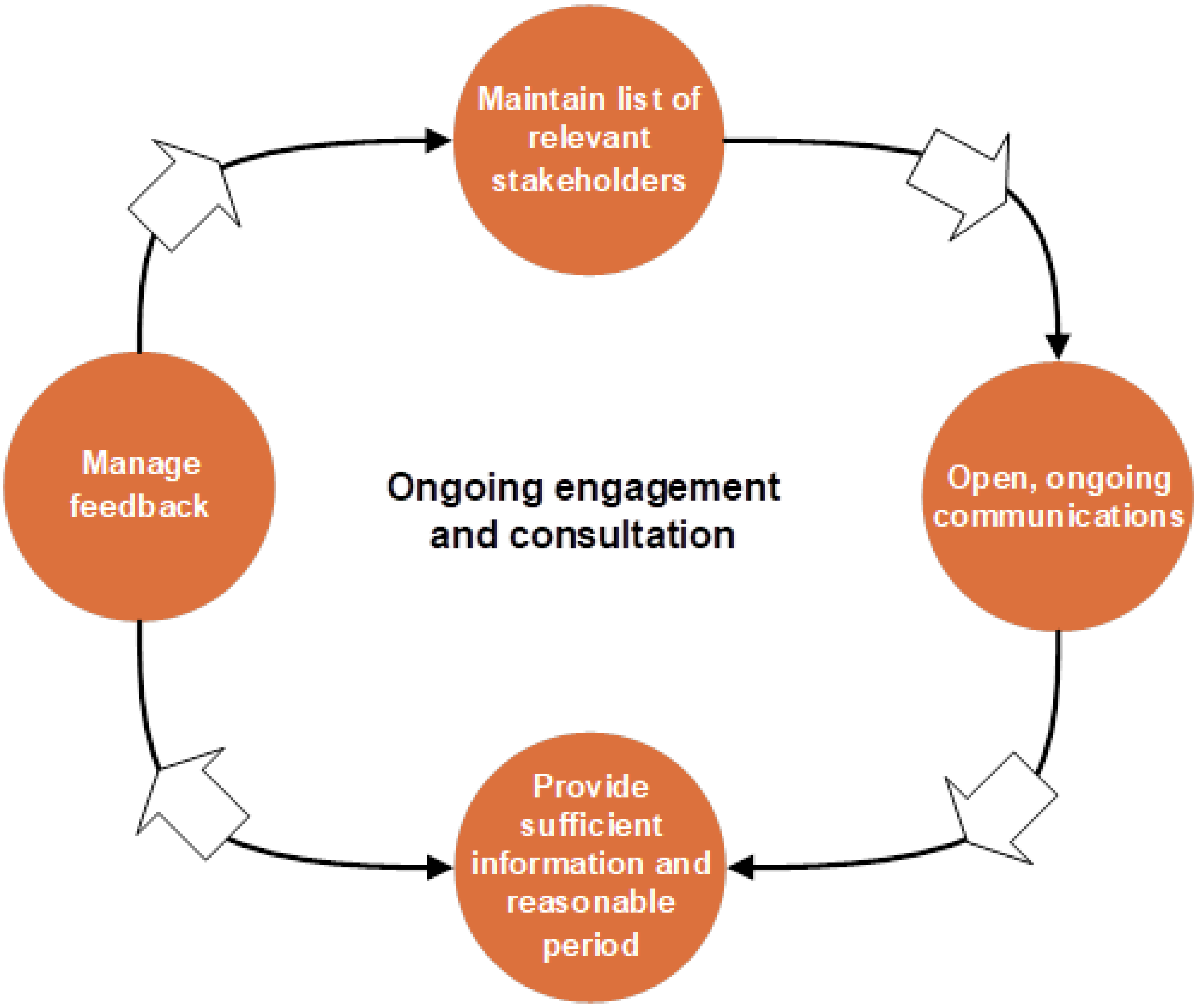

Figure 9.2 Process of ongoing consultation with stakeholders

9.8.2 Stakeholder notifications

As part of ongoing consultation CGG will notify relevant stakeholders in accordance with the schedule in Section 8.0 (Implementation Strategy). In the event of an oil spill, depending on the location, AMSA or the relevant state agencies or port authorities will be the Control Agency and responsible for communications with external parties. Communications between CGG and these organisations is covered in Section 8.0.

Specific arrangements for notifying fishers will be confirmed prior to the one month pre-survey reminder notice described in Section 8.8.4., and be based on advice from the Scientific Advisory Committee. It is likely that there will be greater industry involvement in this process to ensure complete coverage within strict time frames.

9.9 Stakeholder engagement and consultation process

CGG conducted stakeholder engagement and consultation according to the process summarised in Figure 9 1 and described in the sections that follow. The ongoing consultation process is covered in Section 9.8.

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10 References

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Appendix A

CGG environment and HSE policies

Care+Protect

HSE Policy

CGG is committed to optimizing the discovery and development of natural resources while operating safely and with integrity as detailed in our Business Code of Conduct. Economic considerations are not allowed to have an adverse impact on our people, assets, the environment and communities. CGG recognizes that all incidents are preventable and strives for zero harm so as to serve the needs of current and future generations.

Health, Safety, Security, Environment and Social Responsibility (HSE) principles are integrated in our risk management, business planning and processes. Our passion for innovation combined with our culture of continual improvement in HSE increases our competitive advantage.

Scope

This policy applies to all CGG employees and contractors under prevailing influence.

Compliance

A longstanding member of the United Nations Global Compact, CGG recognizes all underlying international ILO conventions and laws, and complies with all applicable national and industry HSE regulations.

We contribute to advancing industry standards and seek to apply best practices.

HSE Principles

CGG provides a healthy, safe and environmentally-friendly workplace and promotes the awareness of workplace hazards.

We protect our employees, contractors and assets against criminal, hostile or malicious acts.

We regularly monitor our employees health program and promote wellness.

We are committed to promoting a working environment that is free from illicit substances and tobacco use.

We apply ecodesign principles and mitigation to prevent and remediate harmful effects on the environment.

We respect and promote human rights, maintain mutually beneficial relationships with local communities and develop local content where practicable.

Leadership, Commitment & Responsibilities

The commitment and cooperation of all employees and contractors is essential, including the right and obligation to stop work and intervene. Willful breach of the *Rules to Live By* will not be tolerated.

Line management is responsible for implementing this policy in full compliance, setting relevant HSE objectives and ensuring resources are in place to achieve those.

HSE-OMS

CGG Health, Safety, Security, Environment and Social Responsibility Operating Management System (HSE-OMS) provides a framework for a company-wide integrated approach to Risk and Opportunity Management.

We conduct risk assessments for each site, product under development and acquisition project and implement controls to reduce the risks to as low as reasonably practicable.

We analyze incidents and potential incidents so as to prevent recurrence with a focus on high risk activities. Opportunities for improvement are assessed and implemented as appropriate.

We ensure the competency of our employees through HSE training programs.

Line management regularly reviews HSE risk controls, rewards performance and demonstrates continual improvement.

"PRISM" is the CGG IT application which supports the implementation of our HSE-OMS.

Stakeholders

CGG selects partners and contractors acknowledging our HSE principles and supports them in fulfilling their responsibilities.

We openly engage and dialogue on HSE with our main stakeholders and publicly disclose our performance.

Paris, April 2018

Sophie ZURQUIYAH
Chief Executive Officer

Appendix B
EPBC PMST report

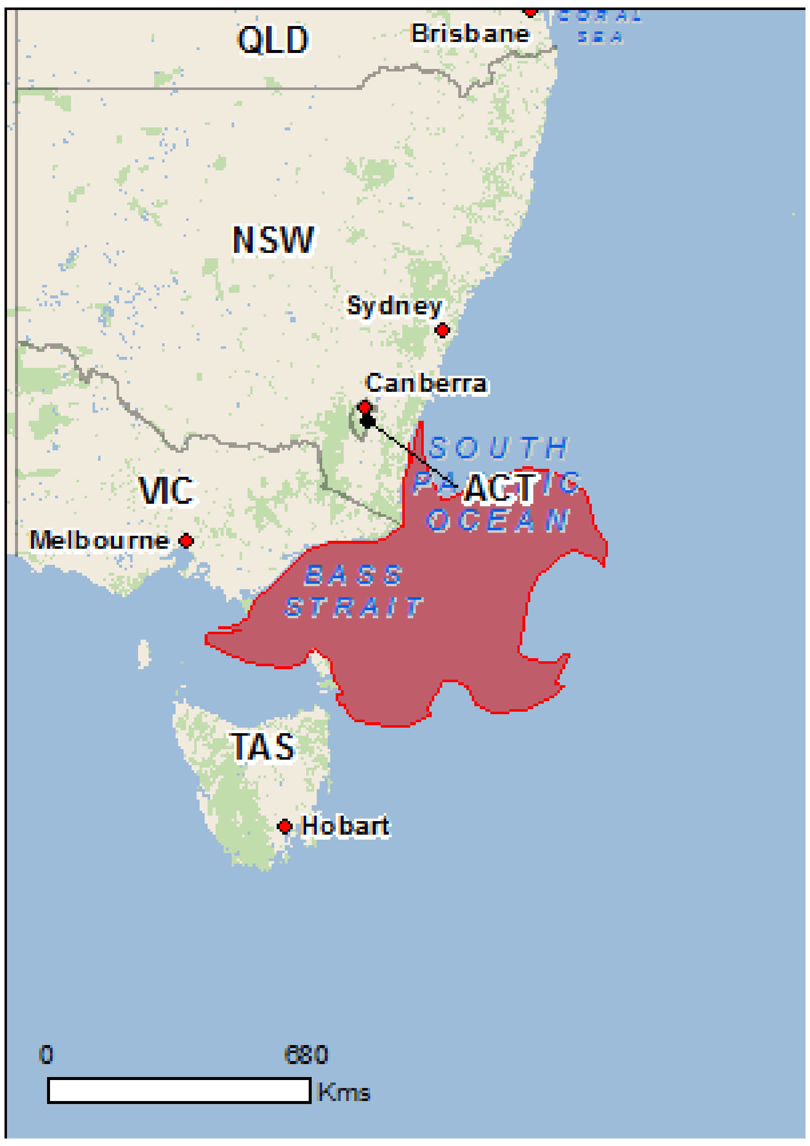
Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

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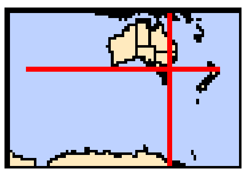

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	9
Listed Threatened Species:	109
Listed Migratory Species:	80

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	3
Listed Marine Species:	124
Whales and Other Cetaceans:	33
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	4

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	44
Regional Forest Agreements:	5
Invasive Species:	57
Nationally Important Wetlands:	8
Key Ecological Features (Marine)	4

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Corner inlet	Within Ramsar site
East coast cape barren island lagoons	Within Ramsar site
Gippsland lakes	Within Ramsar site
Logan lagoon	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area
Gippsland Red Gum (Eucalyptus tereticornis subsp. mediana) Grassy Woodland and Associated Native Grassland	Critically Endangered	Community likely to occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community may occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community likely to occur within area
Lowland Native Grasslands of Tasmania	Critically Endangered	Community likely to occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pardalotus quadragintus Forty-spotted Pardalote [418]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Crustaceans		
Engaeus martigener		
Furneaux Burrowing Crayfish [67220]	Endangered	Species or species habitat may occur within area
Fish		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Galaxiella pusilla		
Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat likely to occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Thymichthys politus		
Red Handfish [83756]	Critically Endangered	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Antechinus minimus maritimus		
Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous longipes Long-footed Potoroo [217]	Endangered	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Vombatus ursinus ursinus Common Wombat (Bass Strait) [66644]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Acacia caerulescens Limestone Blue Wattle, Buchan Blue, Buchan Blue Wattle [21883]	Vulnerable	Species or species habitat may occur within area
Acacia constablei Narrabarba Wattle [10798]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Acacia georgensis Bega Wattle [9848]	Vulnerable	Species or species habitat known to occur within area
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area
Astrotricha crassifolia Thick-leaf Star-hair [10352]	Vulnerable	Species or species habitat may occur within area
Caladenia caudata Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat likely to occur within area
Caladenia orientalis Eastern Spider Orchid [83410]	Endangered	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat known to occur within area
Commersonia prostrata Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area
Correa baeuerlenii Chef's Cap [17007]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat may occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Pomaderris parrisiae Parris' Pomaderris [22119]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat likely to occur within area
Thelymitra jonesii Sky-blue Sun-orchid [76352]	Endangered	Species or species habitat may occur within area
Thelymitra matthewsii Spiral Sun-orchid [4168]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area
Zieria tuberculata Warty Zieria [56736]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Breeding known to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Manta birostris		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Telstra Corporation Limited

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Gabo Island Lighthouse	VIC	Listed place
Montague Island Lighthouse	NSW	Listed place
Wilsons Promontory Lighthouse	VIC	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Morus serrator Australasian Gannet [1020]		Breeding known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Pelecanoides urinatrix Common Diving-Petrel [1018]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Breeding known to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Cosmocampus howensis Lord Howe Pipefish [66208]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Breeding known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Name	Label
Beagle	Multiple Use Zone (IUCN VI)
East Gippsland	Multiple Use Zone (IUCN VI)
Flinders	Marine National Park Zone (IUCN II)

Name	Label
Flinders	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves
[Resource Information]

Name	State
Babel Island	TAS
Ben Boyd	NSW
Blyth Point	TAS
Cape Conran Coastal Park	VIC
Cape Howe	VIC
Cat Island	TAS
Cone Islet	TAS
Craggy Island	TAS
Croajingolong National Park	VIC
Curtis Island	TAS
Devils Tower	TAS
East Gippsland Coastal streams	VIC
East Moncoeur Island	TAS
Eurobodalla	NSW
Ewing Morass W.R	VIC
Foochow	TAS
Gippsland Lakes Coastal Park	VIC
Hogan Group	TAS
Jacksons Cove	TAS
Lake Tyers	VIC
Logan Lagoon	TAS
Mimosa Rocks	NSW
Montague Island	NSW
Nadgee	NSW
North East Islet	TAS
North East River	TAS
Palana Beach	TAS
Patriarchs	TAS
Rame Head	VIC
Rodondo Island	TAS
Sandpatch	VIC
Seal Islands W.R.	VIC
Sellars Lagoon	TAS
Sentinel Island	TAS
Sister Islands	TAS
Southern Wilsons Promontory	VIC
Storehouse Island	TAS
Sugarloaf Rock	TAS
The Lakes National Park	VIC
West Moncoeur Island	TAS
Wilsons Promontory	VIC
Wilsons Promontory Islands	VIC
Wilsons Promontory National Park	VIC
Wingaroo	TAS

Regional Forest Agreements
[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
East Gippsland RFA	Victoria
Eden RFA	New South Wales
Gippsland RFA	Victoria
Southern RFA	New South Wales
Tasmania RFA	Tasmania

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Callipepla californica California Quail [59451]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Domestic Fowl [917]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Turdus philomelos Song Thrush [597]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area

Name	Status	Type of Presence
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Benedore River	VIC
Corner Inlet	VIC
Ewing's Marsh (Morass)	VIC
Lake King Wetlands	VIC
Nadgee Lake and tributary wetlands	NSW
Nargal Lake	NSW
Nelson Lagoon	NSW
Tuross River Estuary	NSW

Key Ecological Features (Marine)

[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Big Horseshoe Canyon	South-east
Upwelling East of Eden	South-east
Canyons on the eastern continental slope	Temperate east
Shelf rocky reefs	Temperate east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.787382 152.658991,-39.913898 152.801814,-39.989695 153.285212,-39.972859 153.55987,-39.821142 153.691706,-39.854886 153.867488,-40.073816 153.691706,-40.199803 153.570857,-40.350679 153.55987,-40.400896 153.691706,-40.609731 153.460993,-40.826229 152.779841,-40.87609 152.076716,-40.751367 151.692195,-40.434353 151.494441,-40.308803 151.153864,-40.308803 150.901179,-40.784649 150.582575,-40.934214 150.604548,-41.124832 150.132136,-41.124832 149.604792,-41.058593 149.319148,-41.008869 148.868708,-40.90931 148.769831,-40.743044 148.637995,-40.726394 148.495173,-40.576361 148.451228,-40.551323 148.550105,-40.417627 148.506159,-40.300424 148.352351,-40.073816 148.330378,-39.981277 148.297419,-39.804264 148.033747,-39.745158 147.912898,-39.82958 147.770075,-39.863319 147.737116,-39.90547 147.737116,-39.956018 147.72613,-40.006528 147.682185,-40.099032 147.330622,-40.031769 146.671443,-39.972859 146.363825,-39.880183 146.056208,-39.660633 145.408015,-39.576004 145.397029,-39.465832 145.429988,-39.45735 145.847468,-39.440383 146.023249,-39.431898 146.155085,-39.372473 145.836482,-39.304497 146.166072,-39.168347 146.363825,-39.100173 146.418757,-39.031933 146.473689,-38.886704 146.495661,-38.621109 146.913142,-37.948476 147.770075,-37.81841 148.286433,-37.80973 148.890681,-37.80973 149.308161,-37.748947 149.571833,-37.522743 149.923396,-37.496598 149.967341,-37.453004 149.989314,-37.094567 149.978327,-36.84001 149.989314,-36.681582 150.0003,-36.354896 150.12115,-36.026834 150.143122,-36.230927 150.176081,-35.706322 150.296931,-35.875643 150.296931,-35.563457 150.395808,-35.581329 150.439753,-35.83112 150.439753,-36.292936 150.472712,-36.690392 150.648493,-37.0332 150.890193,-37.02443 151.022029,-36.892747 151.351618,-36.434487 152.856745,-36.531654 153.55987,-36.857593 154.208064,-37.190901 154.317927,-37.557589 154.471736,-37.80105 154.702448,-37.965801 154.713435,-38.251069 154.658503,-38.12154 154.449763,-37.965801 153.966364,-38.112896 153.592829,-38.285572 153.329157,-38.406201 153.175349,-38.60394 153.02154,-38.801136 152.93365,-39.787382 152.658991,-39.787382 152.658991

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- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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RPS

Appendix C

Oil spill modelling report

REPORT

Gippsland Marine Seismic Survey

Oil Spill Risk Assessment

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Approved:

No.: MAW0698J
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Version	Purpose of Document	Approved by	Reviewed by	Review Date
A	Draft for internal review	B. Gomez	S. Langtry	30/6/2018
B	Draft for internal review		S. Langtry	1/8/2018
0	Draft for External review by RPS Env.		S. Langtry	10/8/2018
1	Revised to RPS Environment		S. Langtry	23/08/2018
2	Revised for aromatic thresholds		S. Langtry	30/08/2018

Approval for issue

Name	Signature	Date
S. Langtry		23/08/2018

Contents

Tables

Figures

RPS

Executive Summary

Background

CGG commissioned RPS to carry out quantitative oil spill modelling to assess potential risks of exposure to hydrocarbons if there was an accidental release during marine seismic survey operations. The information would also be used to assist development of the Environmental Plan (EP) and Oil Pollution Emergency Plan (OPEP). CGG is proposing to conduct the Gippsland three-dimensional (3D) marine seismic survey within Exploration Permit T/49P. Operations are planned to commence around November 2018 and continue to March 2019. The proposed area of operation is located approximately 13 km southeast of Gippsland Lakes Coastal Park, Victoria and 95 km north of Flinders Island, Tasmania, Australia.

Spill fate and trajectory modelling was conducted from an array of locations distributed randomly within the area of potential operations to assess the potential for exposure to surrounding waters and shorelines due to the release of fuel from the survey vessel. The assessment considered the total loss of fuel from the largest fuel tank on the proposed vessel (286 m^3).

The vessel would be powered by Marine Gas Oil, which is a blend of distillated hydrocarbons. The oil type assumed for the spill scenario was Marine Gas Oil (MGO), formulated to DMA specifications. Allowance was made for an initial discharge of 75% of the fuel tank volume within the first 20 minutes, and the remaining 25% over the next 40 minutes to represent a ruptured tank.

The vessel might survey anywhere within a section of Exploration Permit T/49P but would also move into buffer zones surrounding the designated survey area to carry out turns. On this basis, it was assumed for the study that accidental release could occur anywhere within the survey area or the buffer zones at equal probability. Hence, the risk assessment considered the potential outcomes of spills from anywhere within an area largher than the survey area to include the buffer areas.

To provide some differentiation of risks posed by the spill scenario resulting in release within different parts of this wider buffered area, risks were separately assessed for spills occurring anywhere within three sectors (Figure 1.1).

- inshore
- central
- shelf-slope

The general approach was to simulate the defined accident scenario occurring at 100 individual locations distributed randomly within each sector (300 individual simulations in total over the buffered area) to define the potential area that could be exposed to oil due to a spill from a given sector. Results of this modelling will reveal trends in the movement of oil, those locations that might be reached by oil before weathering and dispersing to defined concentrations, and how quickly oil may reach these locations.

The modelling does not take into consideration the likelihood of the spill scenario occurring in the first place or adjust for any spill mitigation or response capabilities that might be in place to reduce the volume of oil that enters the sea or affects the arrival of oil at surrounding locations.

Methodology

The outcomes of a spill, in terms of the trajectory, spread and weathering of spilled oil will be dependent upon the meteorological and ocean (metocean) conditions that prevail while the oil is in or on the sea. The environmental forces that will have the largest effect will be the prevailing current, wind, wind-generated waves and sea temperature. It is therefore necessary to account for trends and variability in these conditions surrounding spill sites. A five-year database of wind and current is available for the area, spanning the years 2008–2012, inclusive, from hind-casting carried out by linked meteorological and hydrodynamic models. These hind-casts make use of meteorological and ocean observations to improve accuracy and have proven to be suitably accurate.

Metocean forcing conditions for the study area were represented by a database of wind and current data representing temporal and spatial variations in conditions across the region spanning a 5-year period. Modelled data, which integrated measurements, is used in lieu of measurement alone because measurements are made at fixed locations and cannot represent spatial variation over the potential trajectories of oil spills.

Three hundred spill start times were then randomly selected from within the months over which the survey will be conducted (November to March) from years that occurred within the time span of the metocean dataset (2008-2012 inclusive). These start times were applied to isolate unique samples of metocean conditions to be applied to individual simulations (100 per sector, also applied randomly), spanning 2 weeks from the start time. This approach is intended to sample the natural distributions of wind and current conditions that occur over the area under study. Frequently occurring conditions should be selected more often by random selection than less usual conditions, to indicate trends. Less common conditions will also be captured, but at lower frequency, to identify variations around these trends.

The exposure footprints of all simulations were then overlayed to map the wider area that could be exposed to oil based on a set of exposure criteria.

Key Findings

Releases from the inshore Zone

- Relatively long and straight sheen trails could extend down-wind and current if the spill scenario occurs under moderate winds, particularly if the slicks enter ocean currents flowing in the same direction. Longest potential trajectories from this zone were calculated for releases towards the north-eastern where sheen could move eastward and up the south-east coast in the South Australian Current.
- The longest distance that concentrations of oil at the sea-surface could extend at > 25 g/m^2, presenting as sheen, was calculated as approximately 110 km. Considering lower concentrations sheens at > 10 g/m^2 the longest calculated distance is 130 km. Concentrations > 0.5 g/m2 were calculated to potentially extend up to 200 km.
- Remnant oil could drift onto the coastline of Victoria if spilled within the inshore zone, most likely arriving at concentrations < 25 g/m^2 after drifting and weathering for > 40 hours. Hence, this oil would present as sheens of partially weathered MGO.
- There is potential for accumulation of the weathered residues over time onto the shoreline of the Victorian and far-south coast of NSW. These residues are likely to be widely spread over distances of kms to 10s of km but highest local concentrations could potentially exceed 1 kg/m^2 of shoreline. Concentrations > 100 g/m^2 of shoreline could potentially be received at any part of the Victorian Coast, depending upon the release point. Shorelines of the islands around Wilsons Promontory and among the Hogan and Kent Island Groups, to the west of the survey area could also accumulate some residues if the spill scenario occurred in the south-west corner of the inshore zone.
- MGO is highly likely to entrain into the water column if released within the study area because sea conditions in the area will be frequently energetic and MGO has low viscosity. Entrained MGO would move and disperse downstream with the prevailing current and entrained oil plumes could contact or pass

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through some receptor areas in the region. Point Hicks on the eastern Gippsland coastline was the receptor area where exposure is more likely (about 30% chance at the lowest threshold of 10 ppb). The likelihood drops as higher thresholds are considered (2% at > 500 ppb for these locations).

- Some offshore receptor areas also have the potential for exposure at concentrations > 10 ppb. The probability will be larger for larger receptor areas and those closer to the survey area because that would increase the chance of plumes moving through part of these areas
- Aromatic hydrocarbons that dissolve from surface films and entrained plumes have a low probability of contacting the coastline and offshore receptors that are located within or adjacent to the survey area. Receptors are unlikely to receive exposure at > 400 ppb unless they are located close to and down-current from the release site. There is a low probability (up to~ 2%) that concentrations might exceed 100 ppb within any of the receptor areas.

Releases from the Central Zone

- Longest trajectories calculated for the Central Zone are towards the east from the north-eastern boundaries of the Central Zone, where the South Australian Current and East Australian Current could transport residues. Longest trajectories in this direction were calculated, at > 25 g/m^2, at 148 km but lower concentration sheens could travel further. Patches of residue could also drift around 100 km to the south-west of the survey are if the spilled occurred in this area to potentially contact the Kent Island Group.
- There is a low probability ($\leq$ 1 %) of surface concentrations exceeding the lower thresholds at the shoreline receptors but there is some potential for accumulation of residues on shorelines along the Victorian Coastline north of the survey area and at shorelines on the east side of Flinders Island.
- There is low probability that entrained or dissolved oil concentrations would arrive at coastline receptors at concentrations exceeding the thresholds if the release occurred within the Central Zone.

Releases from the offshore Zone

- Surface sheens could extend further distance from the Offshore Zone, which may be attributed to the stronger winds and increased effect of ocean currents over this part of the survey area. The longest distance that concentrations of oil at the sea-surface could extend at > 25 g/m^2 was calculated at 180 km and potential distances could extend to 240 km at > 0.5 g/m^2.
- Surface sheens have a reduced likelihood of reaching shorelines if the fuel spill scenario were to occur within the Offshore Zone. Highest probabilities are indicated at only 1-2% for low concentrations (> 0.5 ppb) at any shoreline receptor.
- Some of the larger offshore receptors (e.g. Australian Exclusive Economic Zone and foraging areas of some seabirds) have the potential for exposure by floating oil exceeding each of the thresholds, but at relatively low probability. Shortest times before any residual oil could reach any shorelines was calculated at 4-5 days, for locations along the eastern Gippsland coast and some of the small islands to the east of Flinders Island.
- Entrained diesel is also unlikely to reach shoreline receptors if the spill scenario were to occur in the offshore zone, but the potential is indicated for some of the larger offshore receptors including the upwelling area to the east of Eden (4% at > 500 ppb, 22% at > 10 ppb) and Big Horseshoe Canyon (4% at > 500 ppb, 17% at > 100 ppb).
- There is a low probability that dissolved hydrocarbons would enter any of the sensitive receptors at > 100 ppb, and only low probability of arriving at > 6 ppb in a few receptors (including the Australian Exclusive Economic Zone that encloses the zone).

1 Introduction

CGG commissioned RPS to carry out oil spill modelling to assess the potential for oil to travel to surrounding locations if a fuel spill occurred during marine seismic survey operations in the Gippsland Basin. The information will assist the development of the Environmental Plan (EP) and Oil Pollution Emergency Plan (OPEP). CGG is proposing to conduct the Gippsland three-dimensional (3D) marine seismic survey within Exploration Permit T/49P. Operations are predicted to commence between November 2018 and March 2019. The proposed area of operation is located approximately 13 km southeast of Gippsland Lakes Coastal Park, Victoria and 95 km north of Flinders Island, Tasmania, Australia (Figure 1.1).

Modelling was conducted to assess the potential effect area of a defined spill of Marine Gas Oil (MGO) with respect to surrounding waters and shorelines. The spill scenario considered was a spill volume of 286 m^3 released over 1 hour. To provide additional guidance, given the large area that might be a potential source, the operational area where the vessel would operate, including the survey area and surrounding buffer zones that the vessel may enter to turn (the operational domain), was subdivided into three zones (Figure 1.1):

- inshore sector
- central sector
- offshore sector

Subdivision of the zones was based on arbitrary boundaries.

The modelling study was carried out using modelling and analysis methods that meet and exceed the ASTM Standard F2067-13 "*Standard Practice for Development and Use of Oil Spill Models*". The modelling involved simulating 300 unique spils from locations scattered randomly within the operational domain, with 100 release locations assigned to each sector. Single simulations to calculate the trajectory and fate of the spilled MGO were completed from each location. Metocean conditions (wind and current sequences) were varied among the simulations to explore the range of potential outcomes. Sequences of wind and current were selected, at random, from a 5-year span of wind and current data for the study region.

The modelling was designed to understand trends in the movement of oil, in terms of the direction of travel and potential excursion distances before concentrations fall below defined thresholds and assumes no modifications due to spill response efforts.

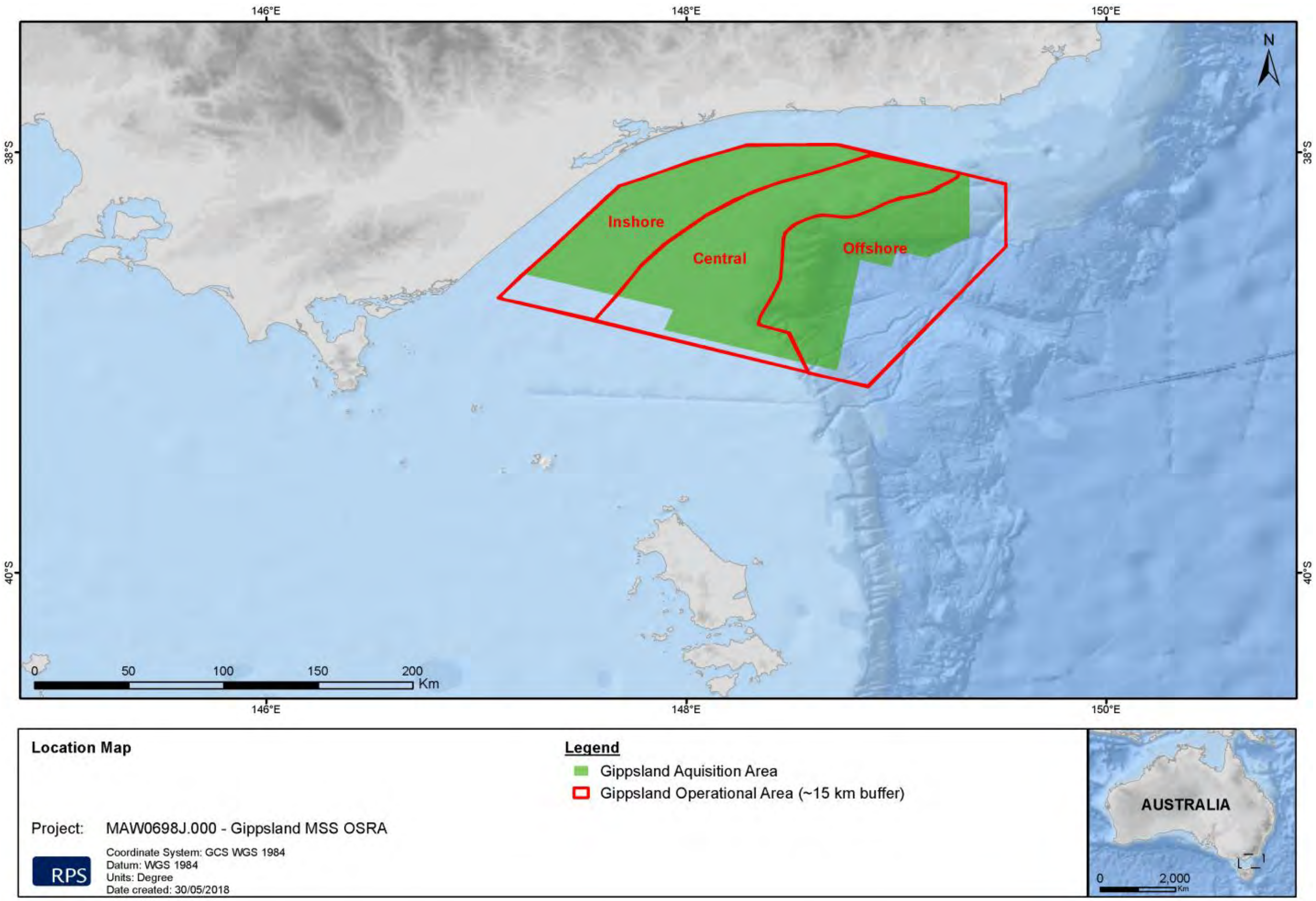

Figure 1.1 Location of the survey area (green polygon) and buffer zone (red outer margin) that the survey vessel may operate within during the Gippsland Marine Survey. The buffer zone is subdivided into the zones assessed separately in this study.

2 Definition of Metocean conditions

The movement and weathering behaviour of MGO spilled into the sea would vary depending on the wind and current conditions that prevail while the fuel is in the marine environment. The study area experiences wind and current conditions that vary from place to place and over time. Hence, different outcomes of the spill scenario can be expected depending on where and when the spill occurs.

2.1 Regional Currents

The Gippsland Basin lies within the eastern portion of Bass Strait, which is a sea strait separating Tasmania from the southern Australian mainland. The strait is a relatively shallow section of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. Bass Strait is subject to relatively strong winds and ocean currents (Jones, 1980). Currents within the straight are primarily driven by tides, winds and larger scale density-driven flows. Circulation patterns are complex due to interactions between large-scale ocean currents, local meteorology and the varied geography and bathymetry of the seafloor (Middleton and Bye, 2007).

Three important currents that influence the region and contribute to the oceanographic complexity are the Leeuwin Current, the South Australian Current, and the East Australian Current:

The Leeuwin Current originates from the tropical waters of the Indian Ocean and migrates down the Western Australian Coast along the continental shelf break. On passing around the southern extent of that coast the Leeuwin Current diverts eastward and becomes known as the South Australian Current, which moves dense, salty and relatively warm water into Bass Strait and down the west coast of Tasmania (Sandery and Kampf, 2007). The East Australian Current is a boundary current that originates in the Coral Sea and carries warm salty water southward down the east coast of Australia, forming meanders that can pass southward along the eastern boundary of Bass Strait. The eastward progression of the South Australian current tends to pass northwards, inshore of the East Australian Current.

The complex behaviour of the regional currents over the region would have a large effect on the transport of spilled fuel and must be represented in the modelling. Regional currents have been modelled at regional and global scales using models that assimilate satellite and instrument measurements. For this study, a hindcast of ocean circulation over the region spanning the years 2008-20012, inclusive, was derived from operation of the HYCOM global ocean model (Source: HYCOM Consortium). Current data represented variation in current flow at daily time steps and a spatial scale of ~7 km. An example of the ocean circulation patterns calculated for the region one day is shown in Figure 2.1.

2.2 Tidal Currents

The effect of tidal currents on water circulation will be largest over shallower inshore waters and weaker over deeper, offshore, waters. Because tidal flows describe elliptical pathways, and tides in the area undergo tidal reversals at about 12-hour intervals, the distance that tides will push spilled oil before the tide reverses will be limited to scales of kilometres. However, tidal flows add variation to the movement of pollutants such as oil, which will contribute to the spread of the oil. Variation in the path of spilled material may also be compounded by interaction with regional currents or the prevailing wind.

Circulation due to tidal flows over the study area were generated using a barotropic tidal model, HYDROMAP. HYDROMAP calculates the movement of water due to astronomical tides and the shape of the seafloor (Isaji and Spaulding, 1984; Isaji et al., 2001; Zigic et al., 2003). Forcing due to tidal waves is calculated from a grid of tidal constituent data derived from long-term satellite observations (Topex Poseidon). HYDROMAP employs a sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. This allows for efficient modelling of tidal currents over larger areas with highest resolution of tidal currents in the shallow tidal areas where tidal flows are more significant and more complex. HYDROMAP was used to set-up a domain that extended 700 km (east-west) by 570 km (north-south). The domain was subdivided horizontally into a grid with 4 levels of resolution. The resolution of the primary level, over the open ocean, was set at 8 km. The resolution then stepped to 4 km, 2 km, 1 km and 500 m towards any coastline. The finer grids were allocated in a step-wise fashion to more accurately resolve flows along the coastline, around islands and over more complex bathymetry. Tidal currents were calculated at hourly time steps.

Net current flow due to ocean currents and tidal currents was calculated at the variable spatial resolution of the tidal grid, at hourly time steps, through aggregation of the current vectors due to each source. An example of the aggregated current calculated for one, hourly, time step is shown in Figure 2.2.

2.3 Wind forcing

High resolution wind data was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR; see Saha et al., 2010). The CFSR wind model is a fully coupled, data-assimilative hind-cast model representing the interaction between the earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals.

The CFSR wind data for the years 2008–2012 (inclusive) was compiled across the model domain. shows an example of the wind field used as input into the oil spill model.

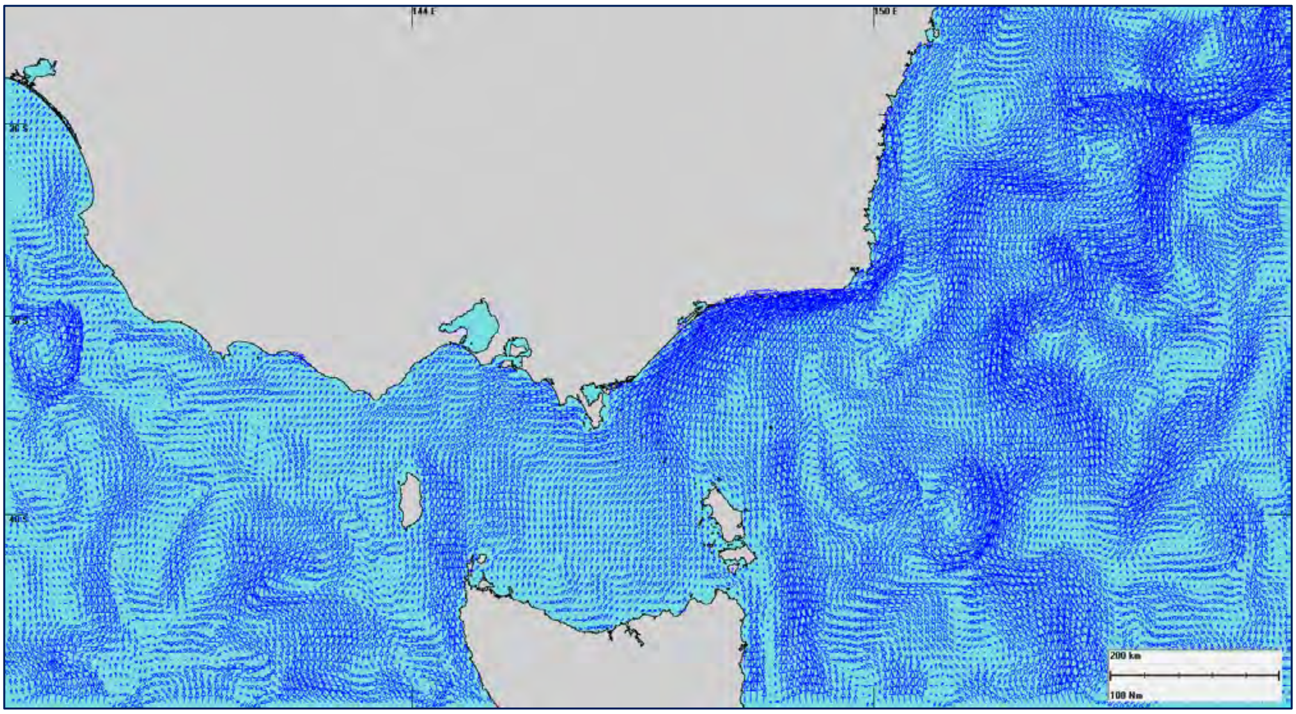

Figure 2.1 Example of the complexity of regional currents over the region, as calculated by the HYCOM ocean model for one point in time.

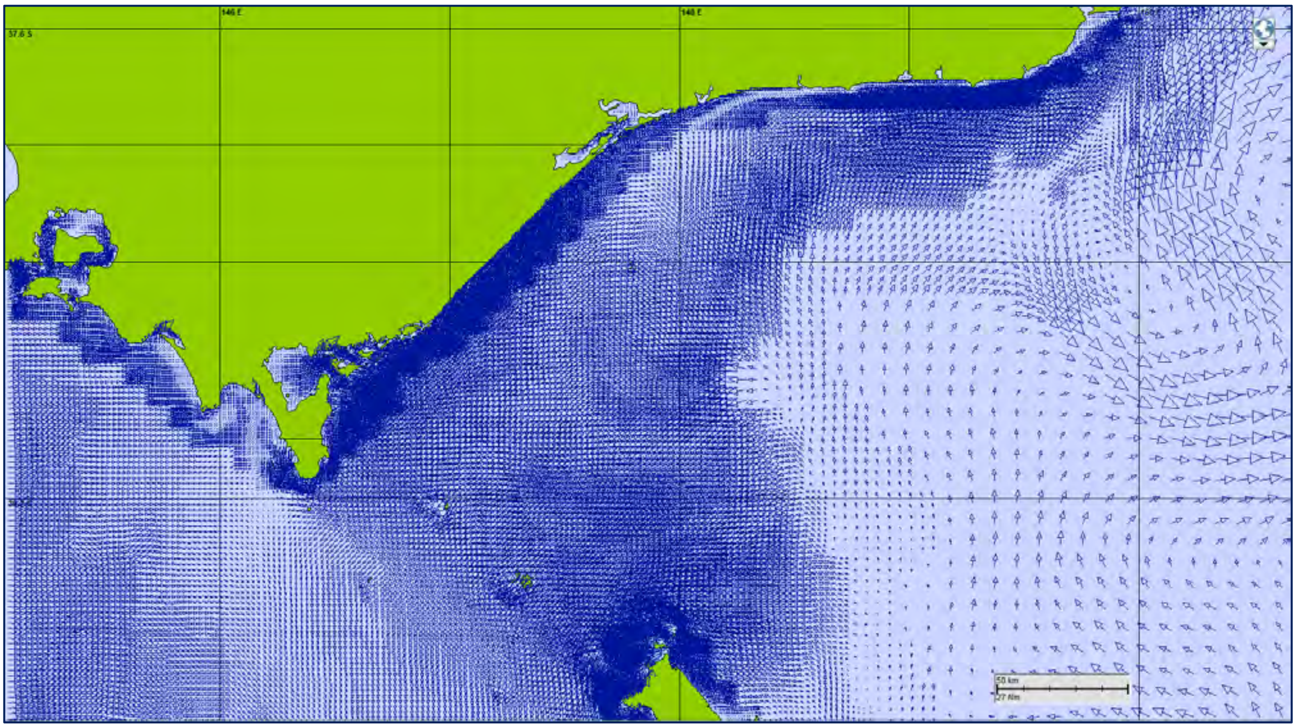

Figure 2.2 Example of the aggregated current at one time-step. Note that the density of the current vectors increases towards coastlines to account for the increased influence of tidal currents.

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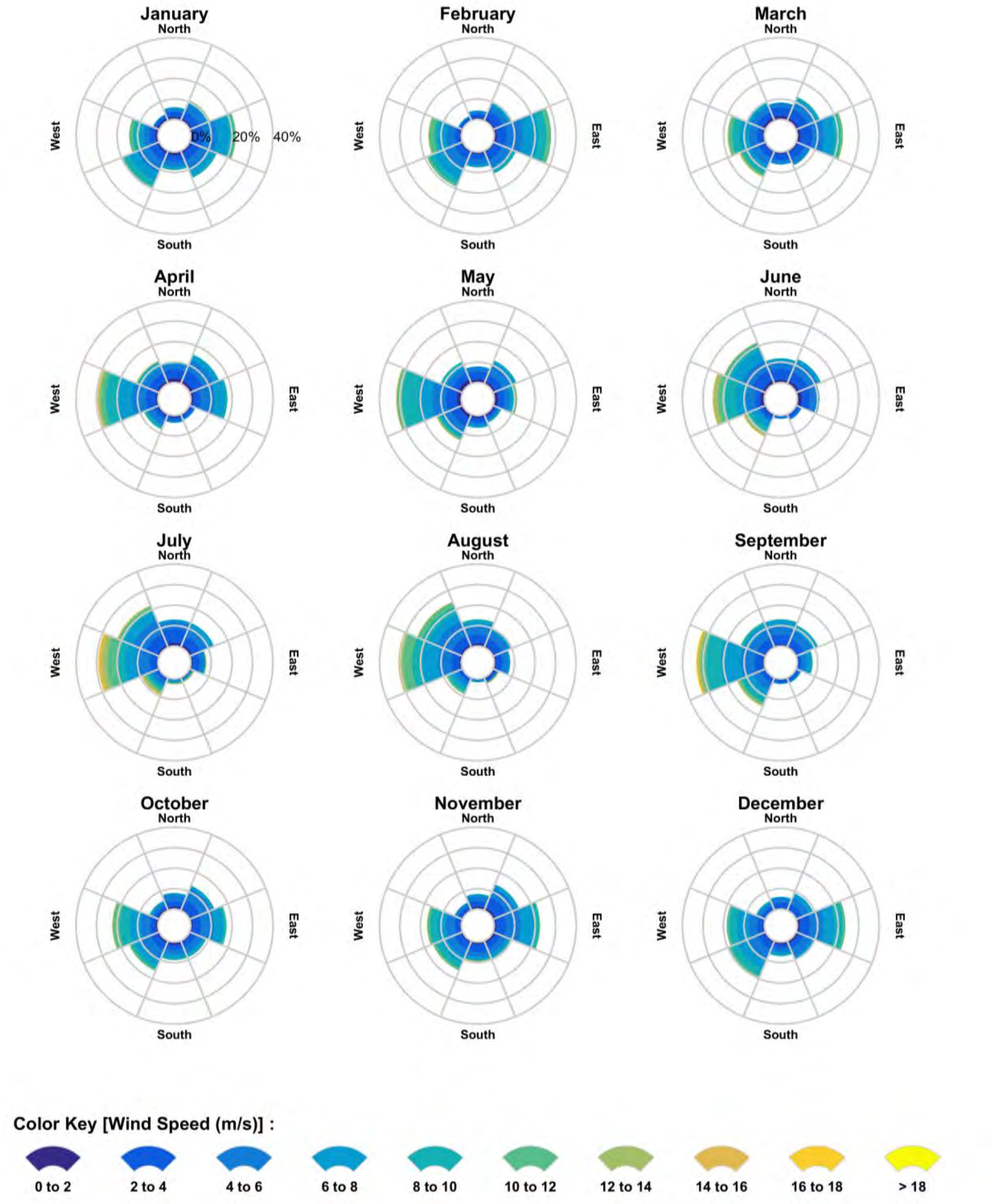

Figure 2.3 Modelled monthly wind rose distributions for the wind node at the near-shore edge central to the operational area (2008–2012 inclusive).The colour key shows the wind magnitude, the compass direction provides the direction FROM and the length of the wedge gives the percentage of the record for a particular speed and direction combination.

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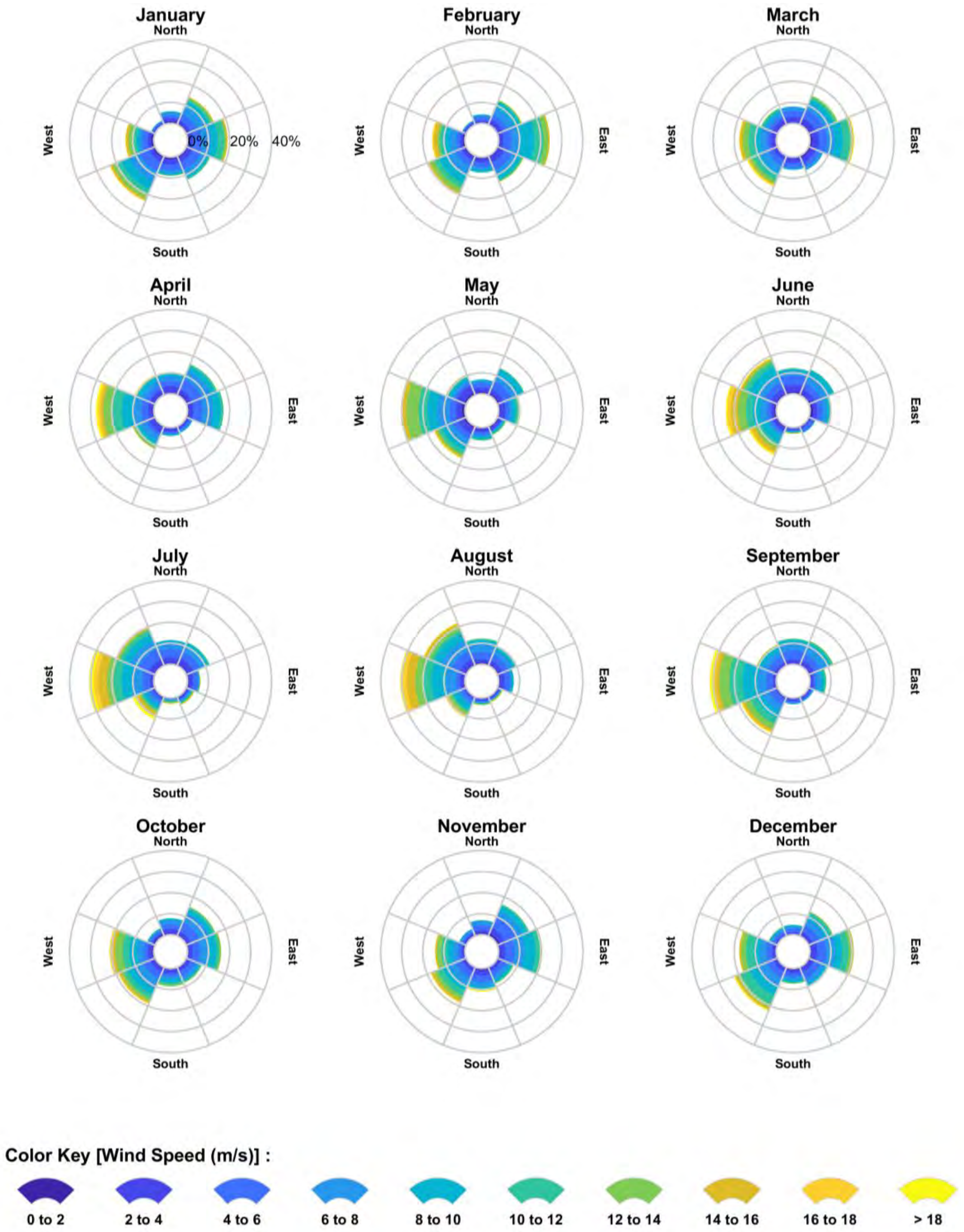

Figure 2.4 Modelled monthly wind rose distributions for the wind node at the centre of the operational area (2008–2012 inclusive).

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2.4 Water Temperature and Salinity

Sea-surface water temperature and salinity, according to the National Oceanographic Data Centre – World Ocean Atlas (www.metoc.gov.au), was found to be fairly consistent throughout the year, ranging between 13°C and 18°C, while salinity varied from 35.3 to 35.6 PSU.

These parameters were used as factors to inform the weathering, movement and evaporative loss of hydrocarbon spills in the surface and sub-surface thermo/halocline layers.

To account for depth-varying sea temperature and salinity, the modelling used monthly-averaged sea temperature and salinity profiles at 10 m depth intervals throughout the water column published by the World Ocean Database (NOAA). Table 2.1 presents the sea temperature and salinity of the surface layer (0-10 m) where entrained and dissolved hydrocarbons might occur if MGO is mixed into the water column from the water surface. This data indicates a similar temperature and salinity range to the water surface.

Table 2.1 Monthly average sea surface temperature and salinity at the release site.

Season	Inshore		Centre		Offshore	
	Sea-Surface Temperature (ºC)	**Salinity (PSU)**	**Sea-Surface Temperature (ºC)**	**Salinity (PSU)**	**Sea-Surface Temperature (ºC)**	**Salinity (PSU)**
January	17.3	35.5	18.3	35.5	19.4	35.5
February	17.8	35.3	18.7	35.4	20.0	35.5
March	18.7	35.7	19.5	35.7	20.3	35.7
April	18.0	35.6	18.8	35.6	18.8	35.6
May	15.7	35.4	17.6	35.4	17.6	35.5
June	15.0	35.5	16.4	35.5	16.4	35.5
July	12.9	35.4	14.1	35.5	15.0	35.5
August	13.3	35.6	13.8	35.5	14.4	35.5
September	13.2	35.5	13.8	35.5	14.1	35.4
October	14.6	35.6	15.0	35.5	15.1	35.5
November	15.5	35.5	16.1	35.5	16.6	35.5
December	16.4	35.4	17.1	35.4	17.6	35.5

3 Oil Spill Model - SIMAP

The oil spill modelling was performed using the Spill Impact Mapping and Planning (SIMAP) model. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for both the surface and subsurface releases (Spaulding et al., 1994; French et al., 1999; French-McCay, 2003; French-McCay, 2004; French-McCay et al., 2004; Spaulding, et al., 1994).

The SIMAP model calculates the transport, spreading, entrainment, evaporation, dissolution and decay of oil released into or onto the sea. Physical entrainment of oil from surface slicks is calculated based on calculation for wind waves as a product of the sustained wind speed and fetch. Dissolution of soluble hydrocarbons into the water column is calculated as the product of the solubility of aromatic components, concentration of the aromatic hydrocarbons in the source oil, the surface area available for dissolution and water temperature. Transport of floating oil is calculated for the prevailing wind and current. In contrast, transport of plumes of entrained oil and dissolved hydrocarbons are calculated for the prevailing current. Allowances are included in the transport calculations of transport for both components for dispersive forces and errors in the wind and current also with allowances for random errors and dispersion. The model calculates the unique transport and weathering behaviour of individual oil types. Input specifications for oil-types include the density, viscosity, pour point, distillation curve (volume lost versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges.

The SIMAP trajectory model separately reports the fate of the spilled oil over time, maintaining a dynamic balance of the mass as (i) oil floating on the water surface (as surface slicks), (ii) hydrocarbons that have evaporated from the slick (iii) oil physically-mixed (entrained) into the water column (iv) aromatic hydrocarbons dissolved in the water column (iv) slick oil that has stranded on shorelines and (vi) oil that has precipitated out of the water column onto the seabed due through attaining negative buoyancy through weathering or adhesion of suspended sediments.

3.1 Modelling approach

The operational area is large and spans a number of oceanographic and wind zones. Hence the wider study area was subdivided into 3 sectors for individual assessment.

As spills can occur during any set of wind and current conditions, wind and current sequences were randomly selected for use in each simulation from each location. This was achieved by randomly selecting 300 unique spill start-times falling within the months over which the survey will be conducted (November to March) from any of the 5 years spanning 2008-20012 (i.e. the time span of the metocean data). The sequence of wind and current data that followed these start time were randomly allocated to each of the 300 simulations, 100 per sector.

Each simulation had the same spill information (i.e. spill volume, duration and oil type) and only varied by the sequence of wind and current that was applied.

During each spill trajectory, the model calculates the movement and spread of oil due to the prevailing metocean conditions as well as the weathering behaviour of the unique oil type, also in response to these conditions. A record is made of the grid cells exposed to hydrocarbons, the time elapsed before exposure occurs and the concentrations of oil involved. Calculations are made, separately, for the exposure of any cell by hydrocarbons that are floating, entrained or dissolved.

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3.2 Oil Properties

The physical and chemical nature of the oil is an important factor that will affect the outcomes of a spill, because it will affect the rate of evaporation and whether oil will have a propensity to physically disperse into the water column (entrain), take up water (emulsify) or persist as solidified residuals.

The oil type assumed for the spill scenario was Marine Gas Oil (MGO), formulated to DMA specifications. MGO blends are manufactured by blending hydrocarbons recovered from distillation of crude oils. They are formulated to contain a proportion of lighter, short-chain hydrocarbons with low ignition points and longer-chain hydrocarbons with higher energy density. MGOs are physically and chemically similar to diesel fuels used for road vehicles and stationary engines but have a marginally higher density due to a raised proportion of longer-chained hydrocarbons. Unlike heavier marine fuel oils, MGO blends do not contain a high proportion of persistent hydrocarbons recovered as residuals of distillation and usually do not require heating to lower their viscosity. Hence, will remain viscous year-round at the sea temperatures in Bass Strait.

MGO specifications are defined by ISO 8217 standard to grades DMX, DMA, DMB, DMC and DMZ. DMA and DMZ are the highest quality MGO blends that are typically used in Australia and are similarly formulated except that DMZ specification allows for higher viscosity.

DMA specified MGO has a density of 829 kg/m^3 (API of 37.6), a low pour point (-14°C) and low dynamic viscosity (4.0 cP at 25°C), which indicates that this oil will spread quickly when spillede at sea and will thin out to a film; which would increase the initial rate of evaporation. However, only around 40% of the spilled volume will evaporate within the first day and about 55% of the volume may persist for over a week on the surface under calm conditions. Approximately, 5% (by mass) of the oil will not evaporate over the longer term (several weeks) but a further 40% will resist evaporation for 1-3 weeks and thus can contribute to the exposures opportunities considered over the time-scale that is the subject of this assessment. MGOs are categorised as a Group 2, non-persistent oil according to the International Tanker Owners Pollution Federation (ITOPF, 2014). However, it should be noted that the persistence categorisation considers much longer time scales (months) than relevant to spill exposure considered in this study.

Due to their low viscosity, MGO blends will mix (entrain) into the upper water column as suspended droplets in the presence of moderate winds and breaking waves, which can commence under winds exceeding around 10 knots on the open sea. These droplets will disperse into the upper part of the water column, held in suspension by wave action, and can mix down to 10's of metres over time. Due to their lower buoyancy, the entrained droplets can also re-float to the surface if conditions subsequently calm for long enough for the droplets to float upwards.

Table 3.1 Physical characteristics assumed for the oil type.

Characteristic	*Marine Gas Oil (MDA blend)*
Density (kg/m^3)	*829 @ 25˚C*
API	*37.6*
Dynamic viscosity (cP)	*4 @ 25°C*
Pour Point (ºC)	*-14*
Oil Property Category	*Group 2*

Table 3.2: Boiling point ranges

Characteristic	Volatiles (%)	Semi-volatiles (%)	Low volatiles (%)	Residual (%)
Boiling point (˚C)	<180	180 – 265	265 – 380	>380
Marine Gas Oil (MDA)	6.0	34.6	54.4	5
	Non-persistent			*Persistent*

3.3 Data analysis

Once all the spill trajectories were completed, the collective set of exposure records were statistically analysed to calculate a series of exposure statistics:

- Maximum exposure (or load) observed on the sea surface;
- Minimum time before sea surface exposure;
- Potential for contact to shorelines;
- Probability of contact to individual sections of shorelines;
- Maximum volume of oil that may contact shorelines from a single simulation;
- Maximum load that an individual shoreline may experience;
- Maximum exposure from entrained hydrocarbons observed in the water column; and
- Maximum exposure from dissolved aromatic hydrocarbons observed in the water column.

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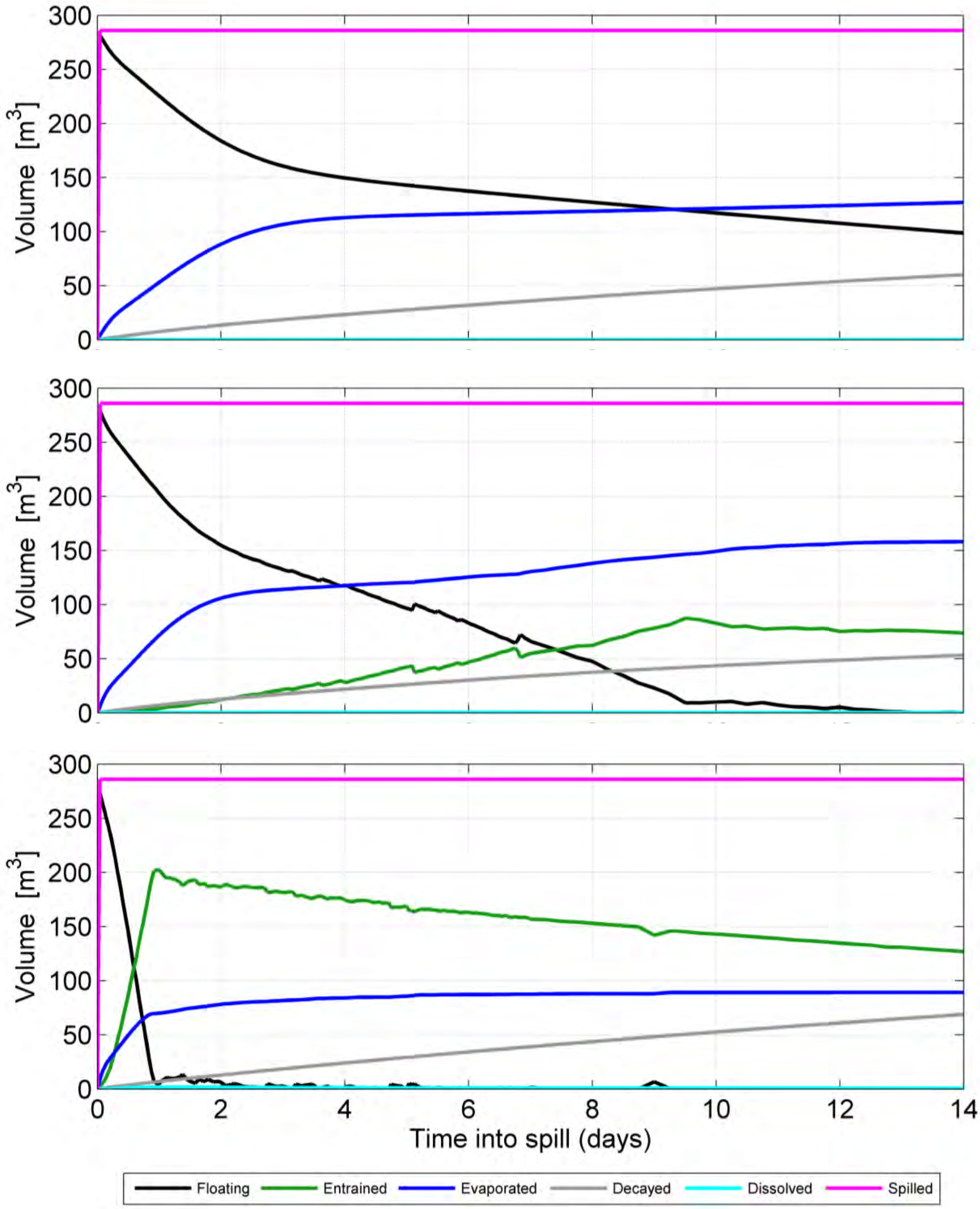

Figure 3.1 Weathering and fates graph, as a function of volume, under 5, 10 and 15 knot static wind conditions. Results are based on a short-term release of 286 m^3 of MDO (weathering calculated for 14 days).

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3.4 Thresholds of exposure

To undertake analysis for exposure it is necessary to define one or more threshold concentrations that define when exposure will be counted, accounting for the potential for effect of the oil at the threshold concentrations. These thresholds need to serve consideration of a wide definition of effect. Multiple thresholds were used as a guide to the gradation of possible effects.

It should be noted when applying this analysis to consideration of effect and consequence that spills typically result in patchy distributions of floating oil and that the model calculated average concentrations over areas of 1600 m^2, which would smooth out local patches with higher and lower local concentration.

3.4.1 Instantaneous exposure thresholds for the sea surface

Exposure thresholds for oil floating at the water surface were calculated as an aerial average over 400 m x 400 m grid cells at 0.5, 10 and 25 g/m^2.

The lower threshold is based on the lower level of visibility of the oil on the water surface. MGO would appear as a rainbow sheen at this concentration (Table 3.4).

Ecological impact to seabirds has been estimated to occur at concentration as low as 10 g/m^2 (~10 µm) according to French et al. (1996) and French-McCay (2009). MGO would appear as a metallic sheen at this concentration. Scholten et al. (1996) and Koops et al. (2004) indicated that a concentration of surface oil equal to 25 g/m^2 or greater would be harmful for all birds that contact the slick.

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Table 3.3 Thresholds used to classify the zones of sea surface exposure

Oil concentration (g/m^2)	Zone description
0.5 - 10	Low
10 - 25	Moderate
> 25	High

Table 3.4 The Bonn Agreement Oil Appearance Code

Code	Description Appearance	Layer Thickness Interval (g/m^2 or µm)	Litres per km^2
1	*Sheen (silvery/grey)*	0.04 – 0.30	40 – 300
2	*Rainbow*	0.30 – 5.0	300 – 5,000
3	*Metallic*	5.0 – 50	5,000 – 50,000
4	*Discontinuous True Oil Colour*	50 – 200	50,000 – 200,000
5	*Continuous True Oil Colour*	200 –>	200,000 –>

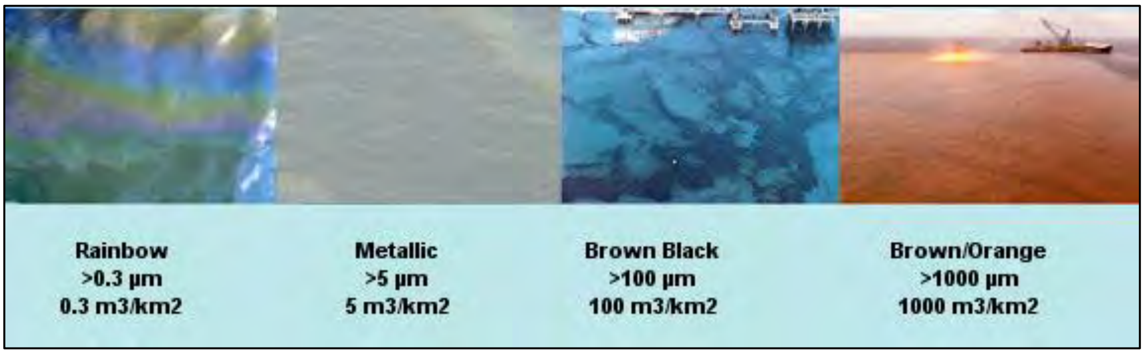

Figure 3.2 Photographs showing the difference between oil colour and thickness on the sea surface (source: adapted from OilSpillSolutions.org 2015).

3.4.2 Instantaneous exposure thresholds for oil in the water

Sub-surface exposure to organisms in the water column or submerged habitats might occur from oil that becomes entrained in the water column, or from soluble hydrocarbons that dissolve from the oil slick or entrained droplets. Studies indicate different routes of exposure and effects for entrained oil and dissolved hydrocarbons.

The route of exposure to soluble hydrocarbons is through absorption into the cells and body tissues of exposed organisms. Toxicity occurs through an additive narcotic effect. Over short durations, toxicity will increase with exposure to increased concentrations. Exponentially lower concentrations are required for the same effect over longer exposures extending to about 4 days (96 hours).

Mono-aromatic hydrocarbons and the two and three ring poly-aromatic hydrocarbons are commonly the largest (but not the only) contributor to the toxicity of solutions generated by mixing oil into water (Di Toro et al., 2007). French et al. (1999) and French-McCay (2002, 2003), reviewed toxicity assessments for the concentrations of dissolved aromatic hydrocarbons that caused acute toxicity (i.e. LC_{50} thresholds) to marine fish and invertebrates species, based on different exposure periods and argued that an additive model provided the best predictor of toxicity effect from soluble aromatic hydrocarbons due to the highly variable exposure patterns that will result from oil spills.

The route of exposure of organisms to whole oil alone (excluding soluble compounds) include physico/chemical effects on contacted tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC 2005).

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons are present. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds. Evaporative weathering will reduce the concentrations of the more soluble shorter-chained soluble compounds, including mono-aromatic hydrocarbons, from slick oil over time so that weathered oil can give up less soluble compounds. Dissolution of soluble hydrocarbons from entrained oil will also reduce the proportion of soluble compounds available for dissolution. Because weathered oil may still be subject to entrainment after soluble compounds have dissolved, entrained oil distributions may extend beyond the area affected by dissolved hydrocarbons. This weathered and water-washed oil will tend to be enriched in the proportion of higher-weight, non-water soluble, PAH compounds with 4 rings or more and other potentially harmful compounds so cannot be judged as innocuous (NRC 2005, Fingas 2011).

The overlap of the effect areas calculated for dissolved and entrained oil should be considered for consequence analysis. These areas could be affected by mixtures of entrained and dissolved hydrocarbons.

3.4.2.1 Instantaneous thresholds for dissolved hydrocarbons

Assessment was made for instantaneous concentrations of dissolved aromatic hydrocarbons in the water column at 6, 50 and 400 parts per billion (ppb = ug/l). Locations were flagged if these concentrations were recorded at any time (judged at 1 hourly time-steps) during a simulation. These thresholds are indicative of increasing potential effects, commencing with potential for tainting of the flesh of commercial fish species and ranging through behavioural effects, reduced survival and direct lethal effects for some species.

The lower threshold may be useful for consideration of effects such as water quality changes, sub-lethal behavioural changes or economic effects on other users of the waterway, such as commercial fisheries. French et al. (1999) and French-McCay (2002, 2003) presented a compilation of toxicity data and argued that dissolved aromatic hydrocarbons as low as 6 ppb could exert lethal effects to the most sensitive life stages of the most sensitive species exposure, but only with relatively long exposure periods (96 hours). However, sublethal effects on some marine species might occur at this concentration with shorter exposure.

The ANZECC water quality guidelines sets a concentration of 50 ppb for the soluble polyaromatic hydrocarbon Naphthalene as a trigger level for investigation of effects if detected in marine waters. This trigger concentration was recommended for protection of 99% of species.

The higher concentration of 400 ppb was chosen as an order of magnitude higher, indicating locations with higher potential for effects over the short term. A wide range of sensitivities have been reported for marine species and outcomes will be dependent on exposure patterns and the types of hydrocarbons that are present. Hence it is not possible to define a definitive lower limit at which biological effects will definitely occur or not occur. For example, NRC (2005) reviewed available toxicity data for exposure of life stages of marine molluscs, crustaceans, cnidarians and fish to the water accommodated fractions of different oils and reported large variation in concentrations that caused lethal effect. The lowest concentration reported to cause lethal effects was 510 ppb (octopus hatchling mortality) with 24 hours of exposure and 390 ppb with 48 hours of exposure. Other studies reported one or two orders of magnitude higher. Gringley et. al (2013) presented evidence that 620 ppb of the water-accommodated fraction (the soluble portion of oil) released from the Deepwater Horizon spill reduced the settlement and survival of corals if exposure was longer than 24 hours. Negri (2016) exposed coral larvae to the soluble extract of condensates, contributed principally by monoaromatic and aromatic hydrocarbons, and demonstrated reduction in settlement success by 10% at 103 ppb and 50% at 339 ppb.

Table 3.5 Dissolved aromatic threshold values applied as part of the modelling study

Trigger level for dissolved aromatic concentrations (ppb)	Potential level of exposure
6	Low
50	Moderate
400	High

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3.4.2.2 Instantaneous thresholds for entrained hydrocarbons

Thresholds set for short term (1 hour) exposure to entrained oil were 10, 100 and 500 ppb. These thresholds were applied to the distributions of whole oil droplets suspended in seawater, not any soluble components that may be present, which are assessed separately via the thresholds for soluble components.

Information to judge the significance of short-term exposure to different concentrations of entrained oil droplets, on their own, is poorly described in the scientific literature. Review of studies that present toxicity data for dispersed oil (e.g. NRC 2005) reveals that they have exposed organisms to mixtures of both soluble hydrocarbons and entrained oil components in the "water-accommodated fraction" (WAF), achieved by agitating a sample of unweathered oil in seawater. Hence, any toxic effects will be confounded by the dominant effect of the soluble hydrocarbons. Exposure times applied to these studies also range 24-168 hours so that they are unreliable indicators for the exposure durations that could have occurred from the spill scenario assessed in this study.

The most directly relevant information on the effects of entrained oil alone is presented in the Natural Resource Damage Assessment Database, compiled by NOAA, from research following the Deepwater Horizon Blowout (https://www.diver.orr.noaa.gov/web/guest/dwh-toxicity-studies). This includes results of toxicity tests for lethal and sublethal effects on marine organisms of dispersed oil generated from oil that had been artificially weathered to reduce soluble components, but soluble PAH fractions still remained in these test exposures.

Observable increases in abnormalities in oyster embryo exposed to the WAF generated from weathered oil were observed from 70 ppb of the non-soluble PAH frac, with 24 hours exposure. The effect concentration for 20% of the test population (EC_{20}) was 100 ppb, whereas 500 ppb was sufficient to result in 100% abnormality. In other tests, oyster embryo exhibited reduced shell development commencing at 30 ppb. The effect concentration for 10% of the test population (EC_{10}) was 90 ppb. Maximum reduction was noted by 500 ppb. Mortality to Yellowfin Tuna embryo was observable from 10 ppb, with 36 hours of exposure, the concentration lethal to 10%of the test population (LC_{10}) was 100 ppb and 500 ppb was lethal to 50% of the test population (LC50).

Note that these tests all involved protracted exposure (24-36 hours). The adoption of concentrations of similar order for assessment over 1 hour of exposure should be conservative.

Note that locations where exposure to both dissolved and entrained oil is calculated would have the potential for combined effects to be exerted.

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Table 3.6 Entrained hydrocarbon threshold values applied as part of the modelling study

Trigger level for entrained hydrocarbon concentrations (ppb)	Potential level of exposure
10	Low
100	Moderate
500	High

3.4.3 Shoreline Thresholds

When floating oil strands on shorelines, local concentrations (i.e. mass per area) of oil will increase above concentrations at the adjacent water surface simply because the same mass of oil will now occupy over a smaller area. Shorelines may also accumulate oil over time, with this oil arriving at different times. It is therefore possible for oil to arrive at shorelines at concentrations lower than the lower water surface threshold (i.e. below 0.5 g/m^2 surface concentration) and build up over time if the rate of arrival of oil exceeds the rate of weathering or release of oil from the shoreline.

Exposure to shorelines was assessed in two ways:

Firstly, the assessment considered if oil could contact shoreline locations at oil-on-water concentrations exceeding the thresholds of 10, 100 or 1000 g/m^2. These were applied as instantaneous thresholds i.e. if they occurred at any time during a simulation, the location would be flagged as exposed at the relevant threshold even if the oil concentration later reduces below threshold through weathering or refloating.

To account for potential spatial errors in the calculation of oil movement, if oil was calculated to come close enough to shorelines to pass into a buffer zone extending 2 km from a shoreline, at concentrations exceeding the thresholds, that shoreline was treated as exposed.

Secondly, calculation was made of the mass of oil that accumulated onto shoreline locations over the full duration of each simulation. These values were then applied to calculate the accumulated concentration (volume per unit area) at the grid scale (i.e. 400 m grids) as well as the total volume along the shoreline of individual shoreline receptors. Shoreline receptors were represented by multiple contiguous grid cells and the total volume calculated for all grid cells were summed. These calculations were not compared to any thresholds and are presented to assist estimation of the scale of impact as well as requirements for clean-up.

As a guide to the significance of oil concentrations on shorelines, French et al. (1996) and French-McCay (2009) have defined an oil exposure threshold of concern for shorebirds and wildlife (aquatic mammals and marine reptiles) on or along the shore at 100 g/m^2, based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004; French-McCay et al., 2011; NOAA, 2013). The threshold of 100 g/m^2 is also recommended in the Australian Maritime Safety Authority's (AMSA) foreshore assessment guide[1] as the acceptable minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone (AMSA, 2007). Observations by Lin and Mendelssohn (1996), demonstrated that loadings of more than 1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (Grant et al., 1993; Suprayogi and Murray, 1999). Oil concentrations on shorelines exceeding 10 g/m^2 might be visible and could result in a social or economic impact for other users.

Table 3.7 Thresholds used to assess shoreline contact (instantaneous)

Shoreline concentration (g/m^2)	Zone description
10–100	Low
100-1,000	Moderate
> 1,000	High

3.5 Sensitive receptors

Exposure potential was assessed for defined geographic areas, referred to as Sensitive Receptors. Sensitive Receptors defined subsections of the coastline, shorelines of islands, state waters, economic zones, marine parks, sanctuary zones, habitat protection zones, foraging areas and other sensitive areas. Geographic bounds followed specifications from the Australian Department of Environment and Victorian Oil Spill Response Atlas.

The geographic bounds of the receptors used to differentiate exposure risks are illustrated in Figure 3.3 to Figure 3.6.

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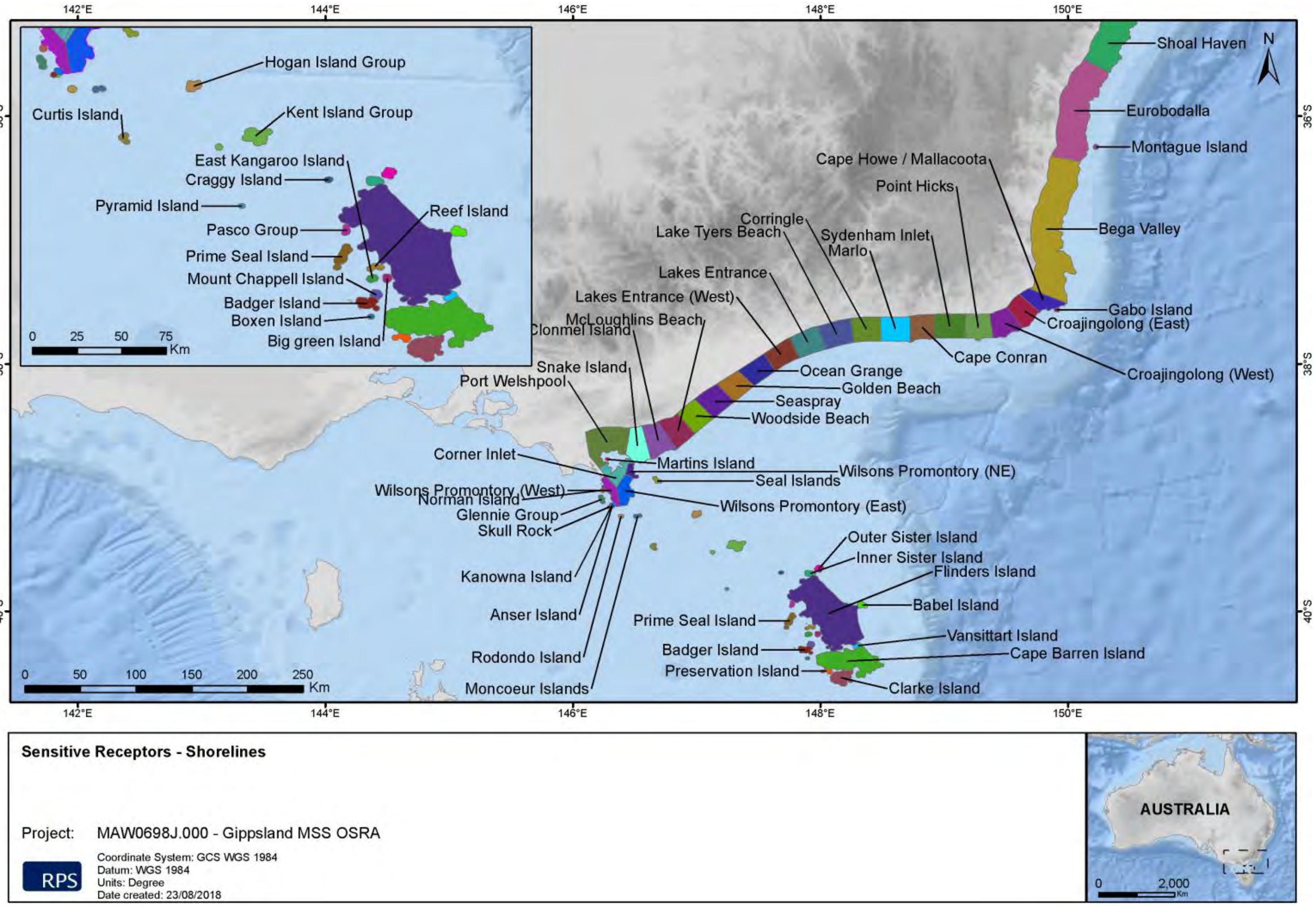

Figure 3.3 Subdivision of shorelines used to define shoreline receptors

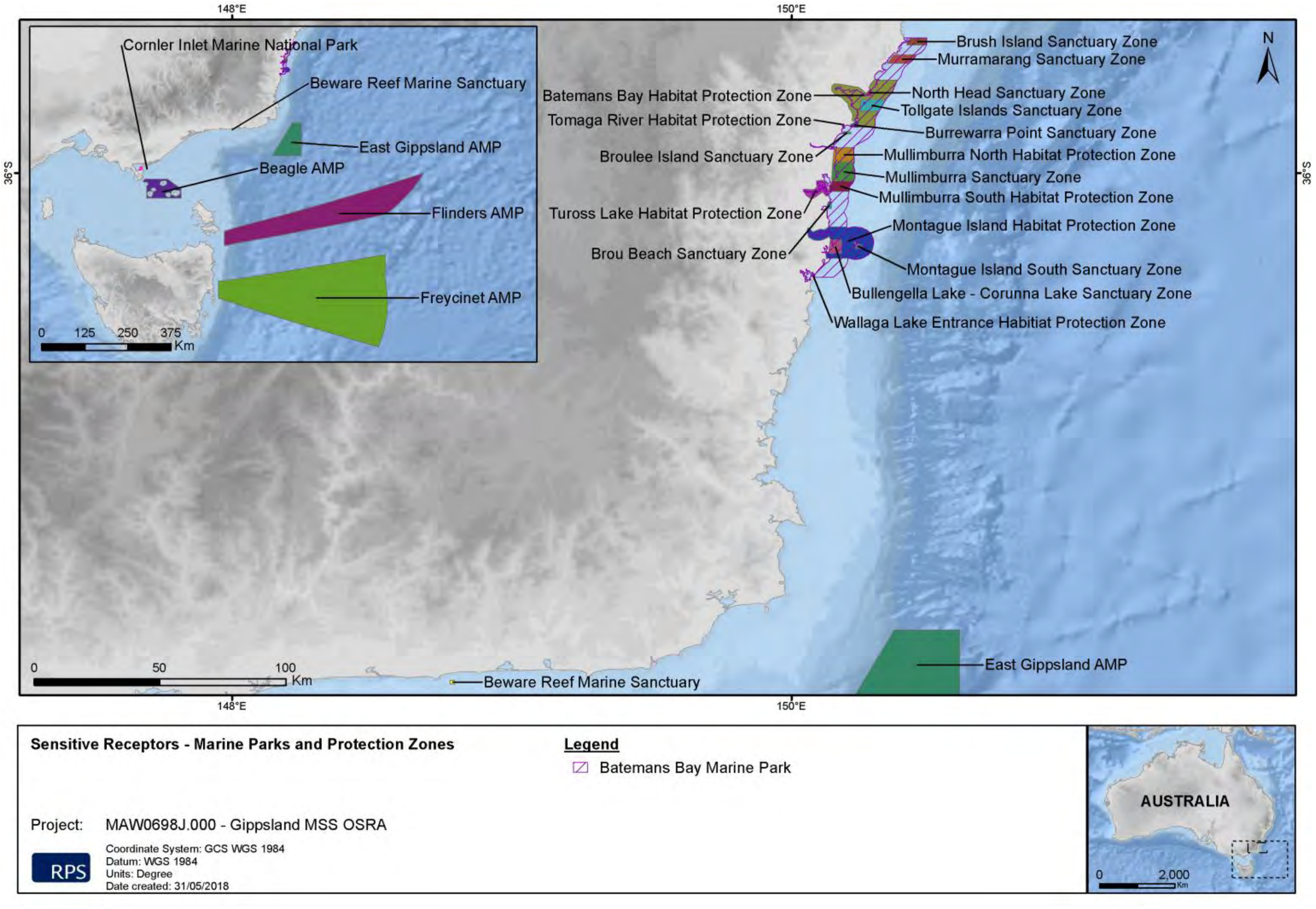

Figure 3.4 Marine Parks and protection zones defined as sensitive receptors.

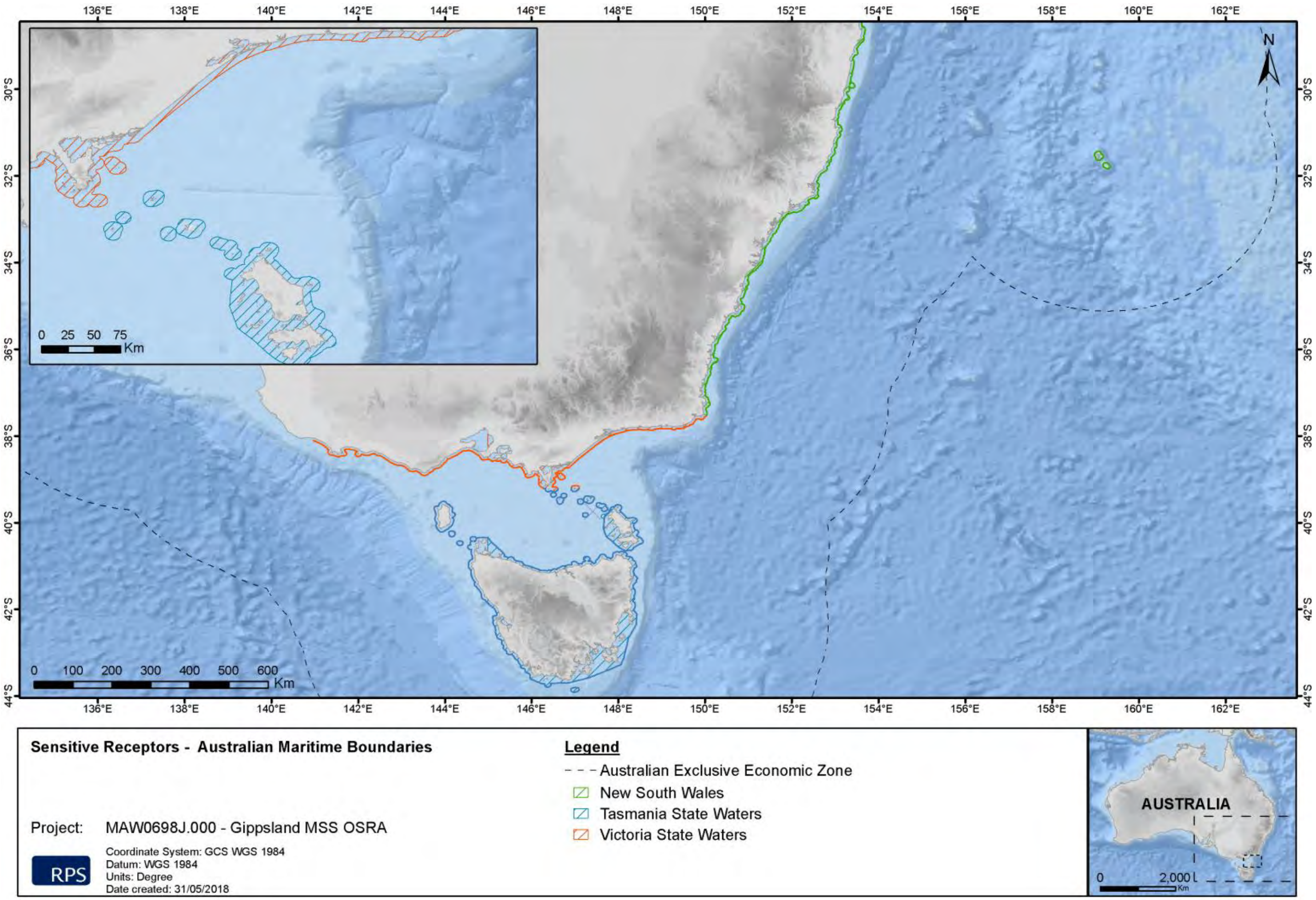

Figure 3.5 State Waters and Economic zones defined as sensitive receptors.

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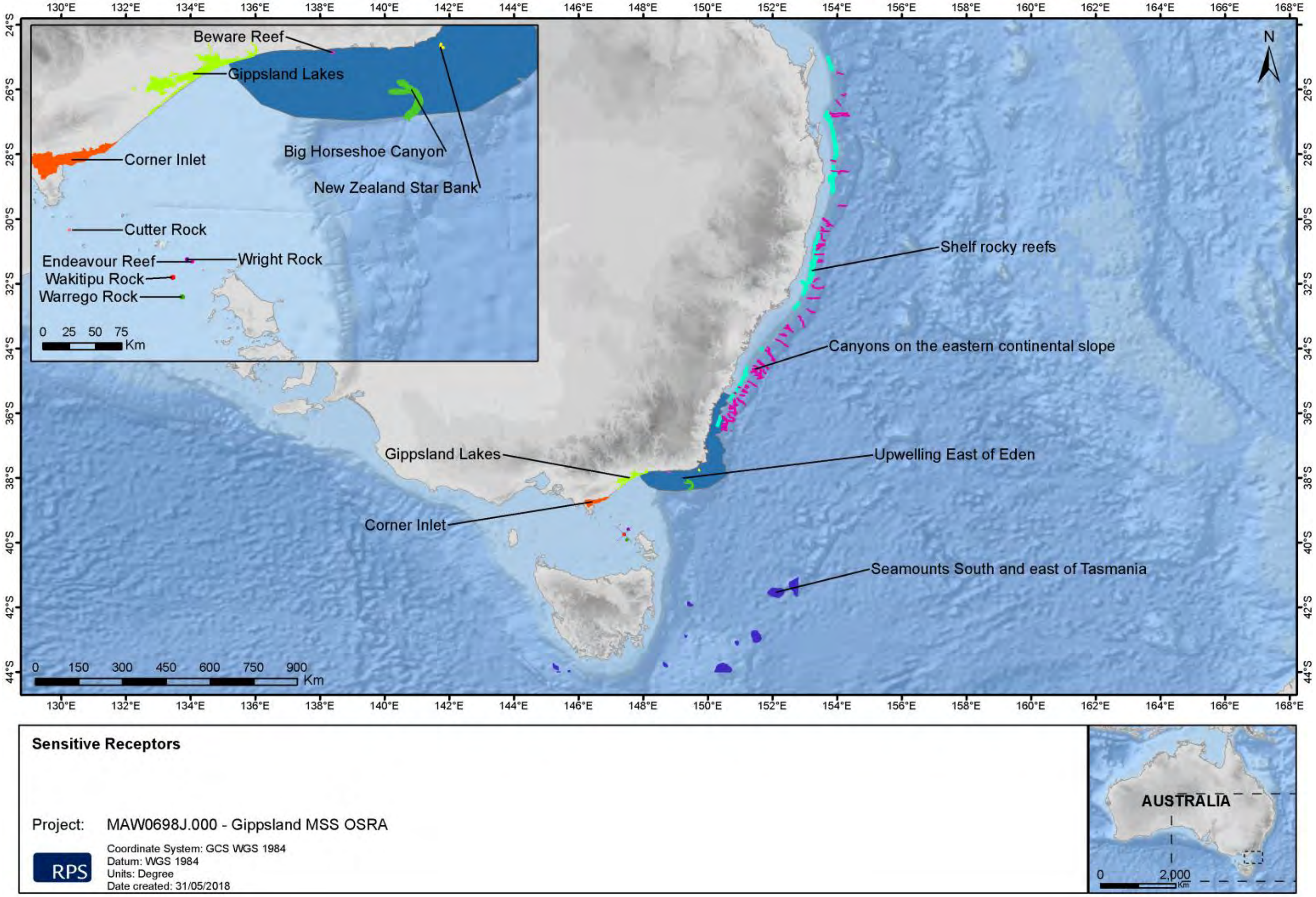

Figure 3.6 Other sensitive receptors.

4 Interpreting Modelling Results

The results from the modelling study are presented in tables and figures, which aim to provide an understanding of both the predicted sea surface exposure, shoreline contact and in-water exposure for the scenario.

Exposure contour maps are based on the following calculations derived from the multiple simulations:

- **The potential zones of exposure (surface oil, shoreline oil, entrained hydrocarbons and dissolved aromatics)** – is determined by comparing the concentrations calculated at each hourly time-step, within each grid cell, to the defined thresholds. Any cell in which the concentration exceeds a threshold is classified as "over-exposed" at that threshold. The collection of grid cells that are classified as over-exposed at any time, in any simulation, defines the area where there is the potential for over-exposure, given variations in possible environmental conditions that might occur. It is important to understand that this zone does not represent the area that would definitely be exposed during a single, isolated spill event. Over-exposure can be expected within part of this area during a single event. The consequence of over-exposure will vary with the threshold concentration that applies.
- The **minimum time before oil exposure on the sea surface –** is determined by recording the elapsed time between the start of the release to when over-exposure (at a given threshold) is first calculated for the sea surface at a grid cell. Sea surface thresholds apply.
- The **frequency of exposure (surface oil, shoreline oil, entrained hydrocarbon or dissolved aromatic)** is calculated by dividing the number of simulations that resulted in over-exposure being determined, for a defined threshold, at each grid cell by the total number of simulations. For this study this ratio was calculated for releases from each sector, where the total number of simulations was 100.
- **Maximum potential shoreline loading –** is determined by calculating the mass of oil that arrives at each shoreline cell over the full duration of each simulation. The highest mass calculated for each grid cell in any simulation is then dividied by the cell area to express the maximum potential loading in g/m^2. *NOTE: This calculation is made to account for the accumulation of oil that strands on shorelines over the full duration of a spill incident. It sums oil arriving at any concentration over time. Consequently, It is possible for accumulation to be calculated at a shoreline cell that was not identified as over-exposed on the basis of oil arriving at concentrations that exceeded sea-surface concentration thresholds.*

Other statistics listed in the tables are based on the following calculations:

- The **greatest distance travelled by a replicate simulation –** is determined by calculating the maximum distance travelled from the release site to defined exposure thresholds in any simulation (out of the 100 simulations per sector in this study. The net direction of travel (from origin to end point) is also given but note that the path of travel will not be a straight line.
- The **frequency of oil exposure to a sensitive receptor –** is determined by dividing the number of replicate simulations in which over-exposure is calculated at any part of a sensitive receptor area, divided by the total number of simulations (i.e. 100 simulations per sector). The geographic bounds of each sensitive receptor area is defined as a collection of grid cells for this calculation.
- The **minimum time before oil exposure to a receptor–** is determined by calculating the shortest elapsed time between the start of the oil release and over-exposure at any grid cell forming part of a receptor polygon during any simulation (of 100 simulations per sector).

- The **minimum time before shoreline contact for a sensitive shoreline receptor –** is determined by calculating the shortest elapsed time before over-exposure was calculated, at a specified threshold, at any grid cell making up part of a shorelione receptor.
- The **maximum potential oil loading within a receptor** – is determined by calculating the maximum loading for any grid cell making up part of a receptor. This is a worst case estimate for the receptor.
- The **average potential oil loading within a receptor** – is calculated by averaging the maximum loads calculated across simulations for any grid cell making up part of a receptor.
- The **maximum volume of oil ashore within a receptor** – is determined by calculating the maximum volume of oil that is calculated to accumulate over time within all cells making up a shoreline receptor. This is a worst case estimate for the receptor.
- The **average volume of oil ashore within a receptor** – is determined by calculatied by averaging the volume of oil calculated to accumulate over time within all cells making up a shoreline receptor across all simulations.
- The **maximum length of shoreline contacted by oil** is determined by calculating the maximum length of shoreline contacted by oil within a shoreline receptor polygon, at a specified threshold, out of all the single spill simulations. This is a worst case estimate for the receptor.
- The **average length of shoreline contacted within a receptor** is determined by calculated by averaging the length of shoreline contacted by oil within a receptor polygon, at a specified threshold, from all the single spill simulations.

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5 Results

5.1 Overview

Results of the simulation and data analysis are presented separately for release of MGO, following the defined spill scenario, from locations within each receptor.

5.2 Inshore Area

This scenario examined a hypothetical release of 286 m^3 of MDO following a vessel collision within the inshore region of the Gippsland seismic survey area (Figure 1.1).

Table 5.1 details the maximum distance travelled by oil on the sea surface at each surface oil threshold. The maximum distances for low, moderate and high exposure were calculated as 110 km, 130 km and 200 km. Longest trajectories were calculated for releases near the north-east boundary, where the South Australian Current could transport films eastward through the coastal waters offshore Victoria and potentially into waters offshore New South Wales. Rleatively long potential trajectories were alsocalculated for spills towards the north-western boundary of this region. The general trend indicated by the modelling is for floating oil to migrate inshore or alongshore, rather than offshore.

Table 5.2 provides a summary of floating oil contact to all receptors. Floating oil was predicted to contact some of the sensitive receptors because those receptors enclose or overlap with the inshore region and some of the simulations represented release within these receptirs. Other receptors are positioned outside of the region and are indicated to be at risk of contact by floating oil at concentrations exceeding the defined thresholds.

A summary of shoreline contact to individual receptors is outlined in Table 5.2. The coastline around Point Hicks is predicted to have highest probability of contact (11%). A peak volume of 131 m^3 onshore is forecast to spread along 40 km of the Gippsland coast.

Figure 5.1 illustrates zones of potential exposure on the sea surface for low (1–10 g/m ^{2}) moderate (10- 25 g/m^2) and high (>25 g/m^2).

Figure 5.2 to Figure 5.4 demonstrate the probability of oil exposure on the sea surface above low, moderate and high exposure while Figure 5.5 to Figure 5.7 show the minimum amount of time before oil exposure reaches the sea surface.

Figure 5.8 illustrates zones of potential shoreline oil accumulation for low (10 -100 g/m ^{2}) moderate (100-1,000 g/m^2) and high (>1,000 g/m^2).

The potential distribution of entrained oil, as the maximum possible at locations surrounding the spil sites is illustrated in Figure 5.9. The results illustrate that entrained oil would more likely drift parallel to or obliquely into the shallow coastal waters and that the moderate threshold (> 100 ppb) could occur in waters offshore most of the Victorian coastline. The potential for higher threshold concentration (> 500 ppb) in these waters is also indicated. The island groups to the west of the survey area could also be exposed to concentrations exceeding 500 ppb. Similar concentrations could occur up to 150 km beyond the survey to the east if the spill occurs near the north-eastern boundary.

Figure 5.10 to Figure 5.12 illustrates the probability of oil exposure on the sea surface above low, moderate and high exposure while. Higher probabilities of exposure above the thresholds are distributed to the north-east of the survey area centred off the coastline between Cape Conran and Point Hicks.

Figure 5.13 illustrates calculations for the maximum concentrations of dissolved aromatic hydrocarbons from all of the simulations of spills from this region. This result indicates a similar general distribution to the calculations for slicks and that peak concentrations will be generally < 50 ppb away from the spill site.

Figure 5.14 to Figure 5.15 illustrates the probability that concentrations of dissolved aromatic hydrocarbons could exceed the low and moderate concentration thresholds. The maximum threshold was not exceeded, except at the release sites.

5.2.1 Sea Surface Exposure and Shoreline Contact

Table 5.1 Summary of potential zones of exposure at each surface oil threshold for a spill in the inshore zone.

Period	Distance and direction	Zones of potential sea surface exposure		
		Low (0.5–10 g/m²)	**Moderate (10–25 g/m²)**	**High (>25 g/m²)**
November to March	Max. distance (km)	200	130	110
	Direction	East	Northeast	Northeast

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Table 5.2: Expected floating oil outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clarke Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Boxen Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Vansittart Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
East Kangaroo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Big green Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Reef Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Badger Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cape Barren Osland	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Flinders Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Babel Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Pasco Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Pyramid Island	1	<1	<1	215	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Inner Sister Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Craggy Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Outer Sister Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Seal Islands	2	1	1	44	48	48	2	1	1	69	69	126	18	1,749	<1	8	<1	5
Kent Island Group	1	<1	<1	175	NC	NC	1	<1	<1	293	NC	NC	0.3	30	<1	<1	<1	4
Curtis Island	1	1	1	104	116	116	1	1	1	106	106	117	16	1,528	<1	10	<1	2
Moncoeur Islands	2	1	1	78	78	78	1	1	<1	79	79	NC	1.9	190	<1	2	<1	<1
Hogan Island Group	2	1	1	54	64	64	1	1	<1	66	113	NC	5.5	546	<1	3	<1	2
Rodondo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Glennie Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Norman Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Montague Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Anser Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kanowna Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Skull Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Martins Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gabo Island	3	1	<1	159	210	NC	5	1	<1	162	202	NC	2.4	125	<1	2	<1	4
South Gippsland	1	1	<1	134	134	NC	1	1	<1	141	141	NC	2.3	231	<1	2	<1	15

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	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Wellington	4	1	1	49	52	81	3	2	1	51	52	88	28	2,717	3	129	2	30
Bega Valley	2	<1	<1	163	NC	NC	2	<1	<1	167	NC	NC	1	86	<1	<1	<1	30
Eurobodalla	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	1.4	<1	<1	<1	<1
Shoal Haven	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Cape Howe / Mallacoota	2	1	<1	169	189	NC	2	1	<1	187	198	NC	2.8	280	<1	4	<1	16
Croajingolong (East)	3	3	1	75	81	104	2	2	1	91	91	121	15	1,081	<1	24	<1	10
Croajingolong (West)	9	4	2	34	52	54	9	4	2	47	55	58	52	3,288	<1	27	<1	12
Point Hicks	11	2	1	41	42	59	11	3	1	43	44	61	37	3,305	<1	45	<1	16
Sydenham Inlet	7	1	1	39	66	69	5	3	1	43	68	72	11	1,016	<1	27	2	16
Cape Conran	5	3	1	58	58	58	8	3	1	62	63	76	34	3,312	2	131	<1	19
Marlo	8	2	1	43	43	45	10	5	2	45	46	49	32	2,016	2	67	2	21
Corringle	8	1	1	52	66	66	7	5	1	54	54	175	17	1,046	2	43	2	20
Lake Tyers Beach	4	1	<1	53	132	NC	5	2	1	51	71	100	14	1,110	<1	23	<1	16
Lakes Entrance	3	1	<1	54	67	NC	3	2	1	59	70	88	38	3,312	2	99	<1	28
Lakes Entrance (West)	3	1	1	61	63	63	3	2	1	66	82	85	20	1,732	2	92	<1	20
Ocean Grange	1	<1	<1	50	NC	NC	1	<1	<1	111	NC	NC	0.8	83	<1	<1	<1	4
Golden Beach	2	<1	<1	51	NC	NC	2	2	<1	54	70	NC	8	675	<1	11	<1	14
Seaspray	3	1	<1	64	89	NC	2	2	1	68	80	88	27	2,656	2	121	<1	16
Woodside Beach	3	1	<1	104	258	NC	2	1	<1	117	127	NC	2.4	192	<1	4	<1	9
McLoughlins Beach	3	1	<1	49	52	NC	3	2	<1	51	52	NC	11	990	<1	14	<1	20
Clonmel Island	4	1	1	56	70	81	3	2	1	51	52	90	28	2,717	<1	30	<1	11
Snake Island	1	1	1	72	106	106	1	1	<1	94	108	NC	2.2	217	<1	3	<1	7
Port Welshpool	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	0.1	<1	<1	NC	NC
Corner Inlet	1	1	<1	134	134	NC	1	<1	<1	271	NC	NC	0.7	68	<1	<1	<1	2
Wilsons Promontory (NE)	1	1	<1	136	136	NC	1	1	<1	141	141	NC	2.3	231	<1	<1	<1	4
Wilsons Promontory (East)	1	1	<1	142	142	NC	1	<1	<1	204	NC	NC	0.5	51	<1	<1	<1	13
Wilsons Promontory (West)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Tasmania State Waters*	3	2	1	43	47	47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Victoria State Waters*	11	4	3	22	23	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New South Wales*	2	<1	<1	155	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Australian Exclusive Economic Zone*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Cutter Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endeavour Reef*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wright Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wakitipu Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Warrego Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Zealand Star Bank*	5	2	1	45	92	92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef*	5	1	<1	30	49	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef Marine Sanctuary*	7	1	1	28	48	68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
East Gippsland AMP*	1	<1	<1	252	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flinders AMP*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Freycinet AMP*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beagle AMP*	5	2	2	33	42	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Batemans Bay Marine Park	1	<1	<1	331	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Murramarang Sanctuary Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tomaga River Habitat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wallaga Lake Entrance Habitiat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Batemans Bay Habitat Protection Zone	1	<1	<1	331	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	1.4	<1	<1	<1	<1
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	<1	<1	NC	NC
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
North Head Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Corner Inlet	3	1	1	57	88	88	3	2	1	51	52	90	28	2,717	<1	35	<1	17
Gippsland Lakes	2	1	1	61	82	82	3	2	1	51	70	88	38	3,312	3	99	2	29
Seamounts South and east of Tasmania*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upwelling East of Eden	15	8	7	1	1	1	10	5	2	45	46	49	32	3,128	2	28	2	7
Big Horseshoe Canyon*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Canyons on the eastern continental slope*	1	<1	<1	189	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shelf rocky reefs*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antipodean Albatross - Foraging*	10	4	3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black Petrel - Foraging*	1	<1	<1	174	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-browed Albatross - Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Bullers Albatross - Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Campbell Albatross - Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flesh-footed Shearwater - Foraging*	1	<1	<1	174	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Great-winged Petrel - Foraging*	1	<1	<1	181	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark – Foraging*	2	<1	<1	158	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark - Migration*	3	2	1	118	122	131	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indo-Pacific/Spotted Bottlenose Dolphin – Breeding*	2	<1	<1	155	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indian Yellow-nosed Albatross - Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Foraging*	7	2	1	59	63	96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Breeding*	1	<1	<1	331	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northern Giant Petrel - Foraging*	1	<1	<1	181	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Foraging*	2	1	1	75	75	76	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Foraging*	16	8	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Breeding*	1	<1	<1	285	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shy Albatross – Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Giant Petrel - Foraging*	1	<1	<1	181	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Foraging*	7	2	2	50	50	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wandering Albatross - Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
White Shark – Foraging*	11	4	3	22	22	37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Distribution*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Breeding*	17	8	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wilsons Storm Petrel - Migration*	1	<1	<1	181	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Breeding*	2	1	1	97	110	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Foraging*	11	4	3	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-fronted Tern - Foraging	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Foraging*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-capped Albatross - Foraging*	1	<1	<1	181	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Humpback Whale – Foraging*	3	2	1	60	61	61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale – Migration*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale - Connecting Habitat*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Distribution*	17	8	7	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold.
* Floating oil will not accumulate on submerged features and at open ocean locations. NA: Not applicable.

RPS

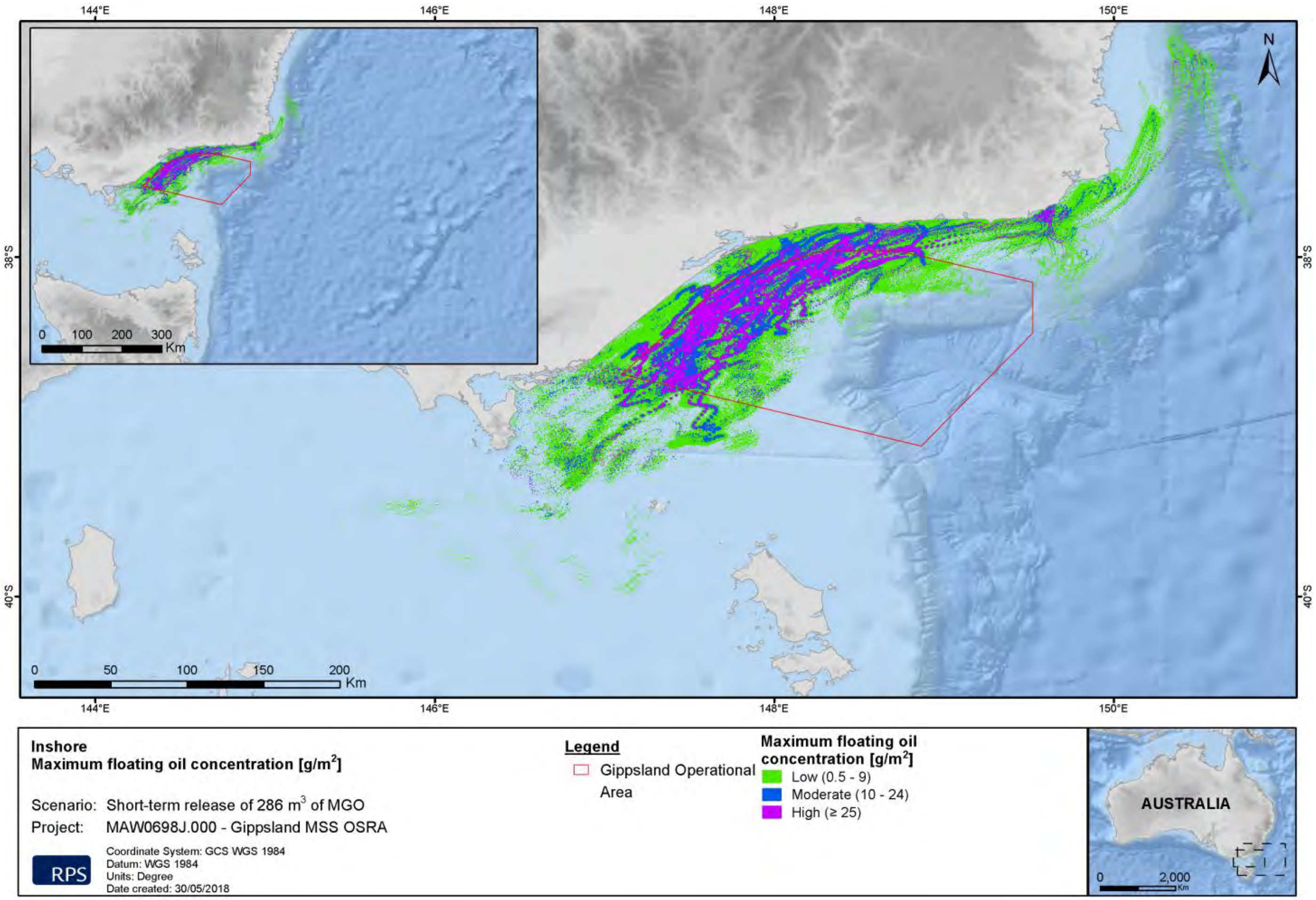

Figure 5.1: Predicted maximum of floating oil concentration for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

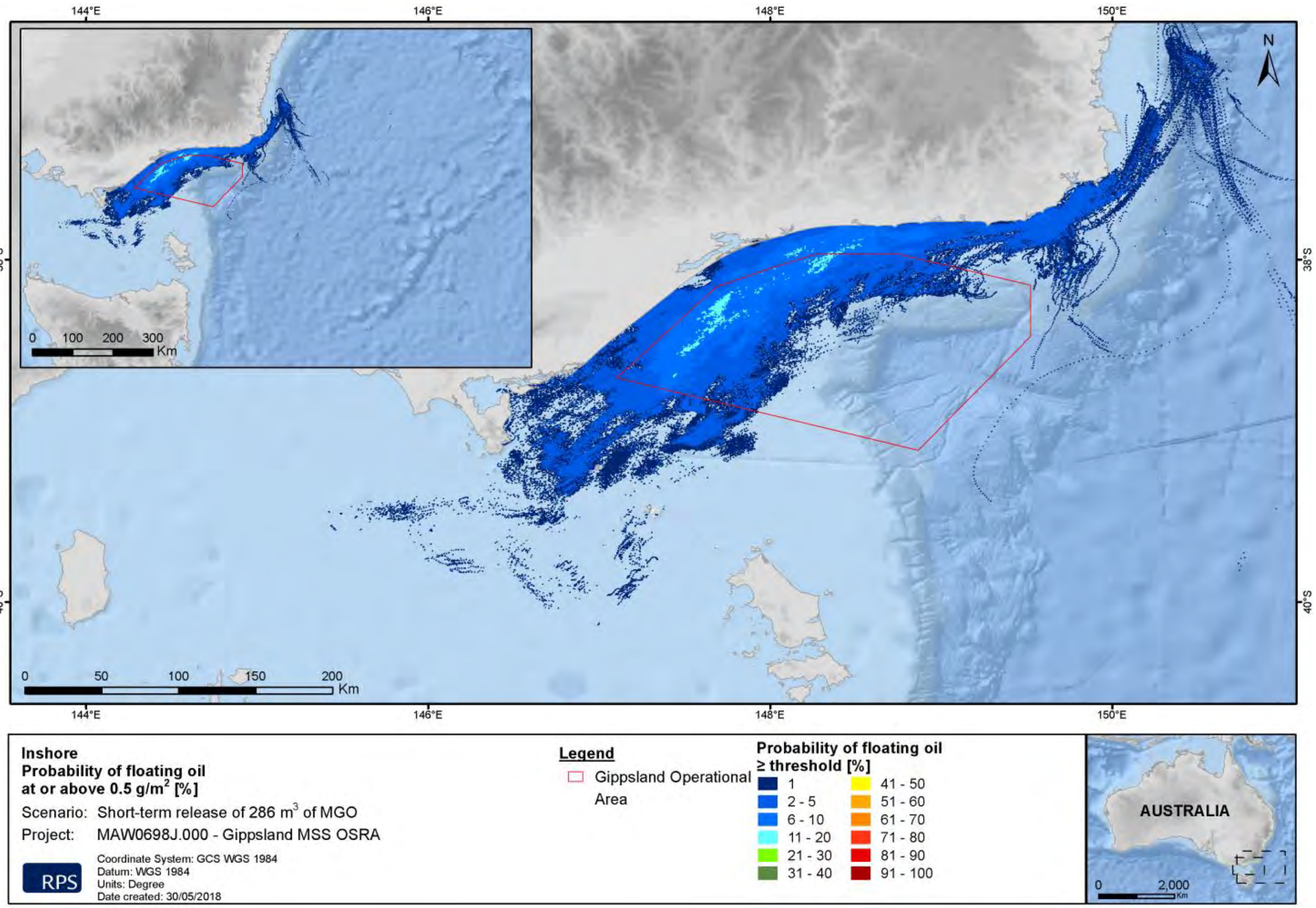

Figure 5.2: Predicted probability of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

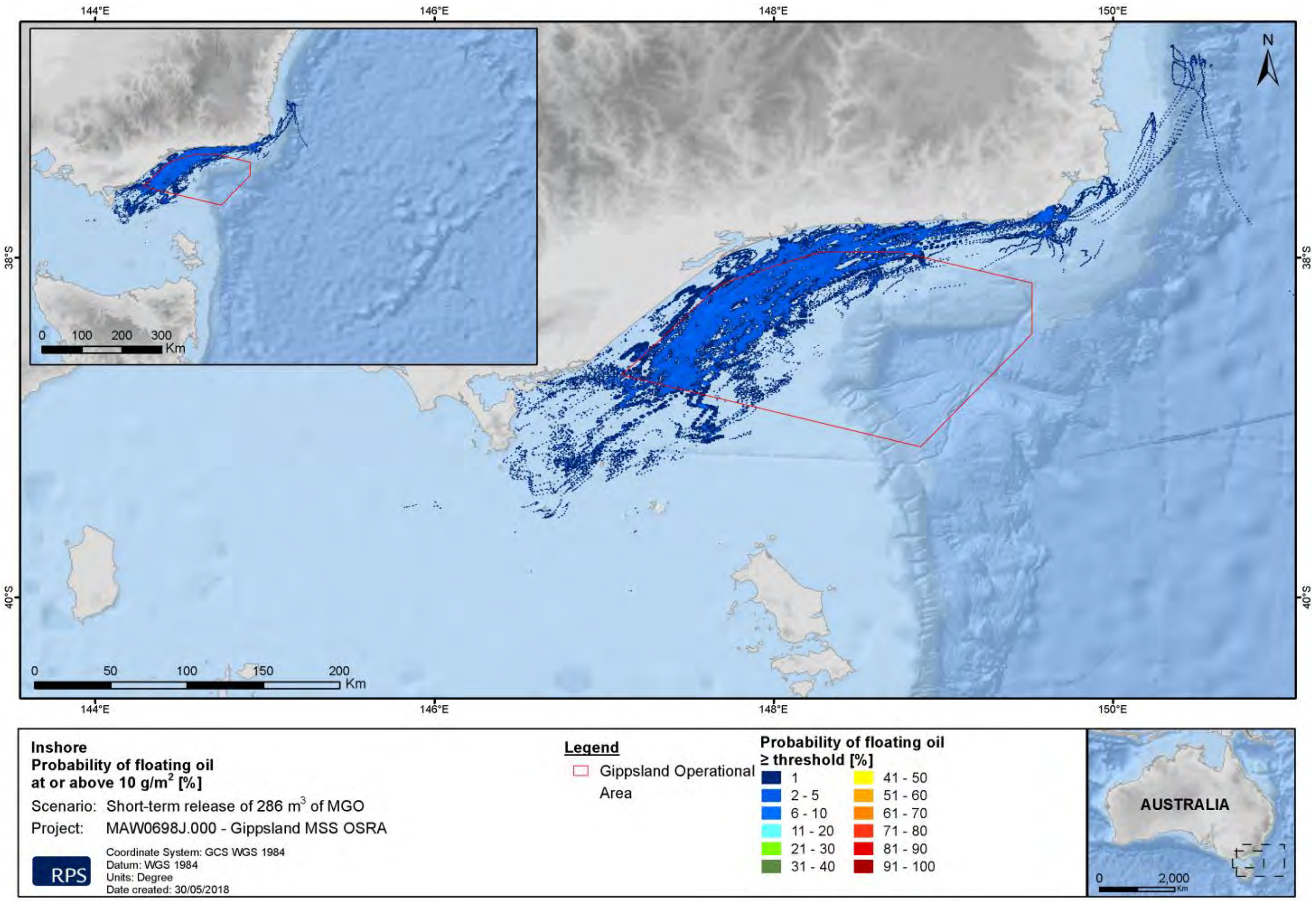

Figure 5.3: Predicted probability of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

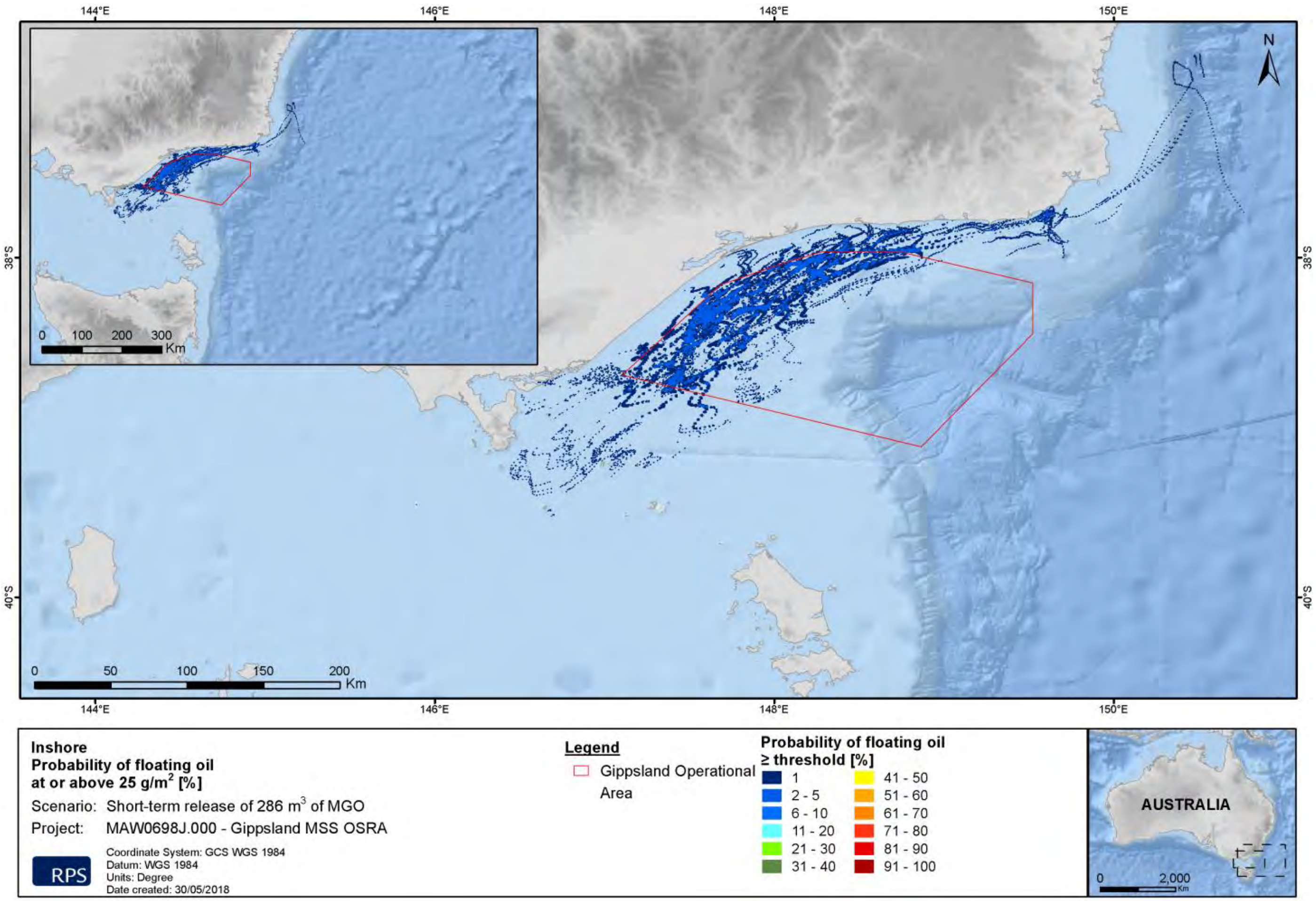

Figure 5.4: Predicted probability of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

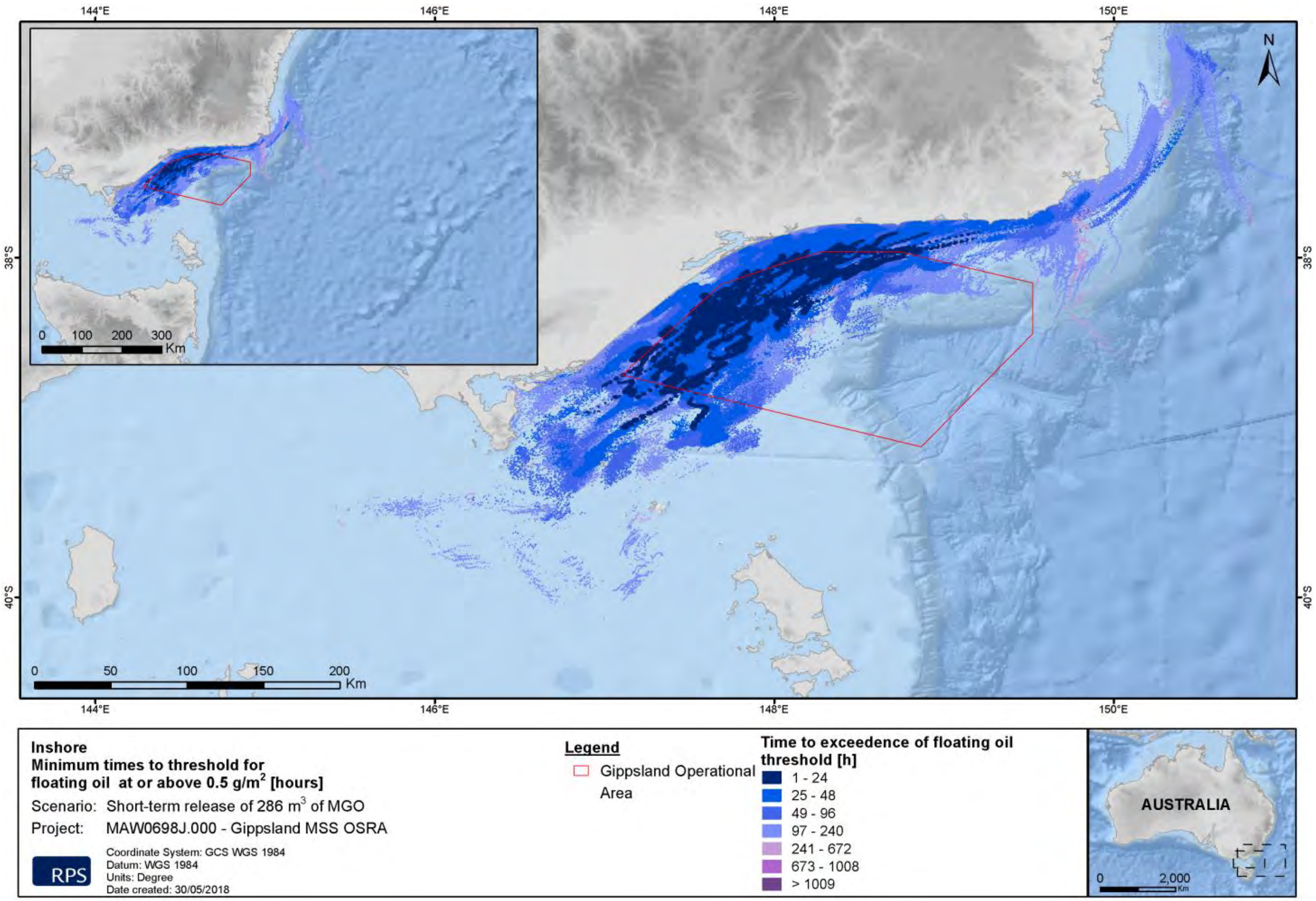

Figure 5.5: Predicted minimum time of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

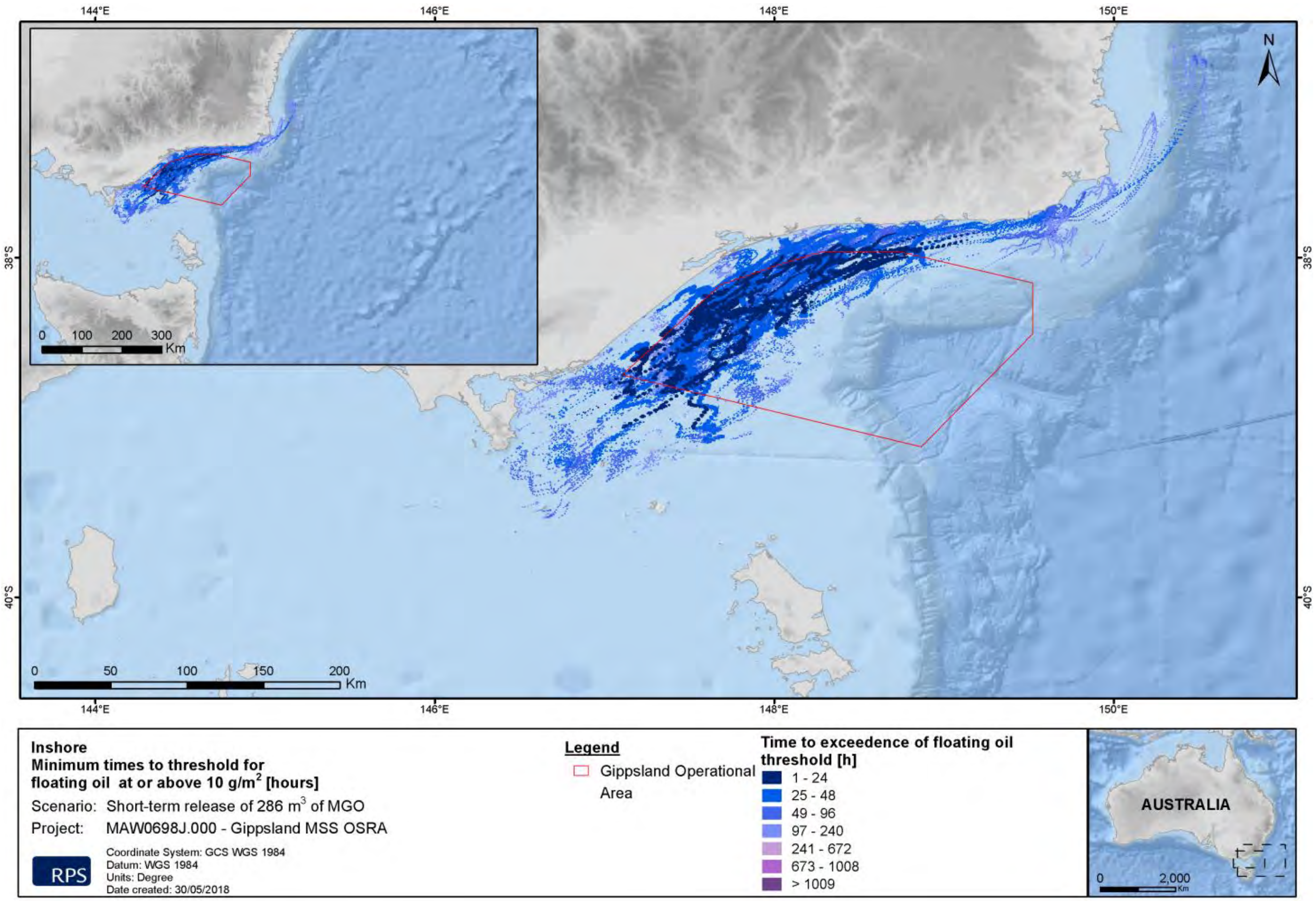

Figure 5.6: Predicted minimum time of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

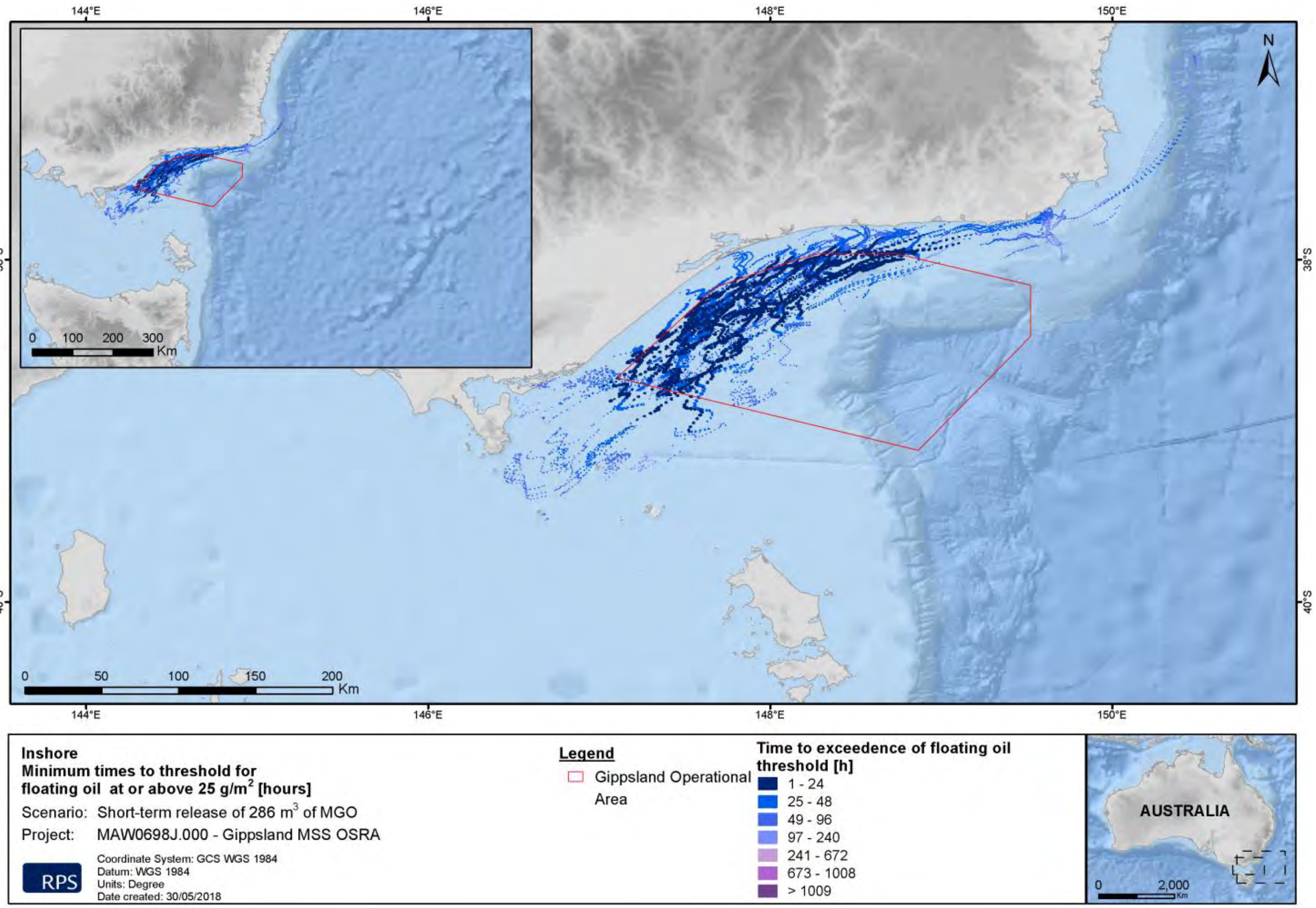

Figure 5.7: Predicted minimum time of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

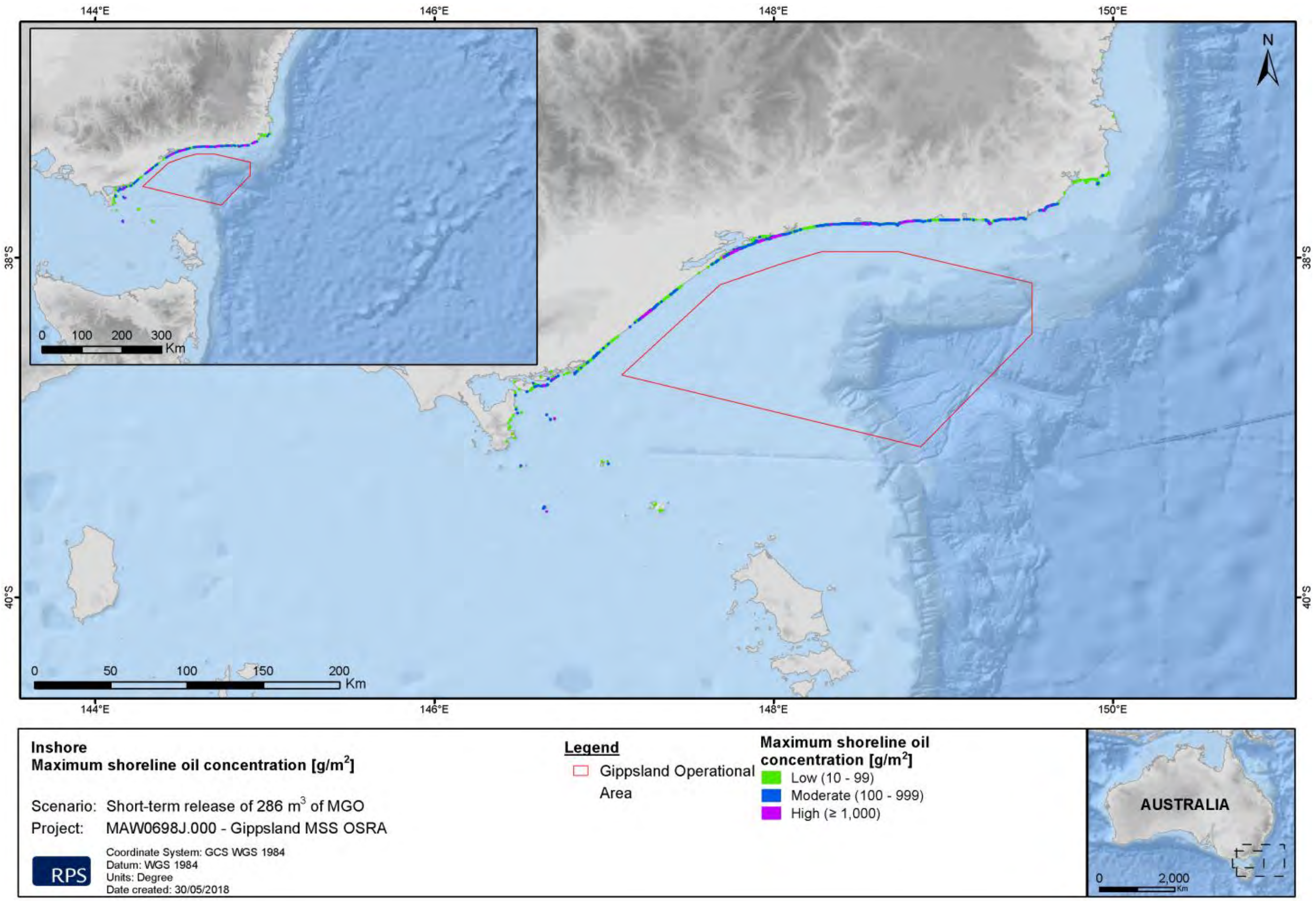

Figure 5.8: Predicted maximum of shoreline oil concentration for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

5.2.2 Instantaneous Entrained Oil

Table 5.3: Expected entrained oil outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	NC	NC
Clarke Island	<1	<1	<1	NC	NC	NC	NC	NC
Boxen Island	<1	<1	<1	NC	NC	NC	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC	NC	NC	NC
Vansittart Island	<1	<1	<1	NC	NC	NC	NC	NC
East Kangaroo Island	<1	<1	<1	NC	NC	NC	NC	NC
Big green Island	<1	<1	<1	NC	NC	NC	NC	NC
Reef Island	<1	<1	<1	NC	NC	NC	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC	NC	NC	NC
Badger Island	<1	<1	<1	NC	NC	NC	NC	NC
Cape Barren Osland	<1	<1	<1	NC	NC	NC	NC	NC
Flinders Island	<1	<1	<1	NC	NC	NC	NC	NC
Babel Island	<1	<1	<1	NC	NC	NC	NC	NC
Pasco Group	<1	<1	<1	NC	NC	NC	NC	NC
Pyramid Island	2	1	<1	189	197	NC	5	445
Inner Sister Island	<1	<1	<1	NC	NC	NC	NC	NC
Craggy Island	<1	<1	<1	NC	NC	NC	<1	<1
Outer Sister Island	<1	<1	<1	NC	NC	NC	NC	NC
Seal Islands	9	5	2	43	43	43	28	2,402
Kent Island Group	4	3	<1	140	141	NC	6	443
Curtis Island	5	3	1	96	96	109	10	748
Moncoeur Islands	7	2	1	77	78	80	9	674
Hogan Island Group	8	2	<1	54	71	NC	7	483
Rodondo Island	5	<1	<1	130	NC	NC	2	76

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	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Glennie Group	1	<1	<1	287	NC	NC	<1	29
Norman Island	<1	<1	<1	NC	NC	NC	<1	<1
Montague Island	1	<1	<1	293	NC	NC	<1	16
Anser Island	3	<1	<1	255	NC	NC	<1	71
Kanowna Island	3	<1	<1	256	NC	NC	<1	71
Skull Rock	3	<1	<1	267	NC	NC	<1	71
Martins Island	<1	<1	<1	NC	NC	NC	<1	<1
Gabo Island	14	7	<1	151	161	NC	15	376
South Gippsland	4	1	<1	135	182	NC	3	214
Wellington	7	5	1	46	49	52	24	2,254
Bega Valley	11	3	<1	168	170	NC	9	453
Eurobodalla	1	1	<1	316	336	NC	2	141
Shoal Haven	1	1	<1	315	324	NC	3	221
Cape Howe / Mallacoota	11	5	<1	134	167	NC	10	413
Croajingolong (East)	17	4	<1	64	105	NC	13	396
Croajingolong (West)	31	11	1	32	48	82	34	1,046
Point Hicks	28	17	2	37	38	42	46	914
Sydenham Inlet	21	11	<1	78	100	NC	22	407
Cape Conran	22	5	1	70	90	200	18	725
Marlo	21	8	1	39	43	97	21	946
Corringle	14	7	1	53	63	193	11	515
Lake Tyers Beach	8	3	<1	98	139	NC	8	386
Lakes Entrance	8	1	<1	63	71	NC	4	237
Lakes Entrance (West)	4	1	<1	65	72	NC	5	427
Ocean Grange	4	1	<1	120	254	NC	4	368
Golden Beach	4	2	<1	144	148	NC	5	267
Seaspray	7	3	<1	137	153	NC	7	359
Woodside Beach	7	4	<1	99	129	NC	8	424
McLoughlins Beach	5	5	1	46	49	52	24	1,980
Clonmel Island	7	3	1	52	52	53	24	2,254

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Snake Island	5	1	1	68	80	95	10	870
Port Welshpool	2	<1	<1	160	NC	NC	<1	64
Corner Inlet	4	<1	<1	135	NC	NC	2	98
Wilsons Promontory (NE)	4	1	<1	135	182	NC	3	150
Wilsons Promontory (East)	4	1	<1	184	197	NC	3	214
Wilsons Promontory (West)	3	<1	<1	242	NC	NC	<1	67
Tasmania State Waters	11	5	1	43	47	76	14	1,007
Victoria State Waters	34	19	5	23	23	23	87	3,637
New South Wales	15	5	<1	128	170	NC	12	453
Australian Exclusive Economic Zone	34	20	7	1	1	1	87	6,229
Cutter Rock	7	1	<1	89	129	NC	4	112
Endeavour Reef	1	<1	<1	297	NC	NC	<1	73
Wright Rock	1	<1	<1	304	NC	NC	<1	73
Wakitipu Rock	1	<1	<1	206	NC	NC	<1	78
Warrego Rock	<1	<1	<1	NC	NC	NC	<1	<1
New Zealand Star Bank	27	12	2	41	42	42	37	811
Beware Reef	20	3	<1	37	91	NC	11	195
Beware Reef Marine Sanctuary	21	4	<1	35	89	NC	13	247
East Gippsland AMP	5	2	<1	228	269	NC	5	445
Flinders AMP	1	<1	<1	329	NC	NC	<1	55
Freycinet AMP	<1	<1	<1	NC	NC	NC	NC	NC
Beagle AMP	14	8	3	42	43	43	27	1,633
Batemans Bay Marine Park	1	1	<1	284	316	NC	3	221
Murramarang Sanctuary Zone	1	1	<1	312	316	NC	2	192

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Brush Island Sanctuary Zone	1	1	<1	320	323	NC	2	143
Tollgate Islands Sanctuary Zone	1	1	<1	310	317	NC	2	126
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	5
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	5
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	10
Batemans Bay Habitat Protection Zone	1	1	<1	309	317	NC	2	159
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	7
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	7
Montague Island Habitat Protection Zone	1	<1	<1	284	NC	NC	<1	73
Burrewarra Point Sanctuary Zone	1	<1	<1	319	NC	NC	<1	61

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1
North Head Sanctuary Zone	1	<1	<1	320	NC	NC	<1	80
Tollgate Islands Sanctuary Zone	1	1	<1	310	317	NC	2	126
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	3
Cornler Inlet Marine National Park	2	1	<1	197	274	NC	2	105
Corner Inlet	7	3	1	50	52	55	20	1,802
Gippsland Lakes	5	1	<1	70	74	NC	3	279
Seamounts South and east of Tasmania	<1	<1	<1	NC	NC	NC	NC	NC
Upwelling East of Eden	34	20	7	1	1	1	87	4,255
Big Horseshoe Canyon	3	2	<1	133	172	NC	5	400
Canyons on the eastern continental slope	3	1	<1	183	192	NC	5	427
Shelf rocky reefs	2	1	<1	276	280	NC	2	131
Antipodean Albatross - Foraging	34	20	7	1	1	9	85	4,255
Black Petrel - Foraging	3	3	1	171	173	197	6	552
Black-browed Albatross - Foraging	34	20	7	1	1	1	85	6,229
Black-faced Cormorant - Foraging	<1	<1	<1	NC	NC	NC	NC	NC
Crested Tern - Breeding	1	<1	<1	284	NC	NC	<1	73
Crested Tern - Foraging	3	3	<1	174	176	NC	6	484

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Bullers Albatross - Foraging	32	20	4	1	1	1	80	6,229
Campbell Albatross - Foraging	34	20	7	1	1	1	85	6,229
Flesh-footed Shearwater - Foraging	3	3	1	171	173	197	6	552
Great-winged Petrel - Foraging	3	3	1	171	177	197	6	552
Grey Nurse Shark - Foraging	7	2	<1	136	192	NC	3	221
Grey Nurse Shark - Migration	10	4	1	69	121	159	10	827
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	15	5	<1	126	170	NC	12	472
Indian Yellow-nosed Albatross - Foraging	34	20	7	1	1	1	85	6,229
Little Penguin - Foraging	22	10	1	50	50	93	21	983
Little Penguin - Breeding	2	1	<1	279	284	NC	2	192
Northern Giant Petrel - Foraging	3	3	1	171	177	197	6	552
Sooty Shearwater - Breeding	<1	<1	<1	NC	NC	NC	<1	8
Sooty Shearwater - Foraging	8	3	1	75	76	77	16	1,529
Short-tailed Shearwater - Foraging	28	15	4	1	1	1	70	6,229
Short-tailed Shearwater - Breeding	5	1	<1	66	287	NC	3	103
Shy Albatross - Foraging	34	20	7	1	1	1	87	6,229

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Wedge-tailed Shearwater - Breeding	<1	<1	<1	NC	NC	NC	<1	8
Southern Giant Petrel - Foraging	3	3	1	171	177	197	6	552
Wedge-tailed Shearwater - Foraging	22	10	2	49	49	50	31	2,354
Wandering Albatross - Foraging	34	20	7	1	1	1	85	6,229
White Shark - Foraging	34	19	5	22	22	22	87	4,255
White Shark - Distribution	34	20	7	1	1	1	87	6,229
White Shark - Breeding	30	15	4	1	1	1	68	4,222
Wilsons Storm Petrel - Migration	3	3	1	171	177	197	6	552
Black-faced Cormorant - Breeding	<1	<1	<1	NC	NC	NC	NC	NC
White-faced Storm-petrel - Breeding	5	3	1	95	101	108	9	839
White-faced Storm-petrel - Foraging	34	20	7	1	1	2	87	4,255
Common Diving-petrel - Breeding	7	3	<1	89	90	NC	7	175
Common Diving-petrel - Foraging	32	20	7	1	1	1	85	6,229
White-fronted Tern - Foraging	<1	<1	<1	NC	NC	NC	NC	NC
Pygmy Blue Whale - Foraging	34	20	7	1	1	1	87	6,229
White-capped Albatross - Foraging	3	3	1	171	177	197	6	552
Humpback Whale - Foraging	15	7	1	59	60	60	17	1,529

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Southern Right Whale - Migration	34	20	7	1	1	1	87	6,229
Southern Right Whale - Connecting Habitat	<1	<1	<1	NC	NC	NC	NC	NC
Pygmy Blue Whale - Distribution	34	20	7	1	1	1	87	6,229

NC: No contact to receptor predicted for specified threshold.

RPS

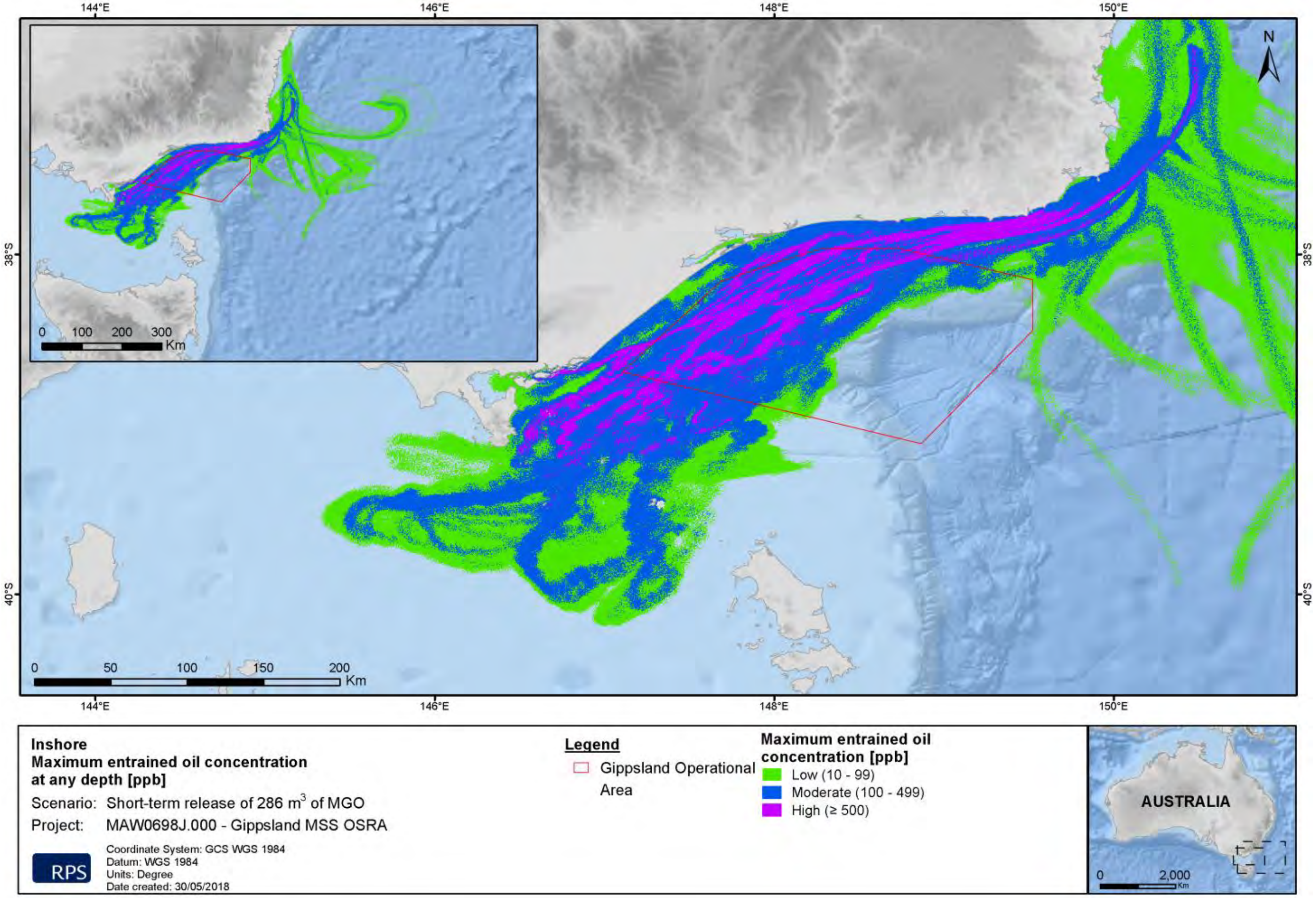

Figure 5.9: Predicted maximum of entrained oil concentration for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

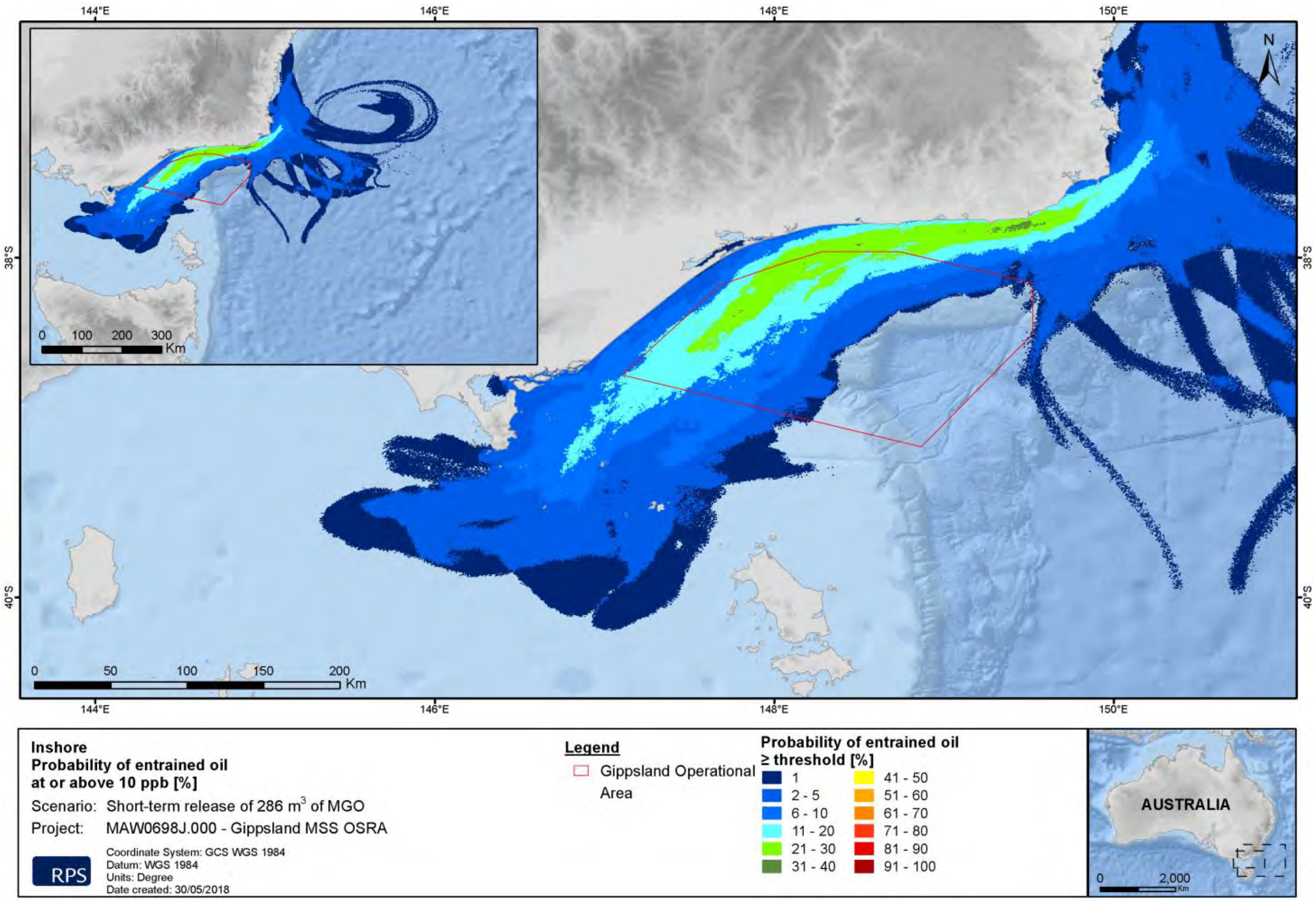

Figure 5.10: Predicted probability of entrained oil concentration at or above 10 ppb for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

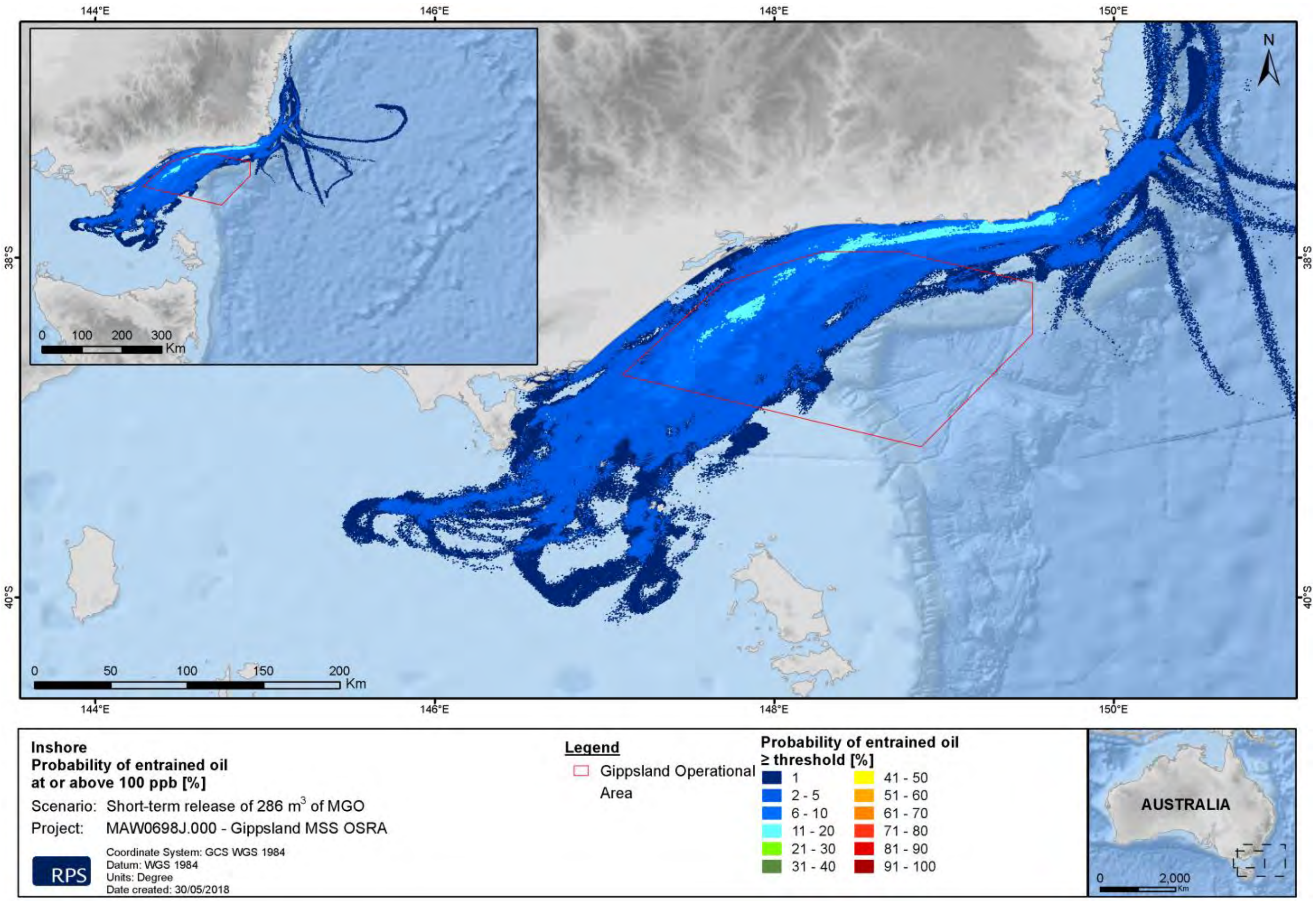

Figure 5.11: Predicted probability of entrained oil concentration at or above 100 ppb for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

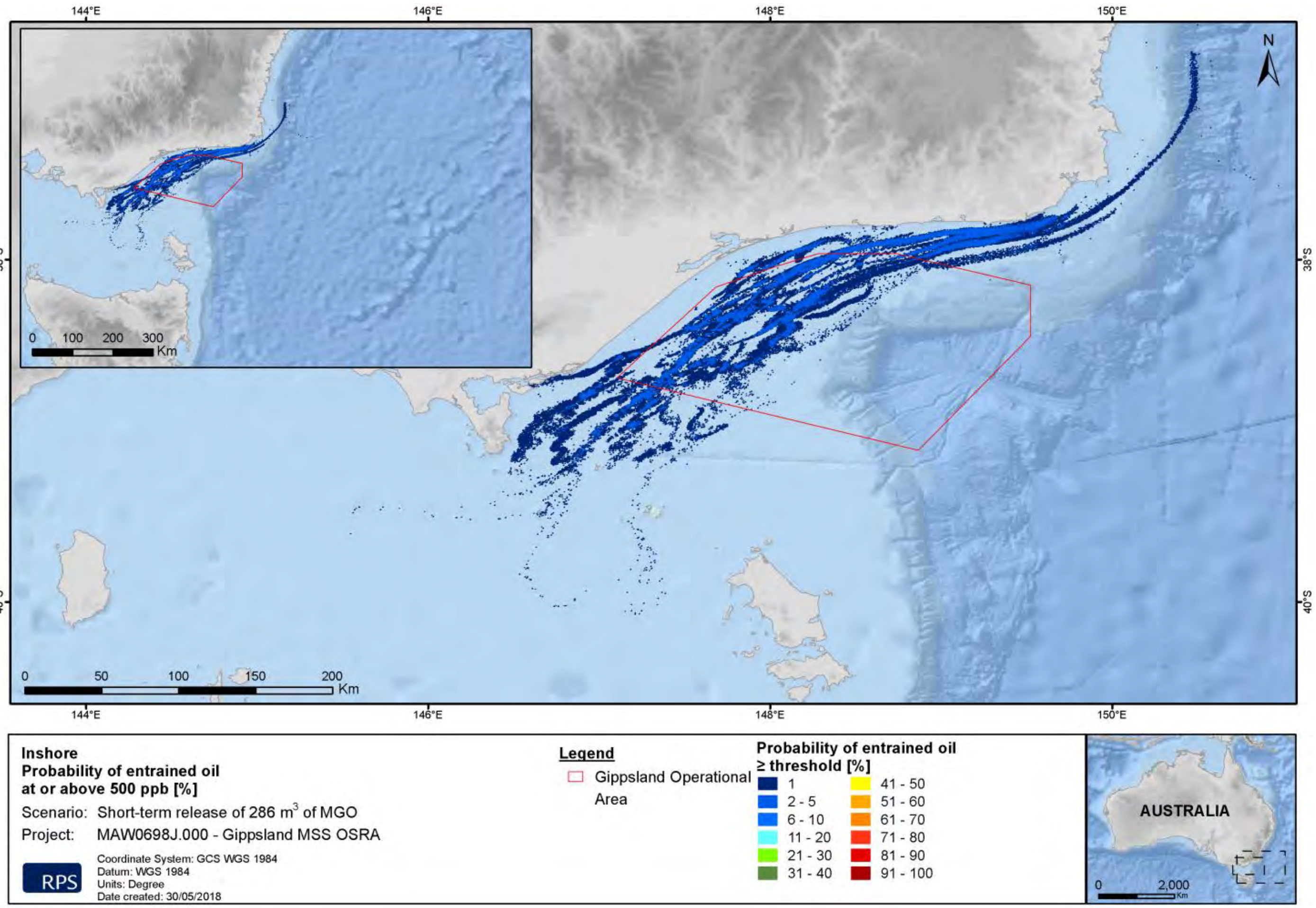

Figure 5.12: Predicted probability of entrained oil concentration at or above 500 ppb for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

5.2.3 Instantaneous Dissolved Aromatic Hydrocarbon

Table 5.4: Expected dissolved aromatic hydrocarbon outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC
Clarke Island	<1	<1	<1	NC	NC
Boxen Island	<1	<1	<1	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC
Vansittart Island	<1	<1	<1	NC	NC
East Kangaroo Island	<1	<1	<1	NC	NC
Big green Island	<1	<1	<1	NC	NC
Reef Island	<1	<1	<1	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC
Badger Island	<1	<1	<1	NC	NC
Cape Barren Osland	<1	<1	<1	NC	NC
Flinders Island	<1	<1	<1	NC	NC
Babel Island	<1	<1	<1	NC	NC
Pasco Group	<1	<1	<1	NC	NC
Pyramid Island	<1	<1	<1	<1	2
Inner Sister Island	<1	<1	<1	NC	NC
Craggy Island	<1	<1	<1	<1	<1
Outer Sister Island	<1	<1	<1	NC	NC
Seal Islands	1	<1	<1	<1	49
Kent Island Group	1	<1	<1	<1	26
Curtis Island	<1	<1	<1	<1	2
Moncoeur Islands	1	<1	<1	<1	34
Hogan Island Group	2	<1	<1	<1	30
Rodondo Island	<1	<1	<1	<1	<1
Glennie Group	1	<1	<1	<1	7
Norman Island	<1	<1	<1	<1	<1
Montague Island	<1	<1	<1	<1	<1
Anser Island	<1	<1	<1	<1	5
Kanowna Island	<1	<1	<1	<1	5
Skull Rock	<1	<1	<1	<1	5
Martins Island	<1	<1	<1	<1	<1
Gabo Island	3	<1	<1	<1	20
South Gippsland	1	<1	<1	<1	11
Wellington	1	<1	<1	<1	46
Bega Valley	<1	<1	<1	<1	6

RPS

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Eurobodalla	<1	<1	<1	<1	2
Shoal Haven	<1	<1	<1	<1	6
Cape Howe / Mallacoota	1	<1	<1	<1	14
Croajingolong (East)	1	<1	<1	<1	9
Croajingolong (West)	3	<1	<1	<1	28
Point Hicks	5	<1	<1	<1	42
Sydenham Inlet	4	<1	<1	<1	21
Cape Conran	3	<1	<1	<1	29
Marlo	4	<1	<1	<1	39
Corringle	3	<1	<1	<1	37
Lake Tyers Beach	1	<1	<1	<1	19
Lakes Entrance	<1	<1	<1	<1	6
Lakes Entrance (West)	1	<1	<1	<1	9
Ocean Grange	<1	<1	<1	<1	5
Golden Beach	<1	<1	<1	<1	3
Seaspray	1	<1	<1	<1	8
Woodside Beach	<1	<1	<1	<1	6
McLoughlins Beach	1	<1	<1	<1	29
Clonmel Island	1	<1	<1	<1	46
Snake Island	1	<1	<1	<1	7
Port Welshpool	<1	<1	<1	<1	<1
Corner Inlet	<1	<1	<1	<1	<1
Wilsons Promontory (NE)	<1	<1	<1	<1	2
Wilsons Promontory (East)	1	<1	<1	<1	11
Wilsons Promontory (West)	<1	<1	<1	<1	5
Tasmania State Waters	3	<1	<1	<1	40
Victoria State Waters	8	1	<1	2	70
New South Wales	1	<1	<1	<1	12
Australian Exclusive Economic Zone	10	2	<1	3	190
Cutter Rock	<1	<1	<1	<1	<1
Endeavour Reef	<1	<1	<1	<1	3
Wright Rock	<1	<1	<1	<1	2
Wakitipu Rock	<1	<1	<1	<1	4
Warrego Rock	<1	<1	<1	NC	NC
New Zealand Star Bank	7	<1	<1	<1	41
Beware Reef	1	<1	<1	<1	7
Beware Reef Marine Sanctuary	1	<1	<1	<1	17
East Gippsland AMP	1	<1	<1	<1	28
Flinders AMP	<1	<1	<1	<1	<1

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Freycinet AMP	<1	<1	<1	NC	NC
Beagle AMP	4	1	<1	<1	77
Batemans Bay Marine Park	<1	<1	<1	<1	6
Murramarang Sanctuary Zone	<1	<1	<1	<1	6
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	NC	NC
Brush Island Sanctuary Zone	<1	<1	<1	<1	<1
Tollgate Islands Sanctuary Zone	<1	<1	<1	<1	3
Mullimburra Sanctuary Zone	<1	<1	<1	<1	<1
Brou Beach Sanctuary Zone	<1	<1	<1	<1	<1
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	<1	<1
Montague Island South Sanctuary Zone	<1	<1	<1	<1	<1
Batemans Bay Habitat Protection Zone	<1	<1	<1	<1	3
Mullimburra North Habitat Protection Zone	<1	<1	<1	<1	<1
Mullimburra South Habitat Protection Zone	<1	<1	<1	<1	<1
Montague Island Habitat Protection Zone	<1	<1	<1	<1	2
Burrewarra Point Sanctuary Zone	<1	<1	<1	<1	<1
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC
North Head Sanctuary Zone	<1	<1	<1	<1	2
Tollgate Islands Sanctuary Zone	<1	<1	<1	<1	3
Broulee Island Sanctuary Zone	<1	<1	<1	<1	<1
Cornler Inlet Marine National Park	<1	<1	<1	<1	<1
Corner Inlet	1	<1	<1	<1	39
Gippsland Lakes	<1	<1	<1	<1	5
Seamounts South and east of Tasmania	<1	<1	<1	NC	NC
Upwelling East of Eden	9	2	<1	3	178
Big Horseshoe Canyon	2	<1	<1	<1	33
Canyons on the eastern continental slope	1	<1	<1	<1	7
Shelf rocky reefs	<1	<1	<1	<1	5
Antipodean Albatross - Foraging	9	2	<1	3	137
Black Petrel - Foraging	1	<1	<1	<1	9
Black-browed Albatross - Foraging	10	2	<1	3	190

RPS

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Black-faced Cormorant - Foraging	<1	<1	<1	NC	NC
Crested Tern - Breeding	<1	<1	<1	<1	2
Crested Tern - Foraging	1	<1	<1	<1	9
Bullers Albatross - Foraging	10	2	<1	3	190
Campbell Albatross - Foraging	10	2	<1	3	190
Flesh-footed Shearwater - Foraging	1	<1	<1	<1	9
Great-winged Petrel - Foraging	1	<1	<1	<1	9
Grey Nurse Shark - Foraging	1	<1	<1	<1	7
Grey Nurse Shark - Migration	2	<1	<1	<1	28
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	1	<1	<1	<1	12
Indian Yellow-nosed Albatross - Foraging	10	2	<1	3	190
Little Penguin - Foraging	4	<1	<1	<1	31
Little Penguin - Breeding	<1	<1	<1	<1	6
Northern Giant Petrel - Foraging	1	<1	<1	<1	9
Sooty Shearwater - Breeding	<1	<1	<1	<1	<1
Sooty Shearwater - Foraging	2	1	<1	<1	85
Short-tailed Shearwater - Foraging	8	2	<1	2	155
Short-tailed Shearwater - Breeding	1	<1	<1	<1	14
Shy Albatross - Foraging	10	2	<1	3	190
Wedge-tailed Shearwater - Breeding	<1	<1	<1	<1	<1
Southern Giant Petrel - Foraging	1	<1	<1	<1	9
Wedge-tailed Shearwater - Foraging	4	1	<1	2	113
Wandering Albatross - Foraging	10	2	<1	3	190
White Shark - Foraging	8	1	<1	2	137
White Shark - Distribution	10	2	<1	3	190
White Shark - Breeding	8	2	<1	2	118
Wilsons Storm Petrel - Migration	1	<1	<1	<1	9
Black-faced Cormorant - Breeding	<1	<1	<1	NC	NC
White-faced Storm-petrel - Breeding	1	1	<1	<1	76
White-faced Storm-petrel - Foraging	9	2	<1	3	137
Common Diving-petrel - Breeding	<1	<1	<1	<1	3
Common Diving-petrel - Foraging	10	2	<1	3	190
White-fronted Tern - Foraging	<1	<1	<1	NC	NC
Pygmy Blue Whale - Foraging	10	2	<1	3	190
White-capped Albatross - Foraging	1	<1	<1	<1	9

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Humpback Whale - Foraging	3	1	<1	2	97
Southern Right Whale - Migration	10	2	<1	3	190
Southern Right Whale - Connecting Habitat	<1	<1	<1	NC	NC
Pygmy Blue Whale - Distribution	10	2	<1	3	190

NC: No contact to receptor predicted for specified threshold.

RPS

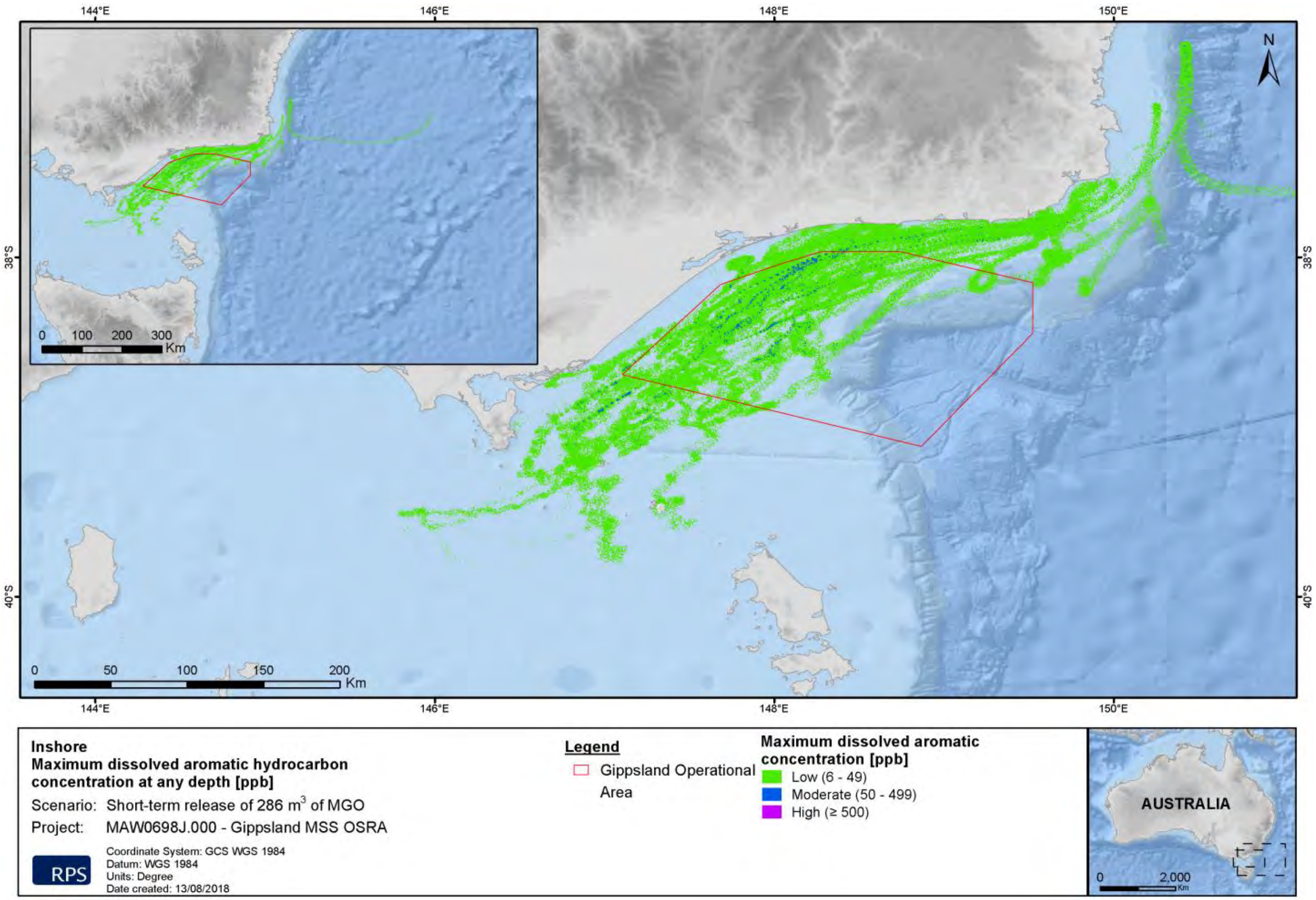

Figure 5.13: Predicted maximum of dissolved aromatic hydrocarbon concentration for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

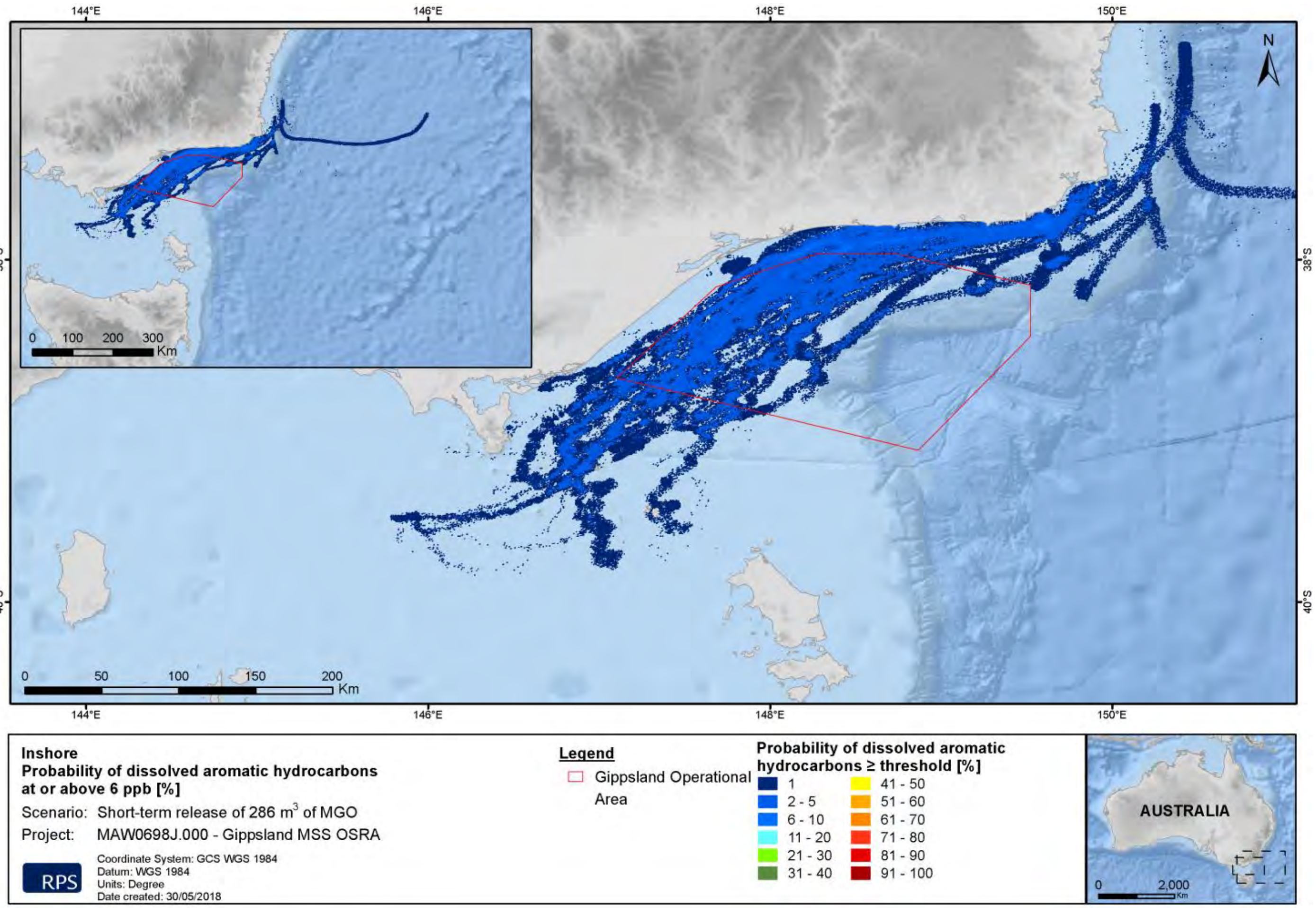

Figure 5.14: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 6 ppb for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

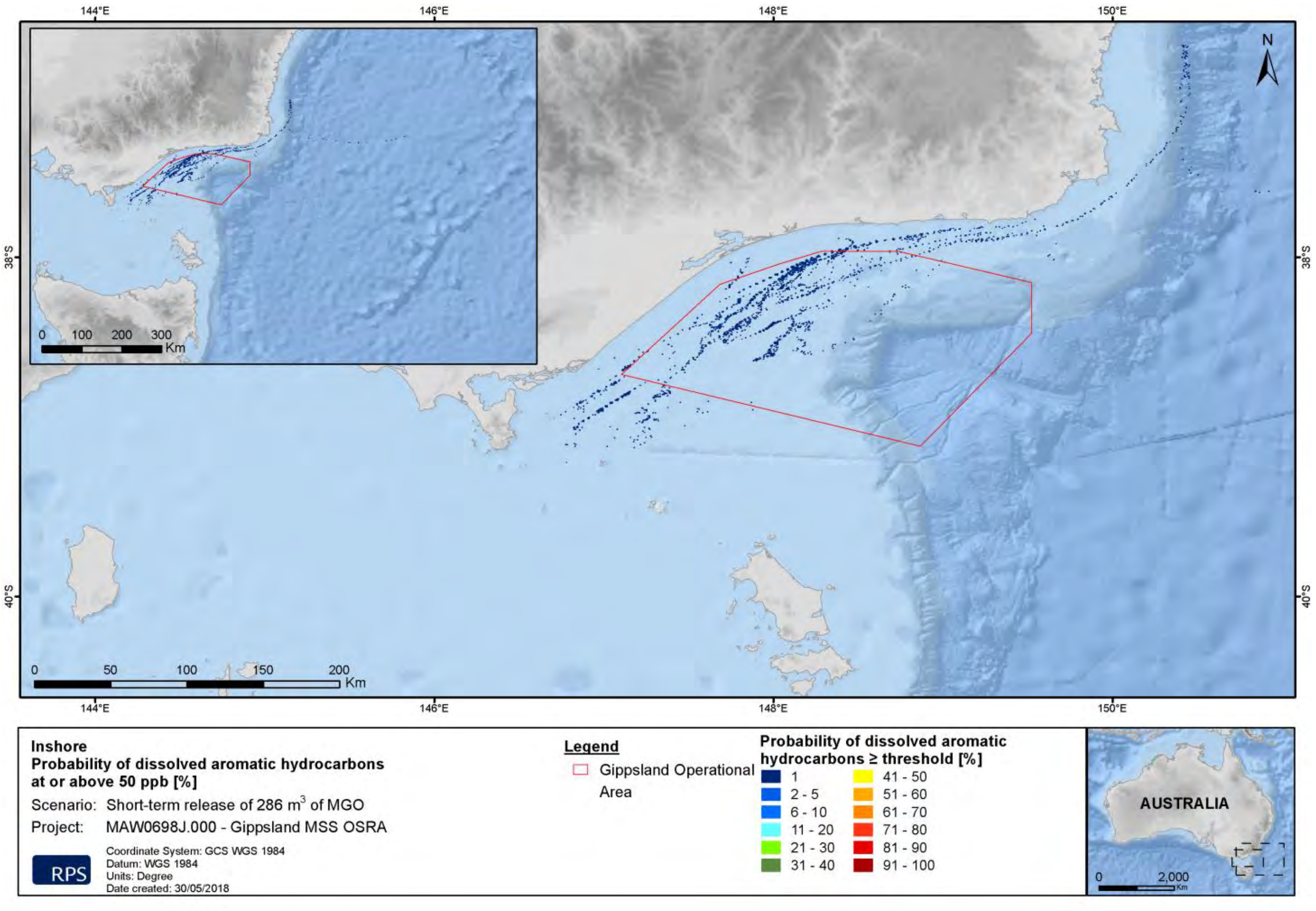

Figure 5.15: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 50 ppb for a short-term release of 286 m³ of MGO within the inshore part of the operational area.

RPS

5.3 Central Area

This scenario examined a hypothetical release of 286 m^3 of MDO following a vessel collision within the Central region of the Gippsland seismic survey area (Figure 1.1).

Table 5.1 details the maximum distance travelled by oil on the sea surface at each surface oil threshold. A maximum distance of 148 km was calculated for the higher threshold (> 25 g/m^2) with distances increasing with decreasing threshold concentrations.

A summary of shoreline contact to individual receptors is outlined in Table 5.2. Decreased risks of shoreline contact are indicated for this region compared to the inshore region. Shorelines around Point Hicks, Bega Valley, Cape Howe/Mallacouta and the Kent Island Group have low probability (~ 1%) of contact at >25g/m^2. The potential for accumulation of residue (up to 71 m^3) over a long section (26 km) of Flinders Island. Worst-case estimates for around 30 m^3 are calculated for Croajingolong (West) and Kent Island Group.

Figure 5.16 illustrates zones of potential exposure on the sea surface for oil arriving at low (1–10 g/m ^{2}) moderate (10- 25 g/m^2) and high (>25 g/m^2) concentrations.

Figure 5.17 to Figure 5.19 demonstrate the probability that oil could arrive at the low, moderate and high threshold concentrations. Figure 5.20 to Figure 5.21 show the minimum amount of time before oil might reach surrounding locations at these threshold concentrations. These figures indicate that oil residues are more likely to have reduced below 25 g/m^2 before reaching shorelines, with this contact occuriing after travel times of the order of 2 to 4 days.

Figure 5.23 illustrates calculations for the maximum concentrations of oil that could accumulate on shorelines given release in the central zone. These results indicate that the highest concentrations on shorelines will be of the order of < 1 kg/m^2 but could exceed 100 g/m^2 .

The potential distribution of entrained oil, as the maximum possible at locations surrounding the spil sites is illustrated in Figure 5.24 and the risks of exposure calculated for entrained oil for individual receptors are detailed in Table 5.7. These results indicate that concentrations exceeding the lower threshold could occur widely over shorelines east of Wilsons Promontory and as far east as the Bega Valley receptor area. In contrast to the inshore zone, entrained oil could travel in a wider range of directions from thie region, reflecting the increased effect of ocean currents and eddies over the deeper water.

Figure 5.25 to Figure 5.26 illustrate the probability of entrained oil contact above low, moderate and high exposure. These figures illustrate a general trend for entrained oil to drift, more frequently, toward the north-east or south-west but the potential for wide movement around the release site. Consistent with releases from the inshore region, higher probabilities of exposure in shallow coastal waters are shown for waters between Cape Conran and Point Hicks.

Figure 5.27 illustrates calculations for the maximum concentrations of dissolved aromatic hydrocarbons from all of the simulations of spills from this region. This result indicates that aromatic hydrocarbons would more likely occur over the outer shelf waters, following similar trajectories to surface films.

Figure 5.29 to Figure 5.30 illustrates the probability that concentrations of dissolved aromatic hydrocarbons could exceed the low and moderate concentration thresholds. The maximum threshold was not exceeded, except at the release sites.

RPS

5.3.1 Sea Surface Exposure and Shoreline Contact

Table 5.5 Summary of potential zones of sea surface exposure at each surface oil threshold.

Period	Distance and direction	Zones of potential sea surface exposure		
		Low (0.5–10 g/m²)	**Moderate (10–25 g/m²)**	**High (>25 g/m²)**
November to March	Max. distance (km)	220	160	148
	Direction	East	East	Northeast

RPS

Table 5.6: Expected floating oil outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the central part of the operational area.

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Clarke Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Boxen Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Vansittart Island	1	<1	<1	181	NC	NC	1	<1	<1	187	NC	NC	0.2	18	<1	<1	<1	3
East Kangaroo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Big green Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Reef Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Badger Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Cape Barren Osland	1	<1	<1	181	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	3.2	<1	<1	<1	<1
Flinders Island	1	1	1	73	74	74	1	1	1	74	74	74	33	3,289	<1	71	<1	26
Babel Island	1	1	1	70	70	70	1	1	<1	72	96	NC	4.9	491	<1	4	<1	6
Pasco Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	0.1	<1	<1	<1	<1
Pyramid Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Inner Sister Island	1	<1	<1	152	NC	NC	2	<1	<1	276	NC	NC	0.9	89	<1	<1	<1	2
Craggy Island	<1	<1	<1	NC	NC	NC	1	<1	<1	296	NC	NC	0.1	14	<1	<1	<1	<1
Outer Sister Island	1	<1	<1	142	NC	NC	1	<1	<1	143	NC	NC	0.6	63	<1	<1	<1	2
Seal Islands	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Kent Island Group	2	2	2	52	53	53	2	1	1	55	55	55	34	3,296	<1	28	<1	6
Curtis Island	1	<1	<1	204	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Moncoeur Islands	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	0.1	<1	<1	<1	<1
Hogan Island Group	1	<1	<1	77	NC	NC	1	<1	<1	225	NC	NC	0.1	14	<1	<1	<1	2
Rodondo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Glennie Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Norman Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Anser Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kanowna Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Skull Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Martins Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gabo Island	3	1	<1	103	107	NC	3	2	1	105	105	118	13	1,025	<1	9	<1	4
South Gippsland	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	0.3	<1	<1	<1	3
Wellington	1	<1	<1	272	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	4.8	<1	<1	<1	2
Bega Valley	3	1	1	58	61	80	4	2	<1	59	61	NC	7	663	<1	10	<1	9
Eurobodalla	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Shoal Haven	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Cape Howe / Mallacoota	3	1	1	85	85	87	2	2	<1	111	112	NC	5.8	404	<1	4	<1	9
Croajingolong (East)	2	1	<1	108	108	NC	2	1	<1	110	111	NC	4.7	470	<1	4	<1	8
Croajingolong (West)	3	1	1	72	94	95	3	2	1	94	95	118	23	1,786	<1	28	<1	13
Point Hicks	4	2	1	70	79	79	2	2	<1	89	89	NC	7.8	539	<1	7	<1	10
Sydenham Inlet	2	<1	<1	93	NC	NC	2	1	<1	94	101	NC	2.7	273	<1	7	<1	16
Cape Conran	1	<1	<1	79	NC	NC	1	1	<1	82	183	NC	2.1	213	<1	2	<1	6
Marlo	2	<1	<1	79	NC	NC	1	1	<1	101	108	NC	5.7	570	<1	14	<1	18
Corringle	1	<1	<1	206	NC	NC	1	<1	<1	215	NC	NC	0.5	52	<1	<1	<1	12
Lake Tyers Beach	1	<1	<1	210	NC	NC	1	1	<1	222	222	NC	3.3	328	<1	8	<1	20
Lakes Entrance	1	<1	<1	191	NC	NC	1	<1	<1	191	NC	NC	0.2	18	<1	<1	<1	8
Lakes Entrance (West)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Ocean Grange	1	<1	<1	272	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	4.8	<1	<1	<1	2
Golden Beach	1	<1	<1	285	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Seaspray	1	<1	<1	284	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Woodside Beach	1	<1	<1	283	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
McLoughlins Beach	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clonmel Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Snake Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Port Welshpool	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Wilsons Promontory (NE)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Wilsons Promontory (East)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	0.3	<1	<1	<1	3
Wilsons Promontory (West)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Tasmania State Waters*	3	2	2	46	53	53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Victoria State Waters*	7	2	2	31	33	33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New South Wales*	4	2	2	44	55	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Australian Exclusive Economic Zone*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cutter Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endeavour Reef*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wright Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wakitipu Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Warrego Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Zealand Star Bank*	2	<1	<1	88	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef*	1	<1	<1	70	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef Marine Sanctuary*	1	<1	<1	70	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
East Gippsland AMP*	1	<1	<1	193	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flinders AMP*	1	1	1	114	114	123	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Freycinet AMP*	1	<1	<1	256	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beagle AMP*	3	2	2	39	39	39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Batemans Bay Marine Park	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	<1	<1	NC	NC
Murramarang Sanctuary Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tomaga River Habitat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wallaga Lake Entrance Habitiat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	<1	<1	NC	NC
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
North Head Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Gippsland Lakes	<1	<1	<1	NC	NC	NC	1	1	<1	191	222	NC	1.8	180	<1	2	<1	8
Seamounts South and east of Tasmania*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upwelling East of Eden	12	7	5	1	1	1	4	2	1	60	61	118	23	1,786	<1	10	<1	6
Big Horseshoe Canyon*	3	2	1	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Canyons on the eastern continental slope*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shelf rocky reefs*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antipodean Albatross - Foraging*	10	7	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-browed Albatross - Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bullers Albatross - Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Campbell Albatross - Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flesh-footed Shearwater - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Great-winged Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark – Foraging*	3	1	1	56	57	61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark - Migration*	3	2	1	49	51	51	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indo-Pacific/Spotted Bottlenose Dolphin – Breeding*	4	2	2	44	55	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indian Yellow-nosed Albatross - Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Foraging*	4	2	1	37	44	52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Breeding*	1	<1	<1	142	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northern Giant Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Foraging*	3	2	1	58	59	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Foraging*	12	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Breeding*	1	<1	<1	142	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shy Albatross – Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Southern Giant Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Foraging*	5	3	2	28	31	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wandering Albatross - Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Foraging*	8	3	2	8	8	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Distribution*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Breeding*	5	2	1	34	34	34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wilsons Storm Petrel - Migration*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Breeding*	2	1	1	142	147	148	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Foraging*	10	7	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-fronted Tern - Foraging	1	1	<1	101	121	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Foraging*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-capped Albatross - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Humpback Whale – Foraging*	4	2	2	37	38	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale – Migration*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale - Connecting Habitat*	1	1	1	69	69	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Distribution*	14	7	5	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold.
* Floating oil will not accumulate on submerged features and at open ocean locations. NA: Not applicable.

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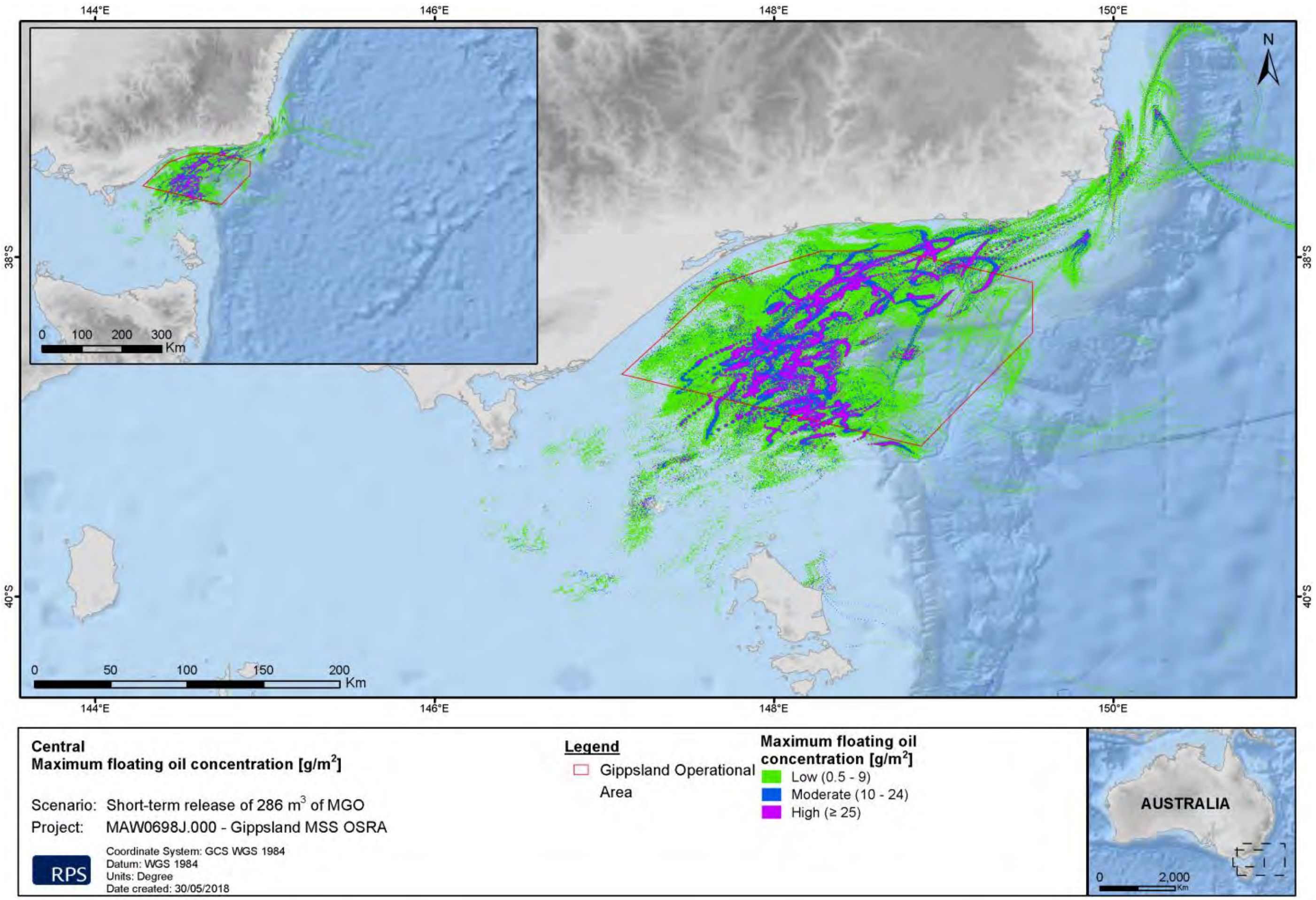

Figure 5.16: Predicted maximum of floating oil concentration for a short-term release of 286 m³ of MGO within the central part of the operational area.

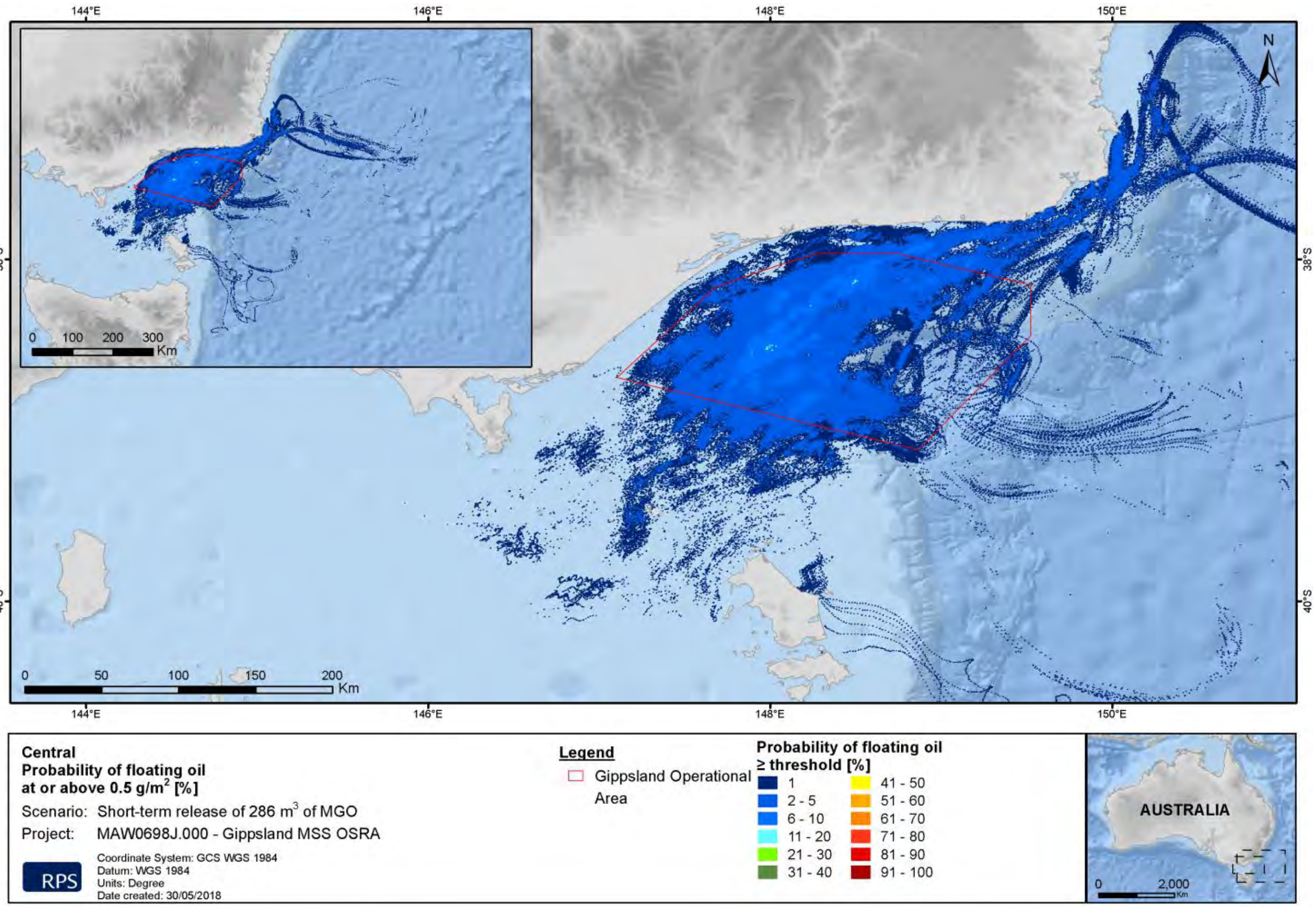

Figure 5.17: Predicted probability of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

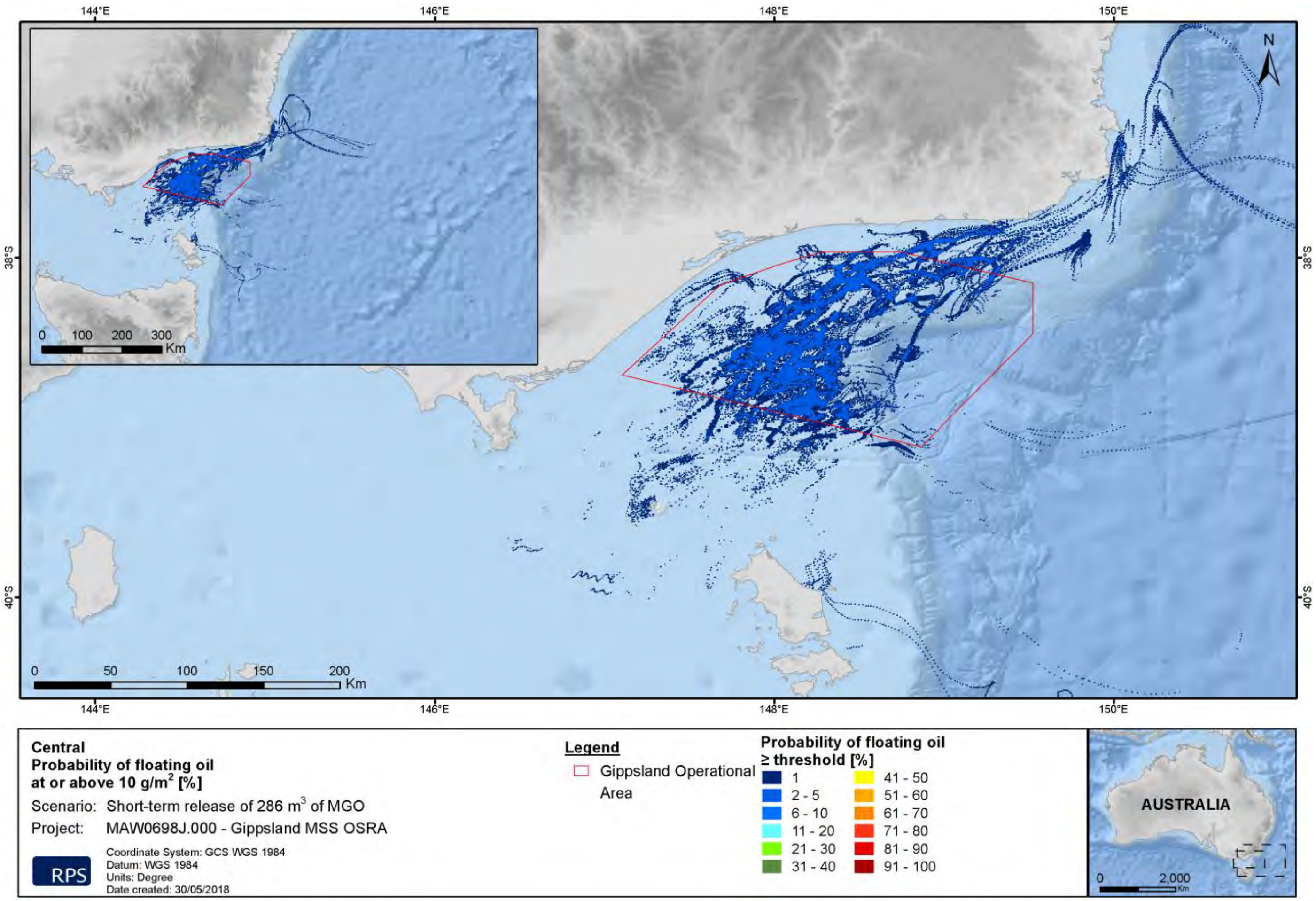

Figure 5.18: Predicted probability of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

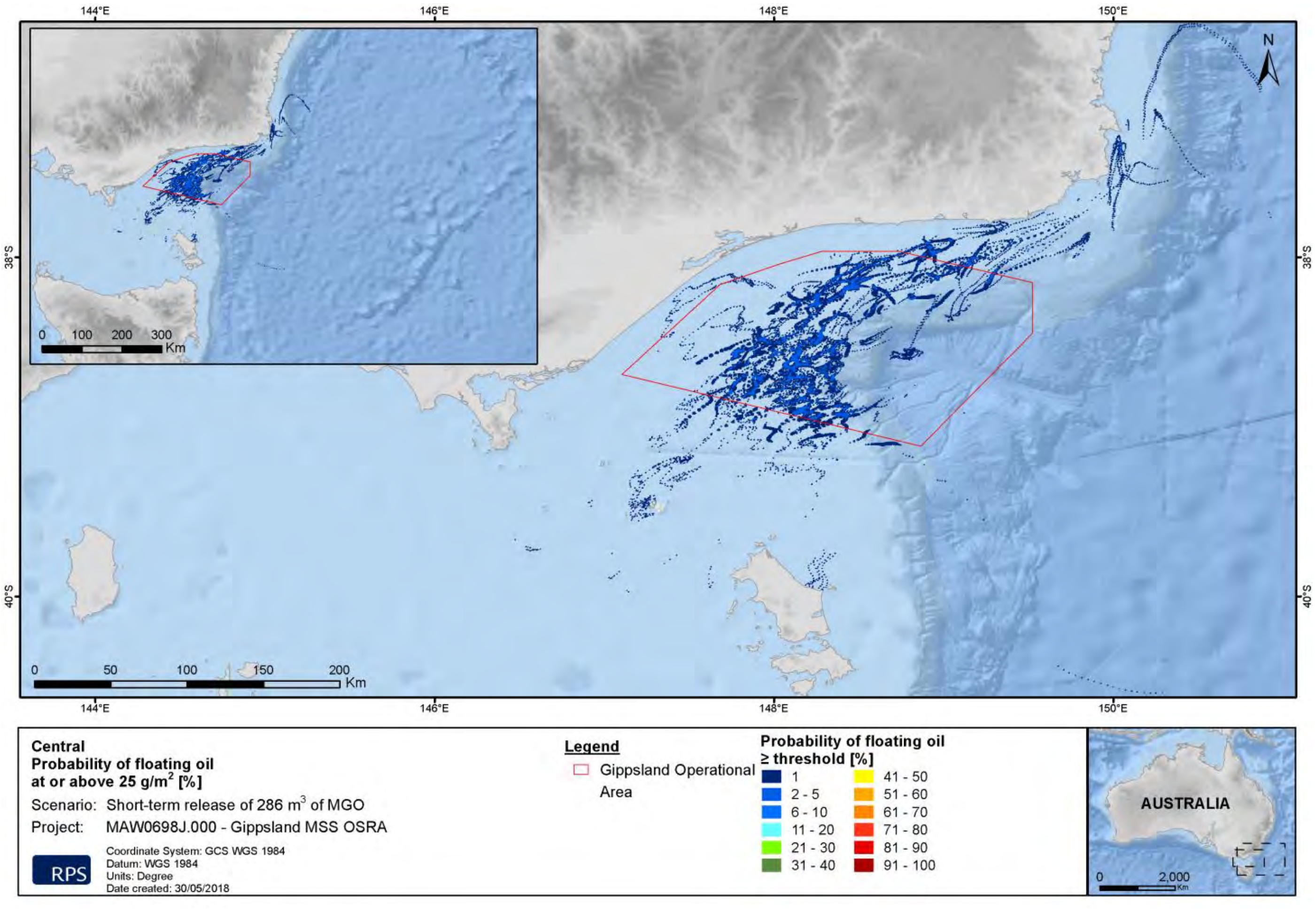

Figure 5.19: Predicted probability of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

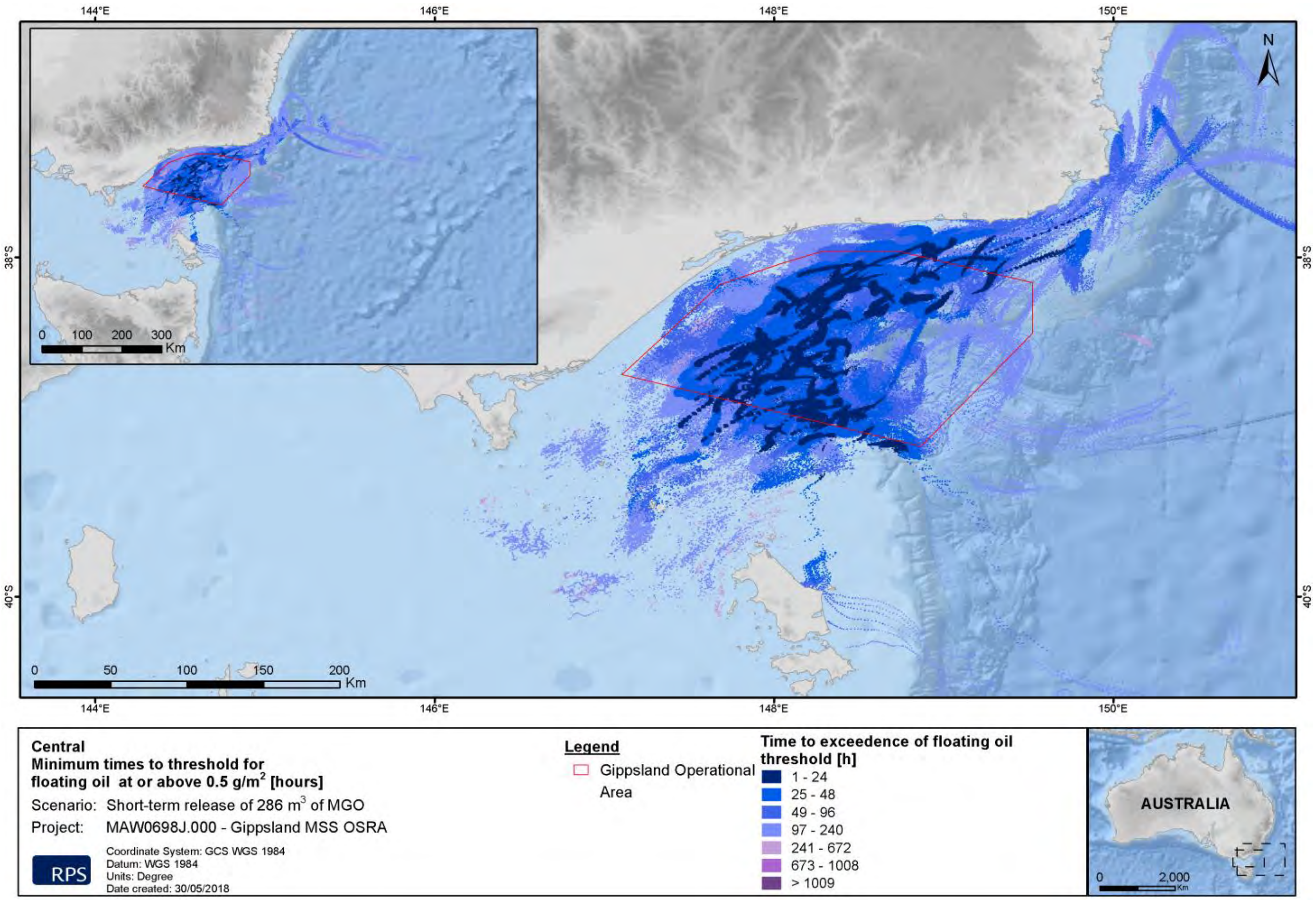

Figure 5.20: Predicted minimum time of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

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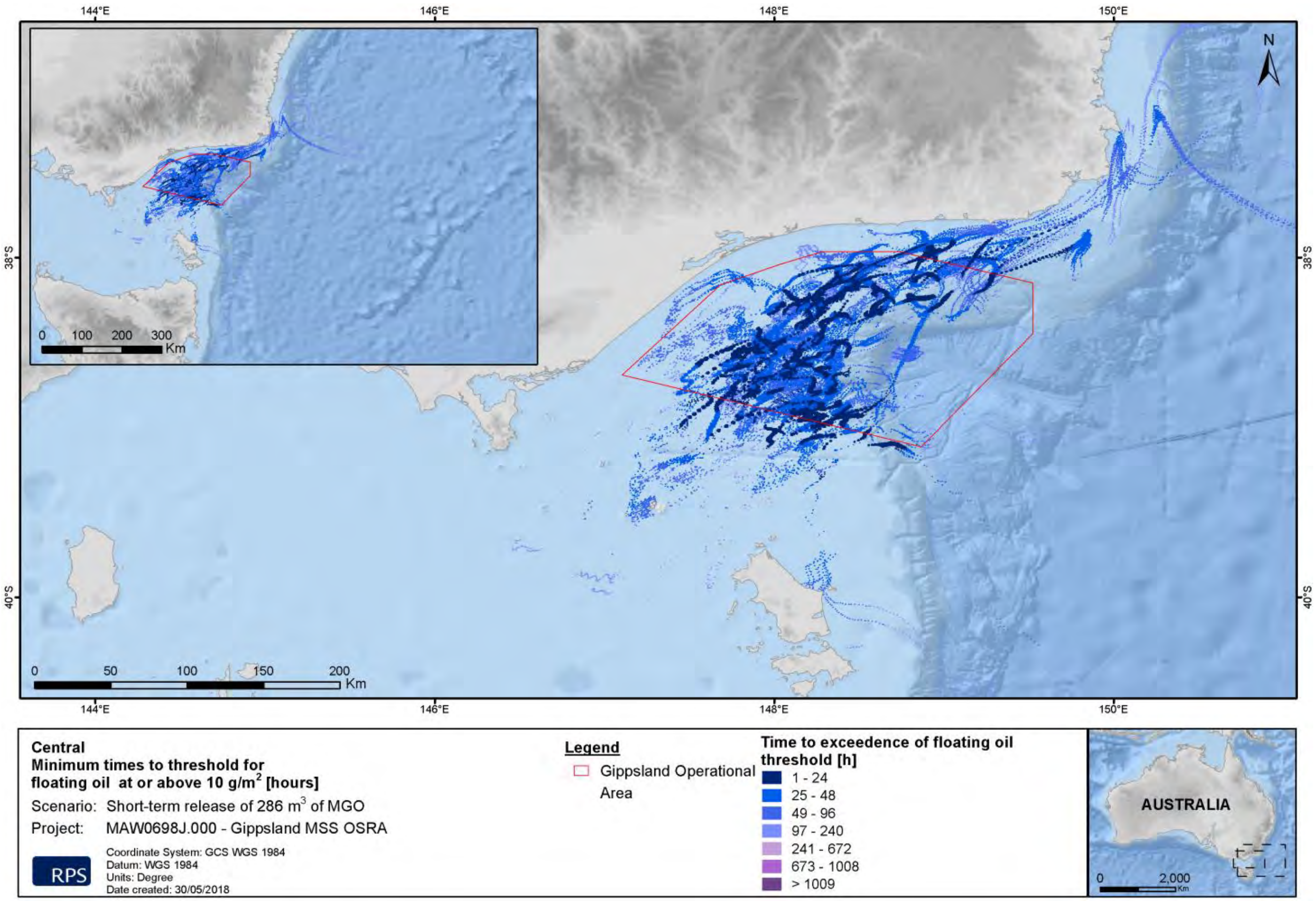

Figure 5.21: Predicted minimum time of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

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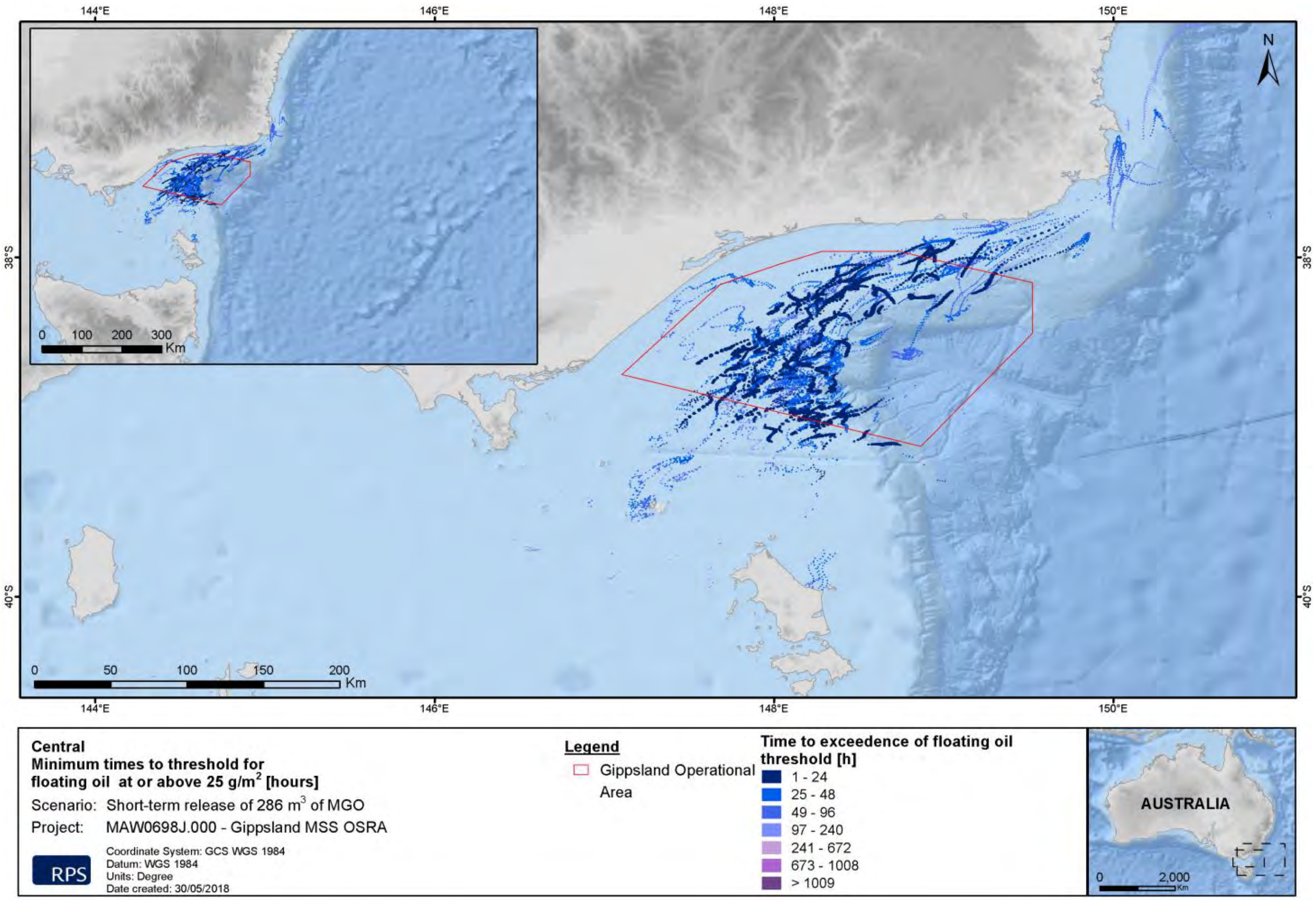

Figure 5.22: Predicted minimum time of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the central part of the operational area.

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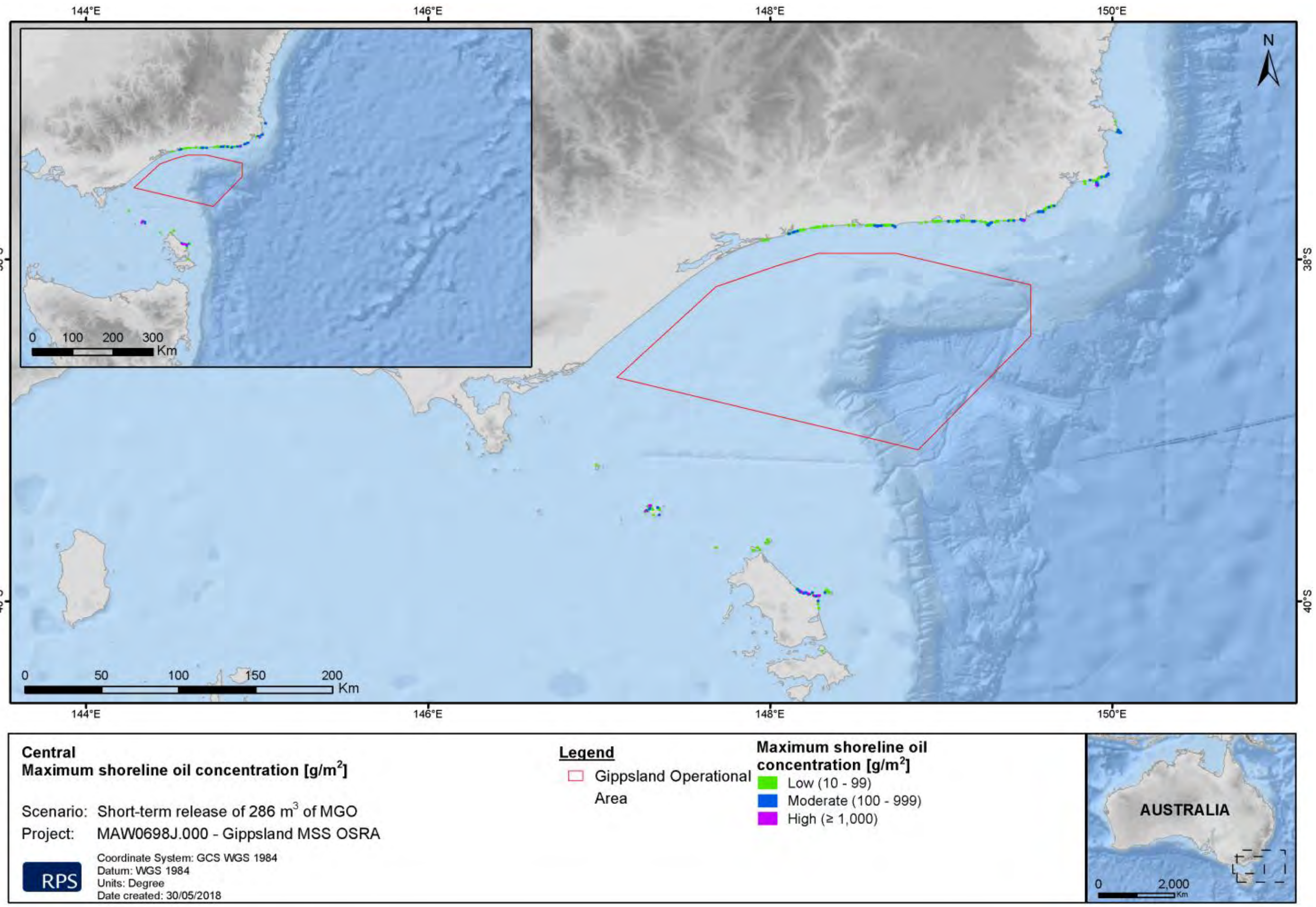

Figure 5.23: Predicted maximum of shoreline oil concentration for a short-term release of 286 m³ of MGO within the central part of the operational area.

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5.3.2 Instantaneous Entrained Oil

Table 5.7: Expected entrained oil outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the central part of the operational area.

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	<1	2
Clarke Island	1	<1	<1	310	NC	NC	<1	37
Boxen Island	<1	<1	<1	NC	NC	NC	<1	<1
Mount Chappell Island	<1	<1	<1	NC	NC	NC	<1	<1
Vansittart Island	1	1	<1	98	99	NC	3	211
East Kangaroo Island	<1	<1	<1	NC	NC	NC	<1	<1
Big green Island	<1	<1	<1	NC	NC	NC	<1	2
Reef Island	<1	<1	<1	NC	NC	NC	<1	<1
Prime Seal Island	2	1	<1	286	309	NC	3	251
Badger Island	<1	<1	<1	NC	NC	NC	<1	<1
Cape Barren Osland	1	1	<1	104	250	NC	2	111
Flinders Island	4	1	1	75	77	81	14	1,302
Babel Island	1	1	1	71	73	74	13	1,291
Pasco Group	2	<1	<1	274	NC	NC	2	72
Pyramid Island	4	2	<1	189	191	NC	4	263
Inner Sister Island	5	3	1	135	136	313	10	606
Craggy Island	8	2	1	117	118	123	10	703
Outer Sister Island	7	4	<1	128	137	NC	8	427
Seal Islands	1	<1	<1	278	NC	NC	<1	41
Kent Island Group	8	4	2	48	48	49	27	1,862
Curtis Island	7	2	<1	198	206	NC	5	215
Moncoeur Islands	2	<1	<1	298	NC	NC	2	100
Hogan Island Group	8	7	1	73	81	198	13	632
Rodondo Island	2	1	<1	302	308	NC	3	142
Glennie Group	1	<1	<1	315	NC	NC	<1	23
Norman Island	<1	<1	<1	NC	NC	NC	NC	NC
Montague Island	<1	<1	<1	NC	NC	NC	NC	NC
Anser Island	1	1	<1	309	310	NC	2	150

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Kanowna Island	1	1	<1	309	310	NC	3	220
Skull Rock	1	1	<1	310	311	NC	3	220
Martins Island	<1	<1	<1	NC	NC	NC	NC	NC
Gabo Island	12	5	1	99	105	116	14	534
South Gippsland	2	<1	<1	286	NC	NC	<1	94
Wellington	2	1	<1	260	291	NC	2	147
Bega Valley	9	3	1	57	59	235	11	616
Eurobodalla	<1	<1	<1	NC	NC	NC	NC	NC
Shoal Haven	<1	<1	<1	NC	NC	NC	NC	NC
Cape Howe / Mallacoota	11	5	<1	62	62	NC	11	343
Croajingolong (East)	11	3	<1	75	125	NC	9	330
Croajingolong (West)	14	8	1	63	66	112	18	612
Point Hicks	11	7	1	69	79	95	16	659
Sydenham Inlet	8	3	1	87	91	116	9	717
Cape Conran	5	1	<1	110	162	NC	4	204
Marlo	4	2	<1	112	127	NC	4	259
Corringle	4	1	<1	164	271	NC	2	110
Lake Tyers Beach	3	<1	<1	204	NC	NC	2	75
Lakes Entrance	2	<1	<1	188	NC	NC	<1	41
Lakes Entrance (West)	1	<1	<1	260	NC	NC	<1	42
Ocean Grange	1	<1	<1	264	NC	NC	2	100
Golden Beach	1	<1	<1	268	NC	NC	<1	76
Seaspray	1	1	<1	273	296	NC	2	121
Woodside Beach	1	<1	<1	275	NC	NC	<1	78
McLoughlins Beach	2	<1	<1	271	NC	NC	2	72
Clonmel Island	2	1	<1	272	291	NC	2	135
Snake Island	2	1	<1	282	319	NC	2	147
Port Welshpool	<1	<1	<1	NC	NC	NC	<1	3
Corner Inlet	2	<1	<1	296	NC	NC	<1	39
Wilsons Promontory (NE)	2	<1	<1	286	NC	NC	<1	56
Wilsons Promontory (East)	2	<1	<1	293	NC	NC	<1	85

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	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Wilsons Promontory (West)	1	<1	<1	308	NC	NC	<1	94
Tasmania State Waters	9	7	2	46	46	47	27	2,038
Victoria State Waters	21	11	3	30	31	33	38	2,282
New South Wales	12	8	2	43	44	46	33	1,504
Australian Exclusive Economic Zone	28	13	5	1	1	1	182	16,515
Cutter Rock	2	<1	<1	222	NC	NC	<1	32
Endeavour Reef	8	1	<1	152	174	NC	7	228
Wright Rock	8	3	<1	134	135	NC	7	288
Wakitipu Rock	5	1	<1	172	181	NC	4	117
Warrego Rock	8	2	<1	155	156	NC	6	169
New Zealand Star Bank	21	9	3	20	41	43	32	1,586
Beware Reef	3	<1	<1	161	NC	NC	2	66
Beware Reef Marine Sanctuary	3	<1	<1	161	NC	NC	2	66
East Gippsland AMP	8	2	1	176	178	232	7	533
Flinders AMP	3	2	1	110	111	113	11	1,004
Freycinet AMP	1	<1	<1	336	NC	NC	<1	36
Beagle AMP	12	8	2	36	36	37	36	3,107
Batemans Bay Marine Park	<1	<1	<1	NC	NC	NC	NC	NC
Murramarang Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Montague Island Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
North Head Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Cornler Inlet Marine National Park	1	<1	<1	298	NC	NC	<1	20
Corner Inlet	2	1	<1	274	292	NC	2	147
Gippsland Lakes	2	<1	<1	204	NC	NC	<1	37
Seamounts South and east of Tasmania	<1	<1	<1	NC	NC	NC	<1	<1
Upwelling East of Eden	26	13	4	1	1	1	110	8,666
Big Horseshoe Canyon	14	4	1	4	4	4	22	1,486
Canyons on the eastern continental slope	1	1	<1	306	314	NC	2	154
Shelf rocky reefs	<1	<1	<1	NC	NC	NC	<1	<1

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Antipodean Albatross - Foraging	26	13	4	1	1	1	110	8,666
Black Petrel - Foraging	2	1	<1	177	311	NC	4	310
Black-browed Albatross - Foraging	28	13	5	1	1	1	182	16,515
Black-faced Cormorant - Foraging	2	1	<1	114	248	NC	3	251
Crested Tern - Breeding	<1	<1	<1	NC	NC	NC	NC	NC
Crested Tern - Foraging	1	1	<1	322	327	NC	2	119
Bullers Albatross - Foraging	28	13	5	1	1	1	182	16,515
Campbell Albatross - Foraging	28	13	5	1	1	1	182	16,515
Flesh-footed Shearwater - Foraging	2	1	<1	177	311	NC	4	310
Great-winged Petrel - Foraging	2	1	<1	177	311	NC	4	310
Grey Nurse Shark - Foraging	9	4	1	55	56	62	11	669
Grey Nurse Shark - Migration	12	5	1	47	49	49	15	986
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	13	8	2	43	44	46	33	1,504
Indian Yellow-nosed Albatross - Foraging	28	13	5	1	1	1	182	16,515
Little Penguin - Foraging	20	10	3	28	36	38	45	2,058
Little Penguin - Breeding	5	1	<1	137	298	NC	4	118
Northern Giant Petrel - Foraging	2	1	<1	177	311	NC	4	310
Sooty Shearwater - Breeding	<1	<1	<1	NC	NC	NC	NC	NC

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Sooty Shearwater - Foraging	9	5	1	57	58	60	12	763
Short-tailed Shearwater - Foraging	28	13	5	1	1	1	182	16,515
Short-tailed Shearwater - Breeding	8	4	<1	82	141	NC	10	386
Shy Albatross - Foraging	28	13	5	1	1	1	182	16,515
Wedge-tailed Shearwater - Breeding	<1	<1	<1	NC	NC	NC	NC	NC
Southern Giant Petrel - Foraging	2	1	<1	177	311	NC	4	310
Wedge-tailed Shearwater - Foraging	20	10	3	26	27	27	45	2,058
Wandering Albatross - Foraging	28	13	5	1	1	1	182	16,515
White Shark - Foraging	26	12	4	8	8	8	56	4,140
White Shark - Distribution	28	13	5	1	1	1	182	16,515
White Shark - Breeding	12	3	1	33	35	37	18	1,627
Wilsons Storm Petrel - Migration	2	1	<1	177	311	NC	4	310
Black-faced Cormorant - Breeding	1	<1	<1	308	NC	NC	<1	13
White-faced Storm-petrel - Breeding	4	3	1	139	145	155	9	672
White-faced Storm-petrel - Foraging	26	13	5	1	1	1	182	16,515
Common Diving-petrel - Breeding	7	1	<1	189	331	NC	4	157
Common Diving-petrel - Foraging	28	13	5	1	1	1	182	16,515
White-fronted Tern - Foraging	2	1	<1	84	86	NC	4	381
Pygmy Blue Whale - Foraging	28	13	5	1	1	1	182	16,515

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
White-capped Albatross - Foraging	2	1	<1	177	311	NC	4	310
Humpback Whale - Foraging	16	8	2	37	38	39	31	2,003
Southern Right Whale - Migration	28	13	5	1	1	1	182	16,515
Southern Right Whale - Connecting Habitat	7	4	1	71	73	74	14	1,302
Pygmy Blue Whale - Distribution	28	13	5	1	1	1	182	16,515

NC: No contact to receptor predicted for specified threshold

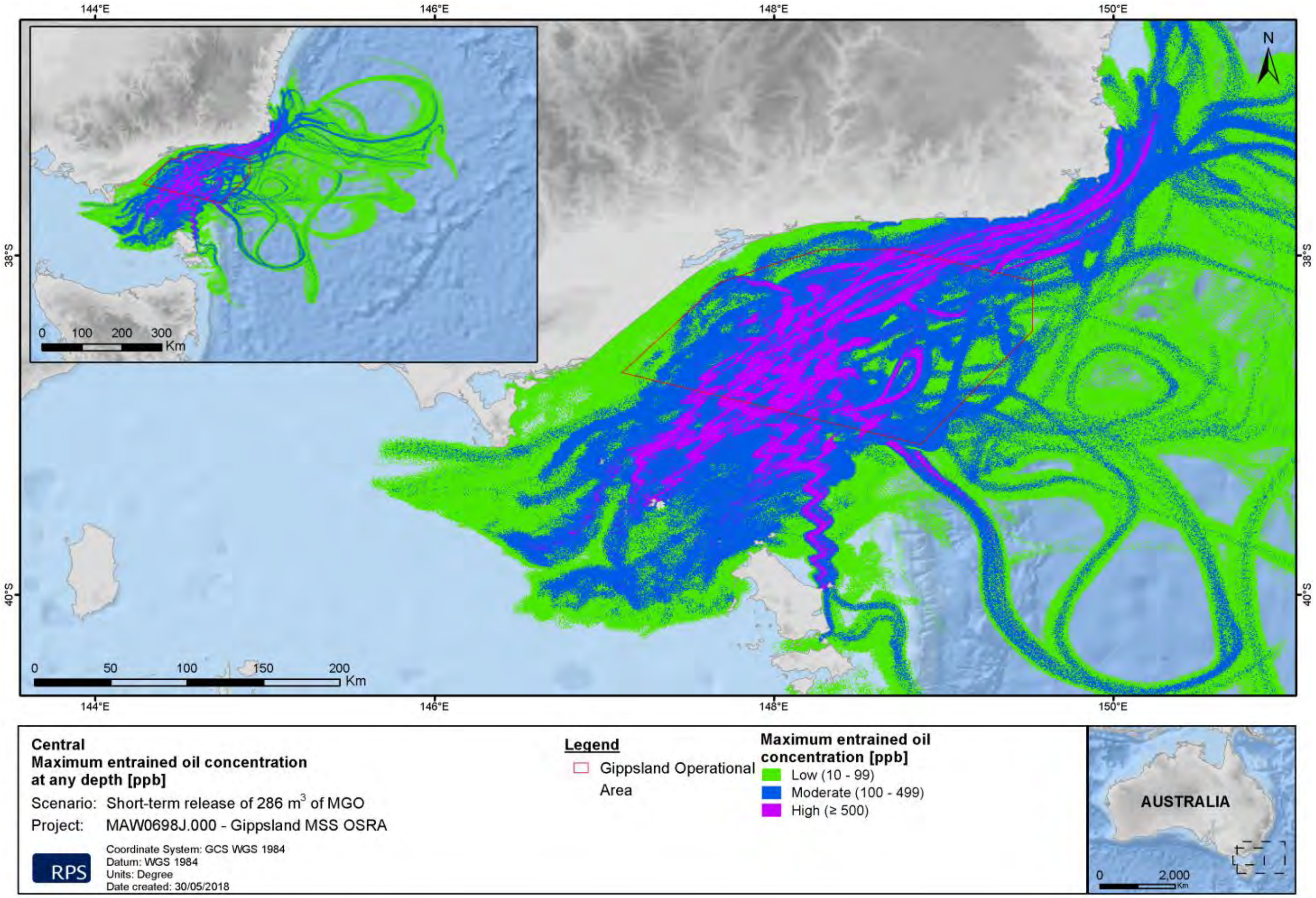

Figure 5.24: Predicted maximum of entrained oil concentration for a short-term release of 286 m³ of MGO within the central part of the operational area.

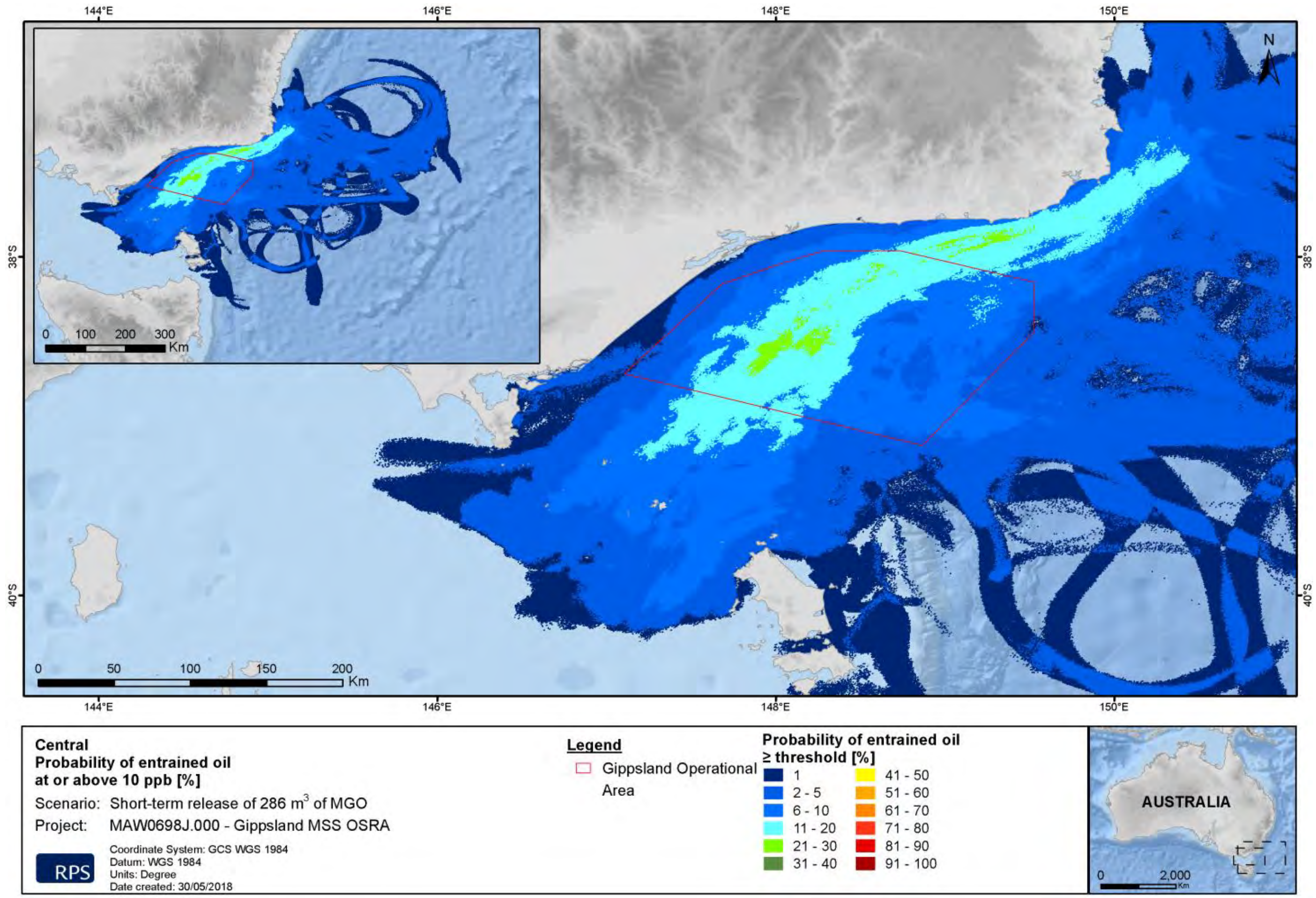

Figure 5.25: Predicted probability of entrained oil concentration at or above 10 ppb for a short-term release of 286 m³ of MGO within the central part of the operational area.

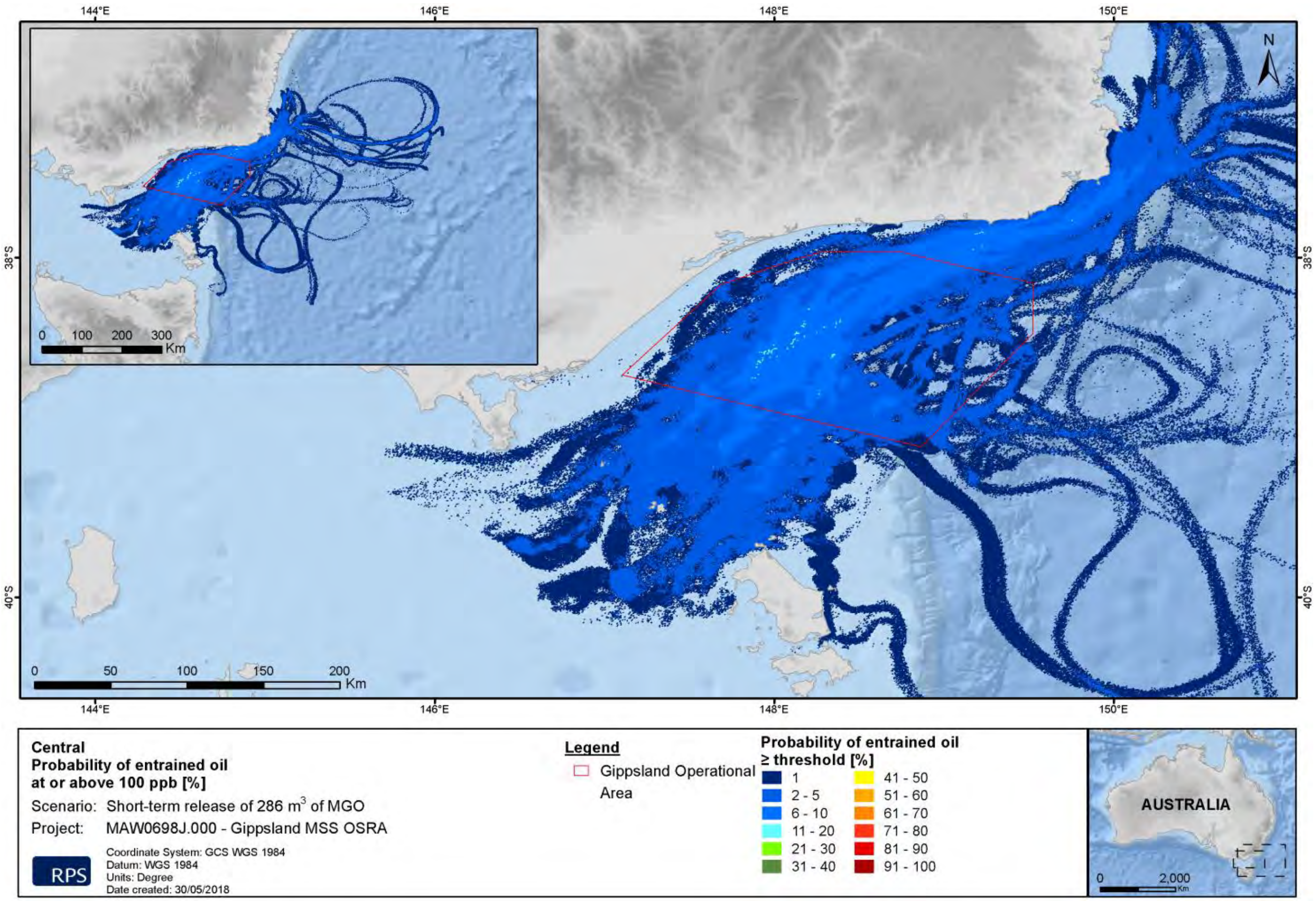

Figure 5.26: Predicted probability of entrained oil concentration at or above 100 ppb for a short-term release of 286 m³ of MGO within the central part of the operational area.

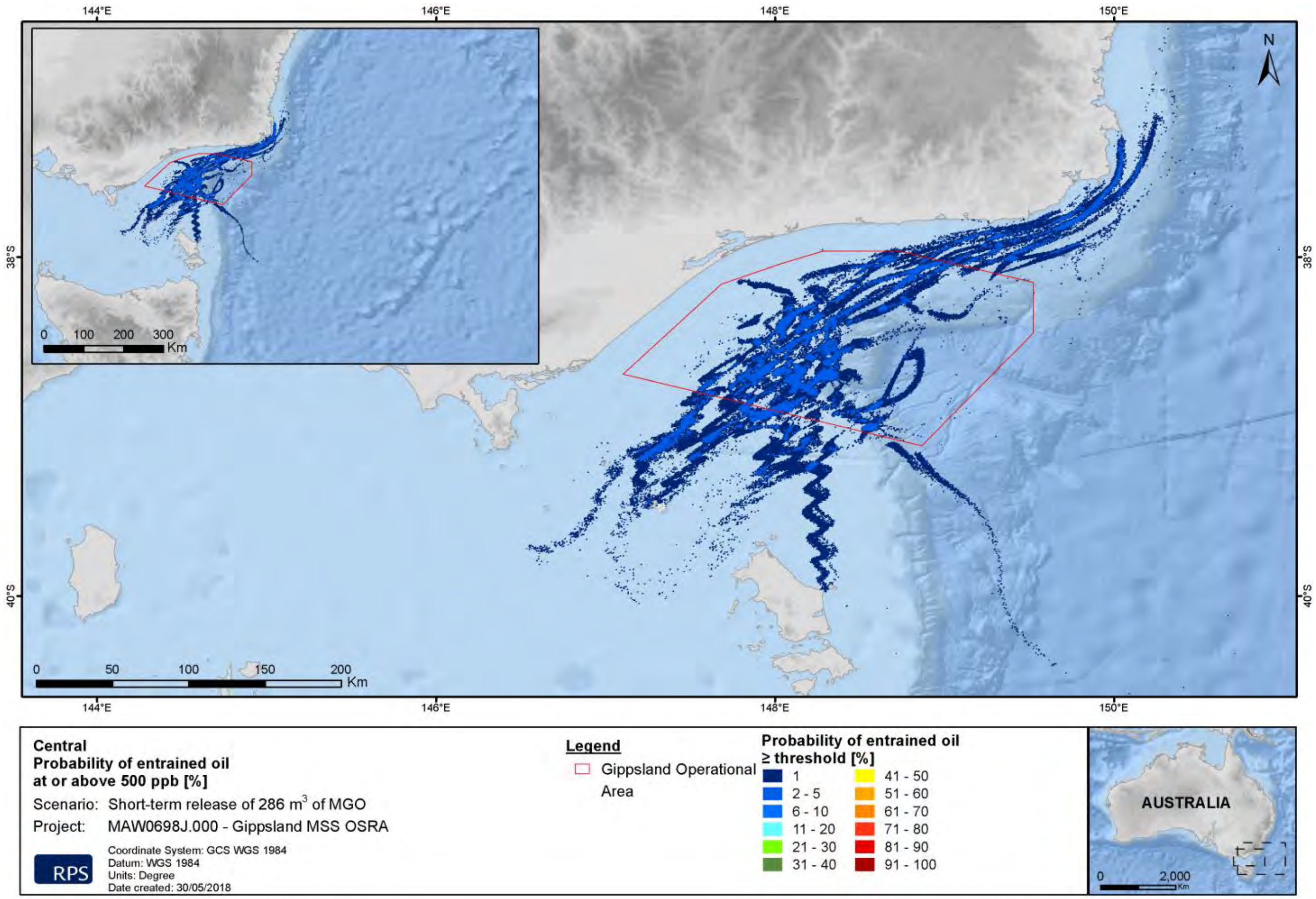

Figure 5.27: Predicted probability of entrained oil concentration at or above 500 ppb for a short-term release of 286 m³ of MGO within the central part of the operational area.

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5.3.3 Instantaneous Dissolved Aromatic Hydrocarbon

Table 5.8: Expected dissolved aromatic hydrocarbon outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the central part of the operational area.

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Preservation Island	<1	<1	<1	<1	<1
Clarke Island	<1	<1	<1	<1	<1
Boxen Island	<1	<1	<1	NC	NC
Mount Chappell Island	<1	<1	<1	<1	<1
Vansittart Island	1	<1	<1	<1	19
East Kangaroo Island	<1	<1	<1	<1	<1
Big green Island	<1	<1	<1	<1	<1
Reef Island	<1	<1	<1	<1	<1
Prime Seal Island	<1	<1	<1	<1	<1
Badger Island	<1	<1	<1	<1	<1
Cape Barren Osland	<1	<1	<1	<1	6
Flinders Island	2	<1	<1	<1	19
Babel Island	1	1	<1	<1	51
Pasco Group	<1	<1	<1	<1	2
Pyramid Island	<1	<1	<1	<1	2
Inner Sister Island	2	<1	<1	<1	26
Craggy Island	1	<1	<1	<1	10
Outer Sister Island	2	<1	<1	<1	12
Seal Islands	<1	<1	<1	<1	<1
Kent Island Group	2	<1	<1	<1	46
Curtis Island	1	<1	<1	<1	12
Moncoeur Islands	<1	<1	<1	<1	3
Hogan Island Group	1	<1	<1	<1	23
Rodondo Island	1	<1	<1	<1	9
Glennie Group	<1	<1	<1	<1	<1
Norman Island	<1	<1	<1	NC	NC
Montague Island	<1	<1	<1	NC	NC
Anser Island	<1	<1	<1	<1	<1
Kanowna Island	<1	<1	<1	<1	<1
Skull Rock	<1	<1	<1	<1	<1
Martins Island	<1	<1	<1	NC	NC
Gabo Island	2	<1	<1	<1	18
South Gippsland	<1	<1	<1	<1	<1
Wellington	1	<1	<1	<1	20

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	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Bega Valley	1	<1	<1	<1	16
Eurobodalla	<1	<1	<1	NC	NC
Shoal Haven	<1	<1	<1	NC	NC
Cape Howe / Mallacoota	1	<1	<1	<1	11
Croajingolong (East)	1	<1	<1	<1	9
Croajingolong (West)	2	<1	<1	<1	31
Point Hicks	1	<1	<1	<1	20
Sydenham Inlet	2	<1	<1	<1	25
Cape Conran	1	<1	<1	<1	9
Marlo	1	<1	<1	<1	7
Corringle	<1	<1	<1	<1	2
Lake Tyers Beach	<1	<1	<1	<1	<1
Lakes Entrance	<1	<1	<1	<1	<1
Lakes Entrance (West)	<1	<1	<1	<1	<1
Ocean Grange	<1	<1	<1	<1	<1
Golden Beach	<1	<1	<1	<1	<1
Seaspray	<1	<1	<1	<1	2
Woodside Beach	<1	<1	<1	<1	6
McLoughlins Beach	1	<1	<1	<1	20
Clonmel Island	1	<1	<1	<1	8
Snake Island	<1	<1	<1	<1	<1
Port Welshpool	<1	<1	<1	<1	<1
Corner Inlet	<1	<1	<1	<1	<1
Wilsons Promontory (NE)	<1	<1	<1	<1	<1
Wilsons Promontory (East)	<1	<1	<1	<1	<1
Wilsons Promontory (West)	<1	<1	<1	<1	<1
Tasmania State Waters	2	1	<1	<1	90
Victoria State Waters	4	1	<1	2	61
New South Wales	2	1	<1	<1	83
Australian Exclusive Economic Zone	10	2	<1	4	231
Cutter Rock	<1	<1	<1	<1	<1
Endeavour Reef	<1	<1	<1	<1	2
Wright Rock	<1	<1	<1	<1	2
Wakitipu Rock	<1	<1	<1	<1	2
Warrego Rock	1	<1	<1	<1	14
New Zealand Star Bank	4	<1	<1	<1	33
Beware Reef	<1	<1	<1	<1	5
Beware Reef Marine Sanctuary	1	<1	<1	<1	7

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
East Gippsland AMP	2	<1	<1	<1	15
Flinders AMP	2	<1	<1	<1	29
Freycinet AMP	<1	<1	<1	<1	<1
Beagle AMP	3	1	<1	<1	57
Batemans Bay Marine Park	<1	<1	<1	<1	<1
Murramarang Sanctuary Zone	<1	<1	<1	NC	NC
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	NC	NC
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC
Montague Island Habitat Protection Zone	<1	<1	<1	<1	<1
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC
North Head Sanctuary Zone	<1	<1	<1	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	<1	<1
Corner Inlet	1	<1	<1	<1	16
Gippsland Lakes	<1	<1	<1	<1	<1
Seamounts South and east of Tasmania	<1	<1	<1	<1	<1
Upwelling East of Eden	8	2	<1	3	231
Big Horseshoe Canyon	2	1	<1	2	93
Canyons on the eastern continental slope	<1	<1	<1	<1	2
Shelf rocky reefs	<1	<1	<1	<1	<1
Antipodean Albatross - Foraging	8	2	<1	3	231

RPS

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Black Petrel - Foraging	<1	<1	<1	<1	3
Black-browed Albatross - Foraging	10	2	<1	4	231
Black-faced Cormorant - Foraging	<1	<1	<1	<1	2
Crested Tern - Breeding	<1	<1	<1	<1	<1
Crested Tern - Foraging	<1	<1	<1	<1	2
Bullers Albatross - Foraging	10	2	<1	4	215
Campbell Albatross - Foraging	10	2	<1	4	231
Flesh-footed Shearwater - Foraging	<1	<1	<1	<1	3
Great-winged Petrel - Foraging	<1	<1	<1	<1	3
Grey Nurse Shark - Foraging	1	<1	<1	<1	19
Grey Nurse Shark - Migration	3	1	<1	<1	54
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	3	1	<1	2	83
Indian Yellow-nosed Albatross - Foraging	10	2	<1	4	231
Little Penguin - Foraging	7	1	<1	2	90
Little Penguin - Breeding	<1	<1	<1	<1	2
Northern Giant Petrel - Foraging	<1	<1	<1	<1	3
Sooty Shearwater - Breeding	<1	<1	<1	NC	NC
Sooty Shearwater - Foraging	1	<1	<1	<1	18
Short-tailed Shearwater - Foraging	10	2	<1	4	215
Short-tailed Shearwater - Breeding	1	<1	<1	<1	7
Shy Albatross - Foraging	10	2	<1	4	231
Wedge-tailed Shearwater - Breeding	<1	<1	<1	NC	NC
Southern Giant Petrel - Foraging	<1	<1	<1	<1	3
Wedge-tailed Shearwater - Foraging	7	2	<1	2	119
Wandering Albatross - Foraging	10	2	<1	4	231
White Shark - Foraging	7	2	<1	3	231
White Shark - Distribution	10	2	<1	4	231
White Shark - Breeding	2	<1	<1	<1	32
Wilsons Storm Petrel - Migration	<1	<1	<1	<1	3
Black-faced Cormorant - Breeding	<1	<1	<1	<1	<1
White-faced Storm-petrel - Breeding	1	<1	<1	<1	8
White-faced Storm-petrel - Foraging	8	2	<1	3	231
Common Diving-petrel - Breeding	<1	<1	<1	<1	<1
Common Diving-petrel - Foraging	10	2	<1	4	215
White-fronted Tern - Foraging	1	<1	<1	<1	20

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Pygmy Blue Whale - Foraging	10	2	<1	4	231
White-capped Albatross - Foraging	<1	<1	<1	<1	3
Humpback Whale - Foraging	4	2	<1	2	119
Southern Right Whale - Migration	10	2	<1	4	231
Southern Right Whale - Connecting Habitat	2	<1	<1	<1	40
Pygmy Blue Whale - Distribution	10	2	<1	4	231

NC: No contact to receptor predicted for specified threshold

RPS

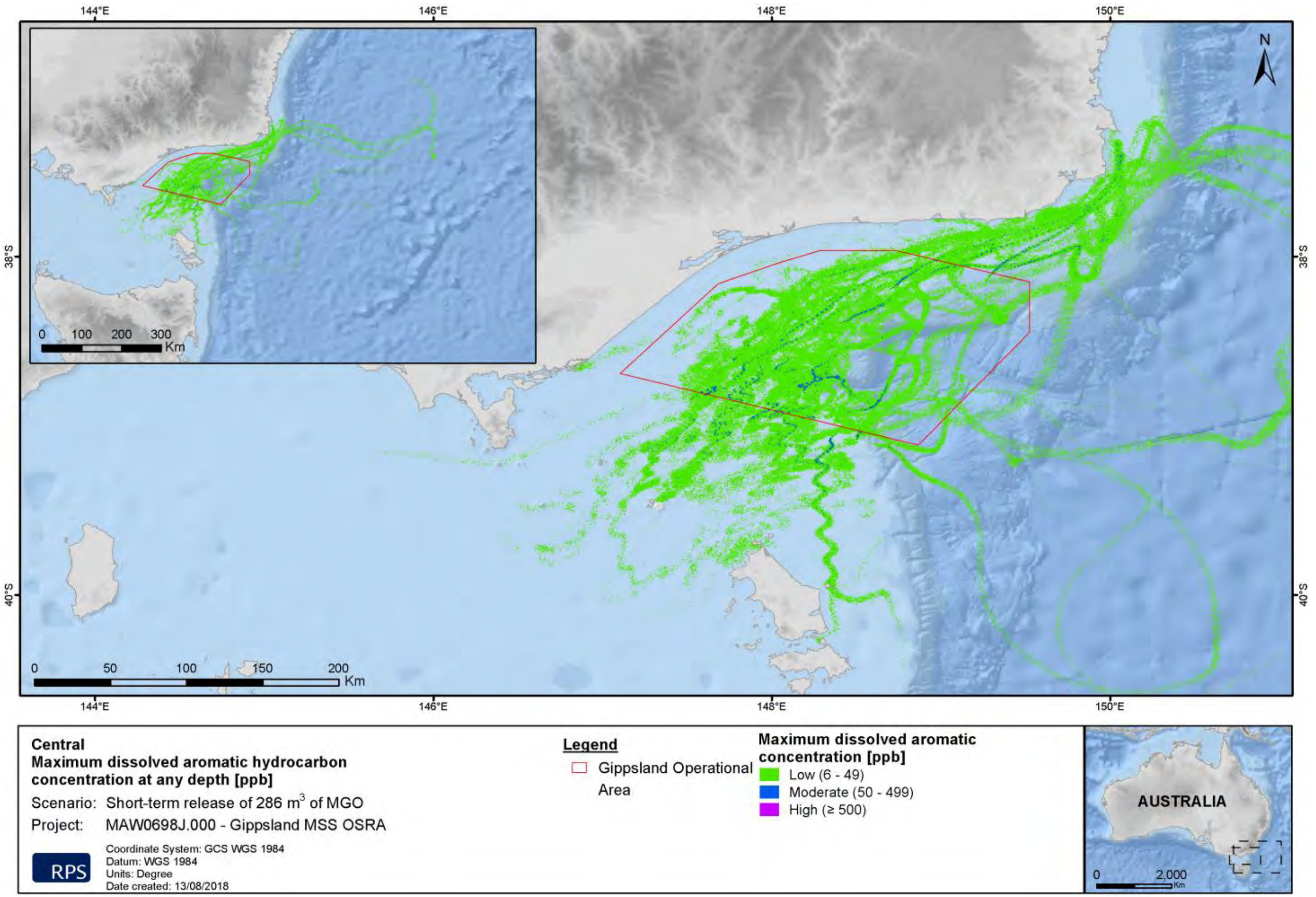

Figure 5.28: Predicted maximum of dissolved aromatic hydrocarbon concentration for a short-term release of 286 m³ of MGO within the central part of the operational area.

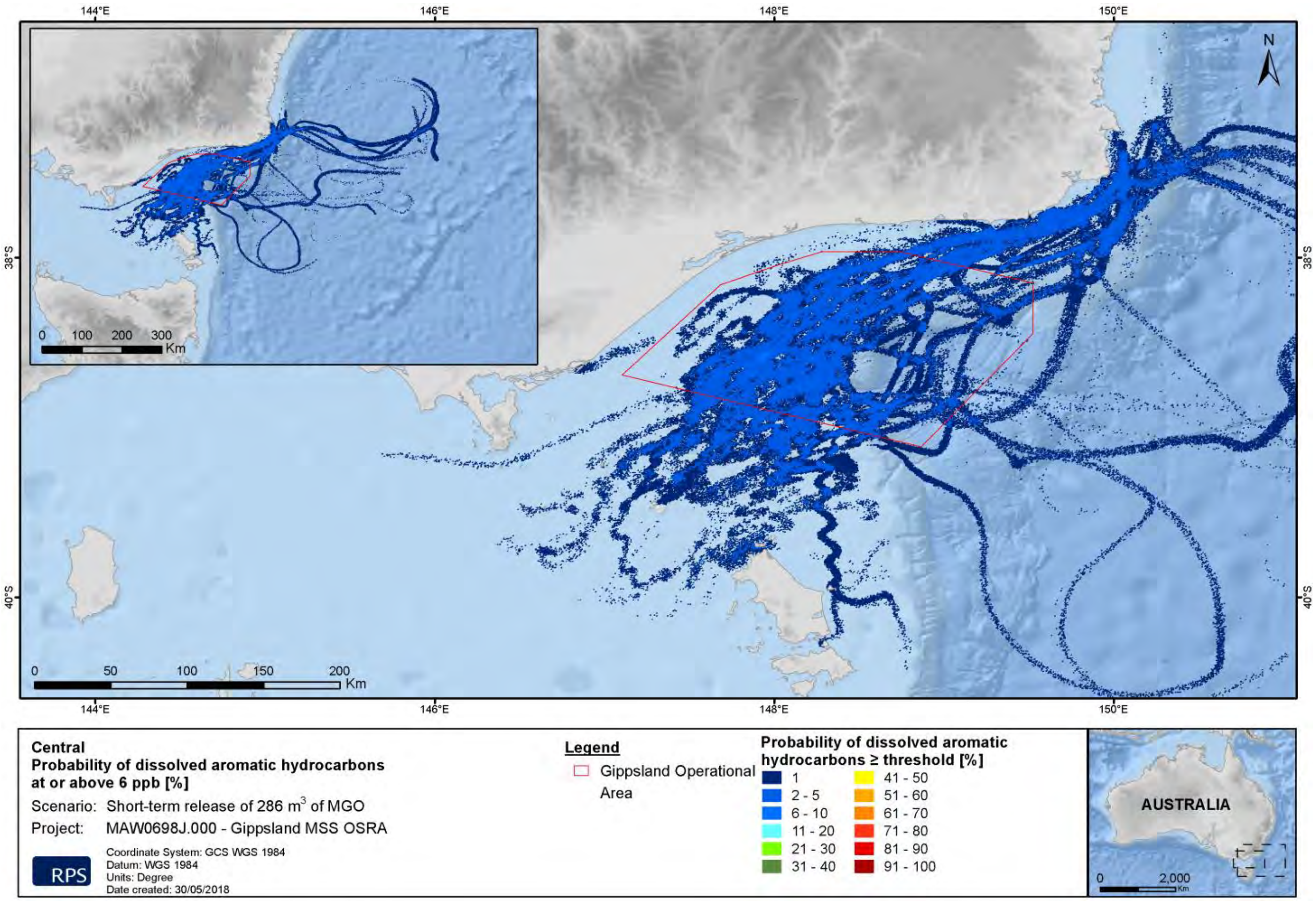

Figure 5.29: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 6 ppb for a short-term release of 286 m³ of MGO within the central part of the operational area.

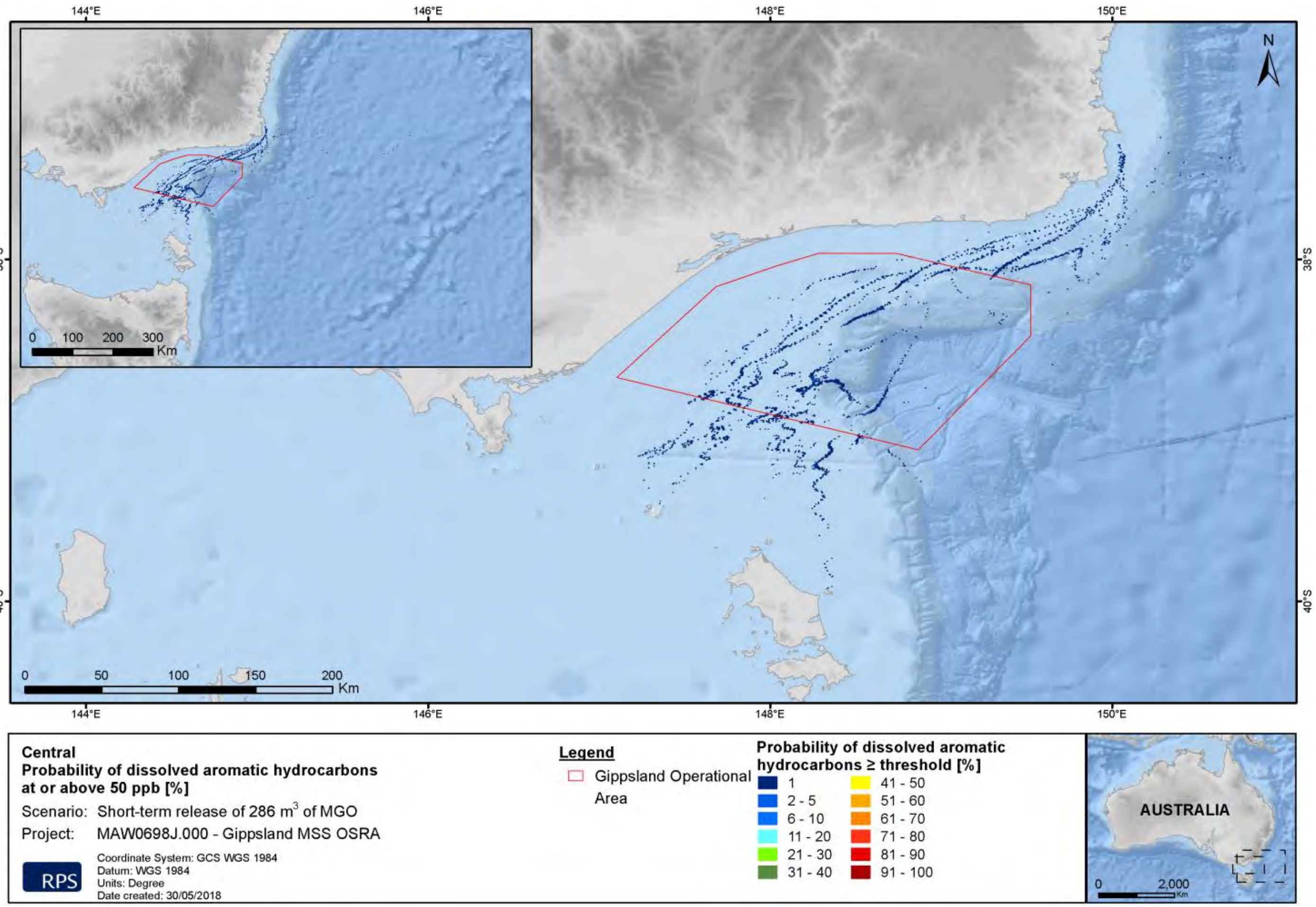

Figure 5.30: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 50 ppb for a short-term release of 286 m³ of MGO within the central part of the operational area.

RPS

5.4 Offshore Area

This scenario examined a hypothetical release of 286 m^3 of MDO following a vessel collision within the Offshore region of the Gippsland seismic survey area (Figure 1.1).

Table 5.9 details the maximum distance travelled by oil on the sea surface at each surface oil threshold. The maximum calculated distances from the source point in any simulation for the low, moderate and high concentration thresholds are 240 km, 190 km and 180 km.

Table 5.10 provides a summary of floating oil contact to all receptors. Floating oil was predicted to contact many Biologically Important Areas, due to the operational area overlapping these regions. The maximum probability forecast at this areas is 17%.

A summary of shoreline contact to individual receptors is outlined in Table 5.10. Contact with any shorelines is unlikely (<1%) at concentrations > 10 g/m^2 and $\leq$ 1% at > 0.5 g/m^2).

Accumulation of residues is indicated as possible on some shoreline sections of the mainland and surrounding islands, with the worst case of the order of 10 m^3 spread over a 30 km section of shoreline.

Figure 5.31 illustrates zones of potential exposure on the sea surface for low (1–10 g/m ^{2}) moderate (10- 25 g/m^2) and high (>25 g/m^2).

Figure 5.32 toFigure 5.34 demonstrates the probability of oil exposure on the sea surface above low, moderate and high exposure while Figure 5.35 to Figure 5.37 show the minimum amount of time before oil exposure reaches the sea surface.

Figure 5.38 to illustrates zones of potential shoreline oil exposure for low (10 -100 g/m ^{2}) moderate (100-1,000 g/m^2) and high (>1,000 g/m^2).

Figure 5.39 illustrates the highest concentrations of entrained oil that were calculated for each of the simulations to indicate the maximum trajectories as entrained oil above the defined thresholds.

The probability that entrained oil could arrive at surrounding locations at the low, moderate and high thresholds is illustrated in Figure 5.40 to Figure 5.42.

Figure 5.43 illustrates the distribution of the maximum concentrations of dissolved aromatic hydrocarbons calculated from all simulations of discharge from the offshore zone. This figure illustrates that the highest concentrations should be directed into deeper ocean locations.

The probability that dissolved aromatic hydrocarbons could arrive at surrounding locations at the low, and moderate concentration thresholds is shown in Figure 5.44 to Figure 5.45. The High Concentration threshold was not exceeded.

5.4.1 Sea Surface Exposure and Shoreline Contact

Table 5.9 Summary of potential zones of sea surface exposure at each surface oil threshold.

Period	Distance and direction	Zones of potential sea surface exposure		
		Low (0.5–10 g/m^2)	**Moderate (10–25 g/m^2)**	**High (>25 g/m^2)**
November to March	Max. distance (km)	240	190	180
	Direction	Southeast	East	Southeast

RPS

Table 5.10: Expected floating oil outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Clarke Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Boxen Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Vansittart Island	1	<1	<1	181	NC	NC	1	<1	<1	181	NC	NC	0.1	14	1	1	<1	8
East Kangaroo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Big green Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Reef Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	NC	NC	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Badger Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cape Barren Osland	2	<1	<1	201	NC	NC	1	<1	<1	209	NC	NC	0.3	26	<1	<1	<1	<1
Flinders Island	1	1	1	142	142	144	1	1	<1	145	145	NC	8.8	876	<1	8	<1	5
Babel Island	1	<1	<1	130	NC	NC	1	<1	<1	131	NC	NC	1	96	<1	<1	<1	<1
Pasco Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Pyramid Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Inner Sister Island	1	<1	<1	110	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Craggy Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Outer Sister Island	1	<1	<1	106	NC	NC	1	<1	<1	120	NC	NC	0.5	53	<1	<1	<1	<1
Seal Islands	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Kent Island Group	1	<1	<1	137	NC	NC	1	1	<1	154	177	NC	1.8	185	<1	3	<1	8
Curtis Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Moncoeur Islands	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Hogan Island Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Rodondo Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Glennie Group	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Norman Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montague Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	1.9	<1	<1	<1	<1
Anser Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kanowna Island*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Skull Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Martins Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gabo Island	1	<1	<1	154	NC	NC	1	<1	<1	171	NC	NC	1	98	<1	<1	<1	3
South Gippsland	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Wellington	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Bega Valley	1	<1	<1	162	NC	NC	1	1	<1	169	171	NC	2.3	233	<1	3	<1	4
Eurobodalla	1	<1	<1	322	NC	NC	1	<1	<1	325	NC	NC	0.2	20	<1	<1	<1	4

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Shoal Haven	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cape Howe / Mallacoota	2	1	<1	152	191	NC	1	1	<1	168	192	NC	3.1	307	<1	2	<1	5
Croajingolong (East)	1	<1	<1	194	NC	NC	1	<1	<1	195	NC	NC	0.1	12	<1	<1	<1	2
Croajingolong (West)	2	<1	<1	98	NC	NC	2	1	<1	102	102	NC	2.9	289	<1	5	<1	9
Point Hicks	2	<1	<1	116	NC	NC	1	<1	<1	140	NC	NC	0.4	40	<1	<1	<1	7
Sydenham Inlet	1	<1	<1	152	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	2.5	<1	<1	<1	8
Cape Conran	1	<1	<1	182	NC	NC	1	<1	<1	185	NC	NC	0.7	73	<1	<1	<1	7
Marlo	1	<1	<1	185	NC	NC	1	1	<1	205	210	NC	1.4	136	<1	2	<1	11
Corringle	1	<1	<1	192	NC	NC	1	1	<1	195	198	NC	2	196	<1	9	<1	18
Lake Tyers Beach	1	<1	<1	195	NC	NC	1	<1	<1	200	NC	NC	0.6	57	<1	<1	<1	<1
Lakes Entrance	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Lakes Entrance (West)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Ocean Grange	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Golden Beach	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Seaspray	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Woodside Beach	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
McLoughlins Beach	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clonmel Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Snake Island	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Port Welshpool	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Wilsons Promontory (NE)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Wilsons Promontory (East)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Wilsons Promontory (West)	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tasmania State Waters*	2	1	1	106	106	131	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Victoria State Waters*	2	1	<1	73	89	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New South Wales*	1	<1	<1	142	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Australian Exclusive Economic Zone*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cutter Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endeavour Reef*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wright Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wakitipu Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Warrego Rock*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Zealand Star Bank*	2	<1	<1	56	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef*	1	<1	<1	166	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beware Reef Marine Sanctuary*	1	<1	<1	166	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
East Gippsland AMP*	3	2	2	15	15	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Flinders AMP*	3	2	1	86	90	90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Freycinet AMP*	1	<1	<1	145	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beagle AMP*	1	<1	<1	132	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Batemans Bay Marine Park	1	<1	<1	315	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	1.4	<1	<1	<1	2
Murramarang Sanctuary Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tomaga River Habitat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wallaga Lake Entrance Habitiat Protection Zone*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	6.2	<1	<1	<1	2
Brou Beach Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Montague Island South Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Mullimburra South Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Montague Island Habitat Protection Zone	1	<1	<1	321	NC	NC	1	<1	<1	325	NC	NC	0.2	20	<1	<1	<1	<1
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
North Head Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gippsland Lakes	<1	<1	<1	NC	NC	NC	<1	<1	<1	NC	NC	NC	<0.1	<0.1	<1	<1	NC	NC
Seamounts South and east of Tasmania*	1	<1	<1	239	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upwelling East of Eden	8	4	4	1	1	1	1	1	<1	103	109	NC	2.3	233	<1	3	<1	6

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Big Horseshoe Canyon*	8	4	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Canyons on the eastern continental slope*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shelf rocky reefs*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antipodean Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black Petrel - Foraging*	1	<1	<1	264	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-browed Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Foraging*	2	<1	<1	196	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crested Tern – Foraging*	1	<1	<1	266	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bullers Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Campbell Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flesh-footed Shearwater - Foraging*	1	<1	<1	264	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Great-winged Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark – Foraging*	1	<1	<1	179	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grey Nurse Shark - Migration*	1	1	<1	130	130	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indo-Pacific/Spotted Bottlenose Dolphin – Breeding*	1	<1	<1	142	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indian Yellow-nosed Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Foraging*	3	1	1	106	106	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Penguin – Breeding*	1	<1	<1	113	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northern Giant Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sooty Shearwater – Foraging*	3	2	1	63	64	65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Foraging*	9	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Short-tailed Shearwater – Breeding*	1	<1	<1	113	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shy Albatross – Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

RPS

	Probability (%) of films arriving at receptors			Minimum time to receptor (hours)			Probability (%) of shoreline oil			Minimum time to receptor (hours) for shoreline oil			Maximum local accumulated concentration (g/m²)		Maximum accumulated volume (m³) along this shoreline		Maximum length of shoreline (km)	
	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 0.5 g/m²	≥ 10 g/m²	≥ 25 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	Mean	Peak
Southern Giant Petrel - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wedge-tailed Shearwater – Foraging*	4	2	1	49	51	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wandering Albatross - Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Foraging*	7	3	2	20	20	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Distribution*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White Shark – Breeding*	1	<1	<1	167	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wilsons Storm Petrel - Migration*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Black-faced Cormorant – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Breeding*	1	<1	<1	238	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-faced Storm-petrel – Foraging*	8	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Breeding*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Common Diving-petrel – Foraging*	10	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-fronted Tern - Foraging	2	1	<1	153	185	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Foraging*	8	5	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
White-capped Albatross - Foraging*	<1	<1	<1	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Humpback Whale – Foraging*	3	2	1	52	54	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale – Migration*	8	4	3	2	2	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southern Right Whale - Connecting Habitat*	2	1	1	106	137	137	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pygmy Blue Whale – Distribution*	8	4	4	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold.
* Floating oil will not accumulate on submerged features and at open ocean locations. NA: Not applicable.

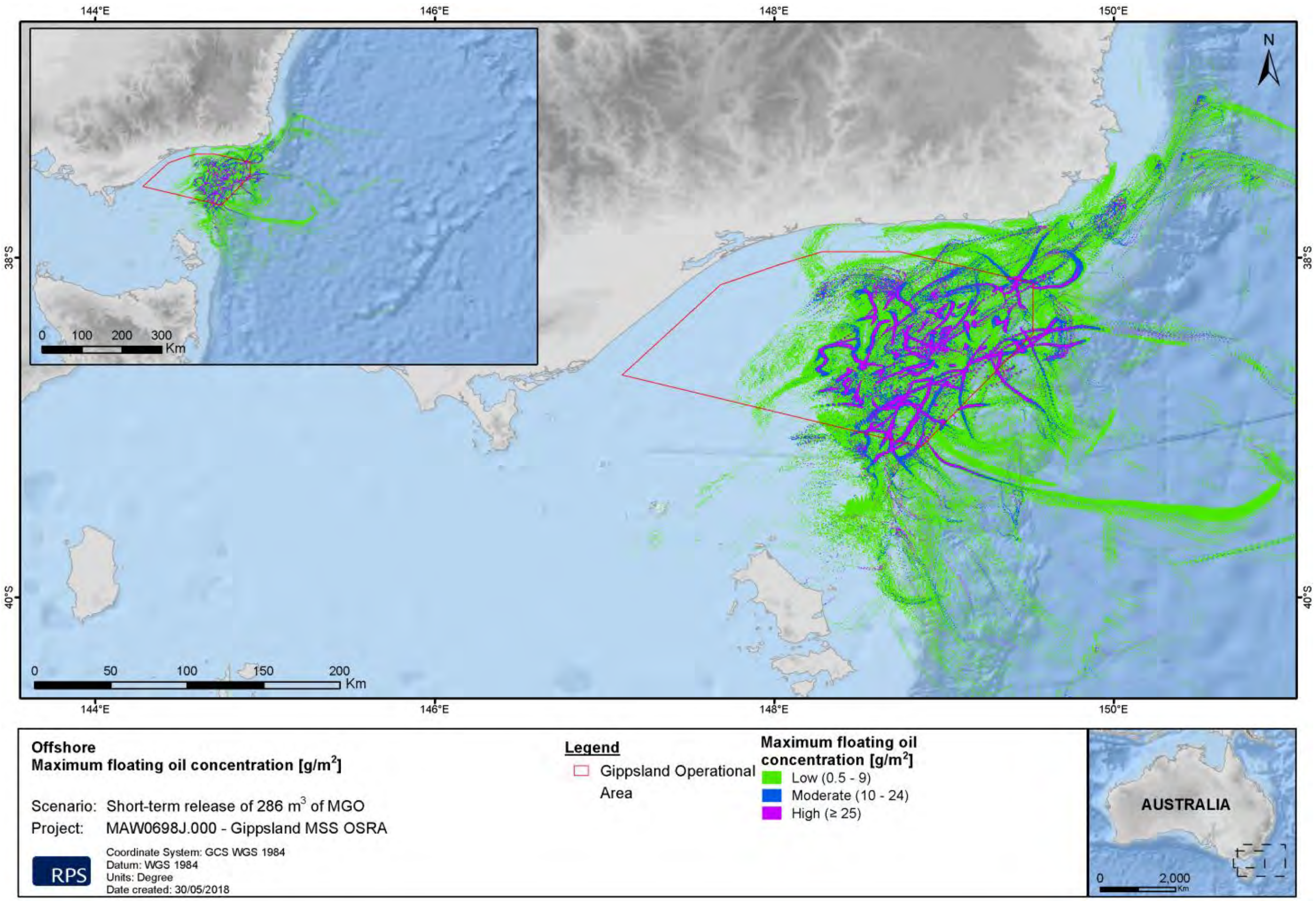

Figure 5.31: Predicted maximum of floating oil concentration for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

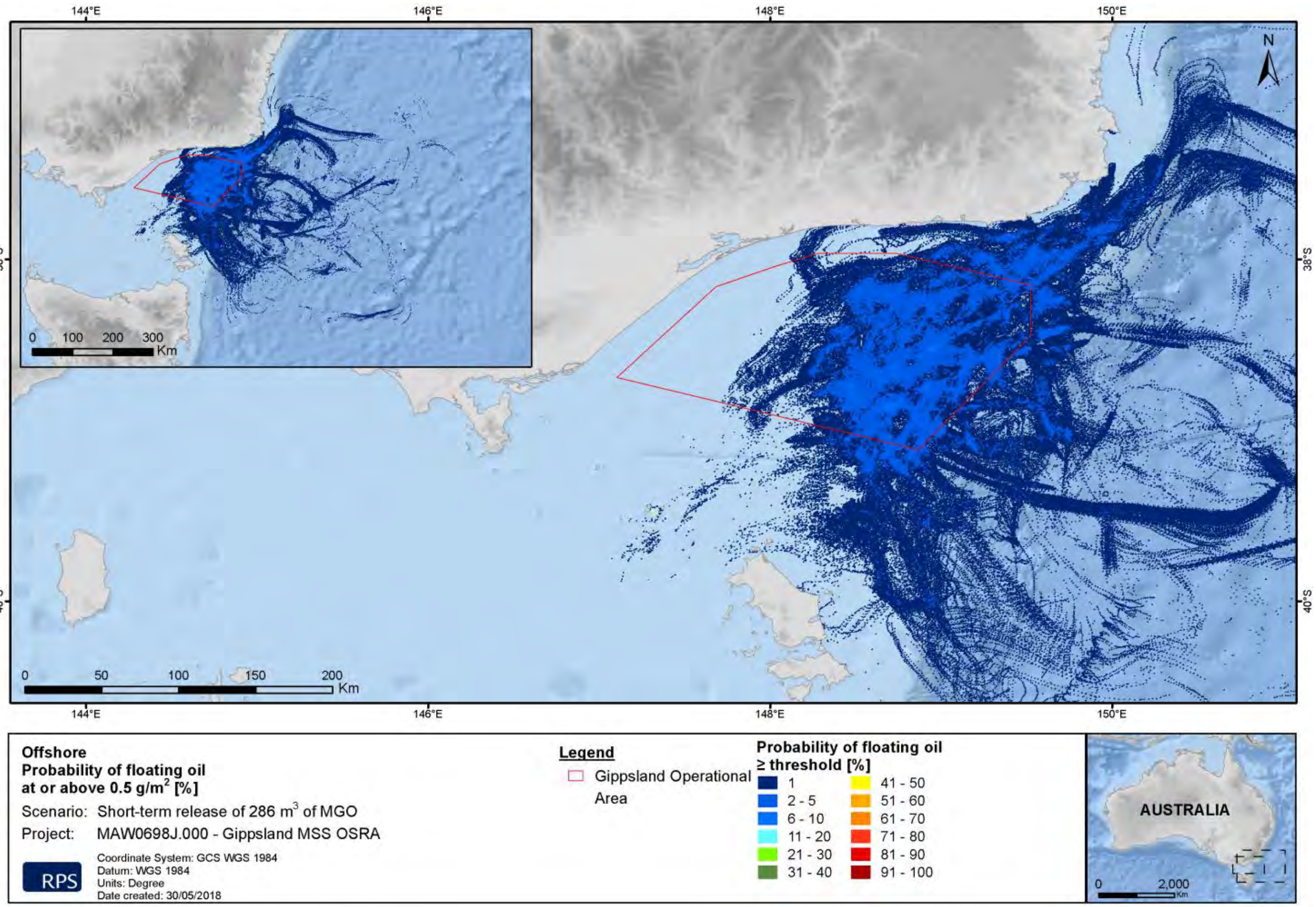

Figure 5.32: Predicted probability of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

RPS

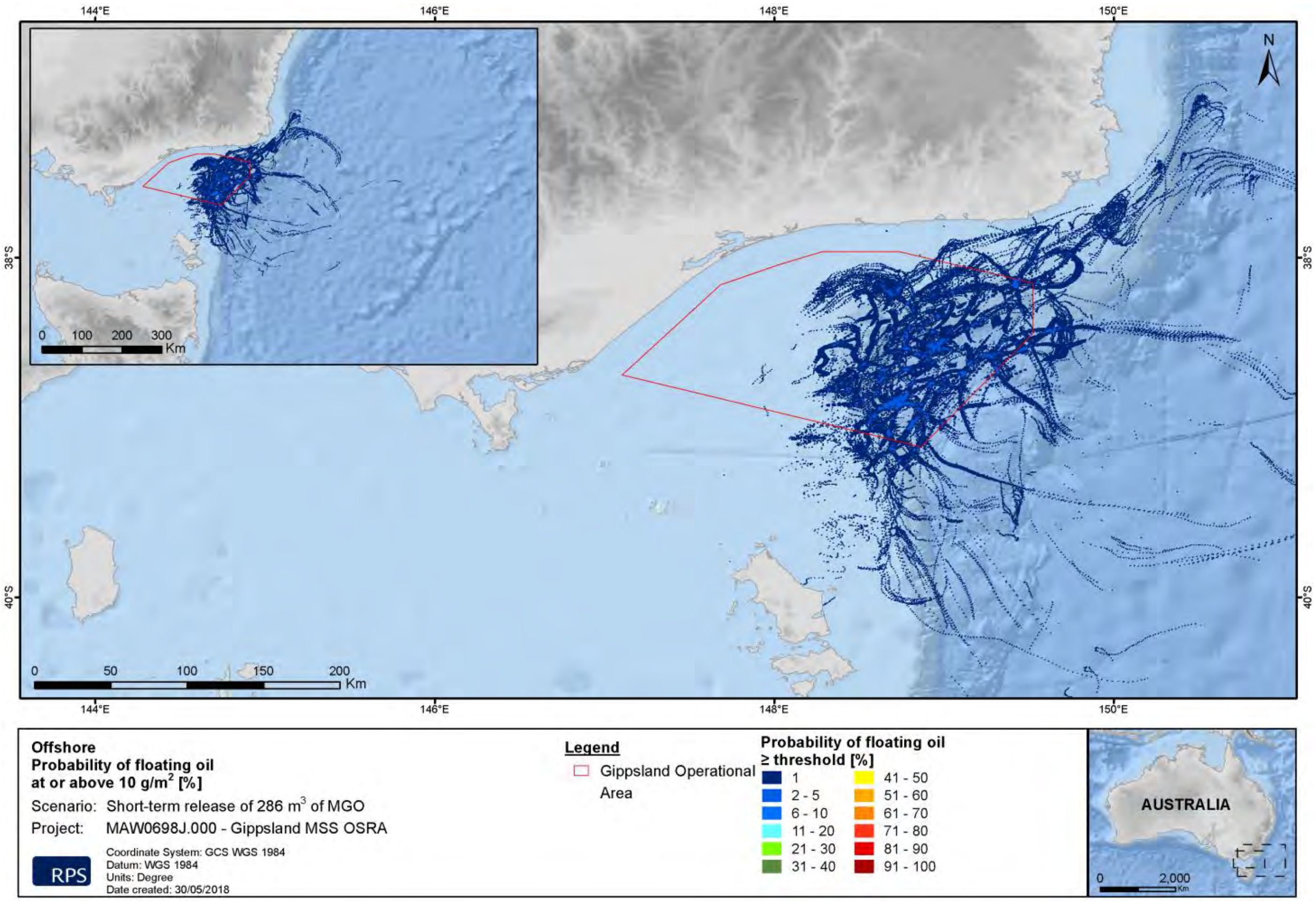

Figure 5.33: Predicted probability of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

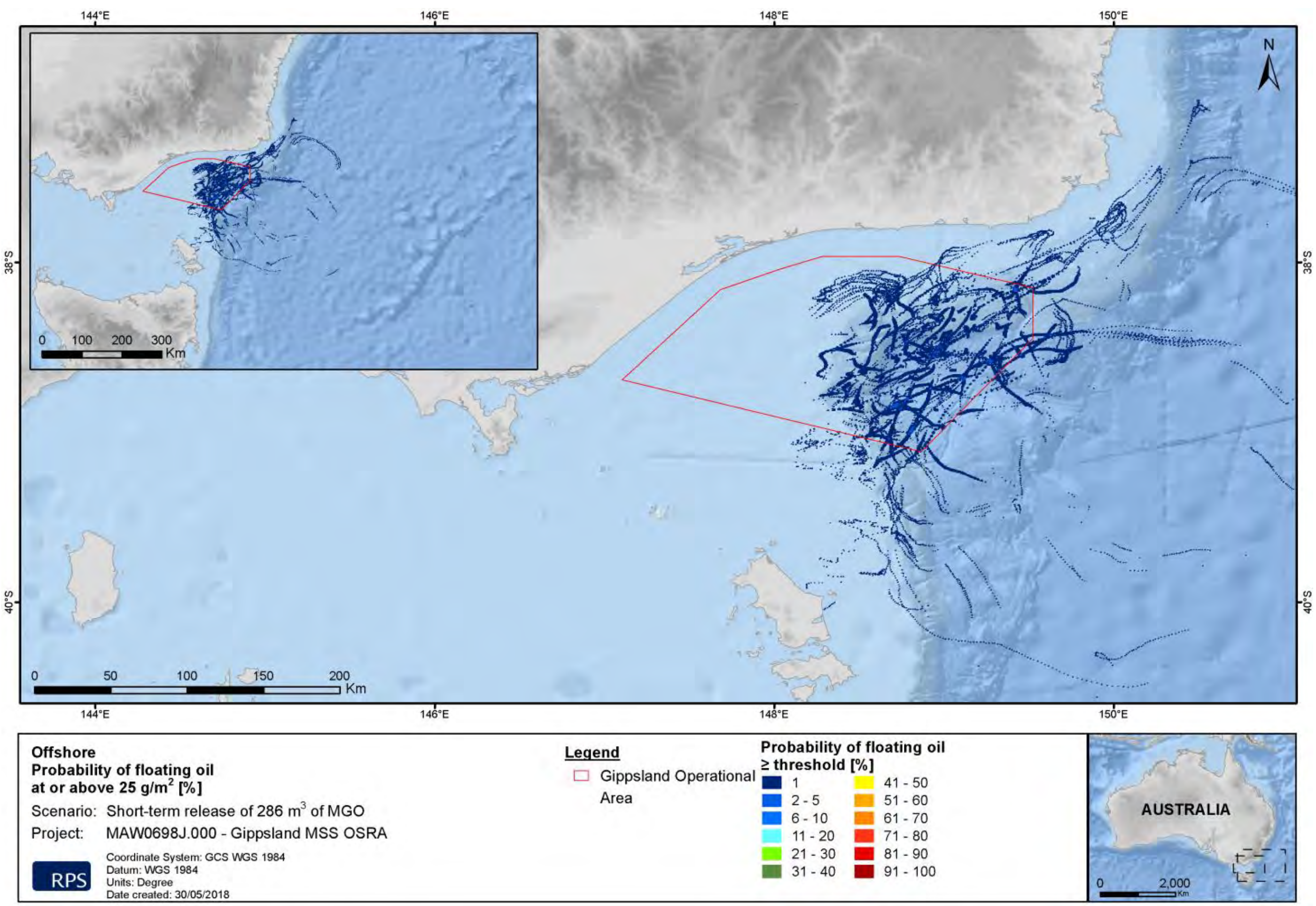

Figure 5.34: Predicted probability of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

RPS

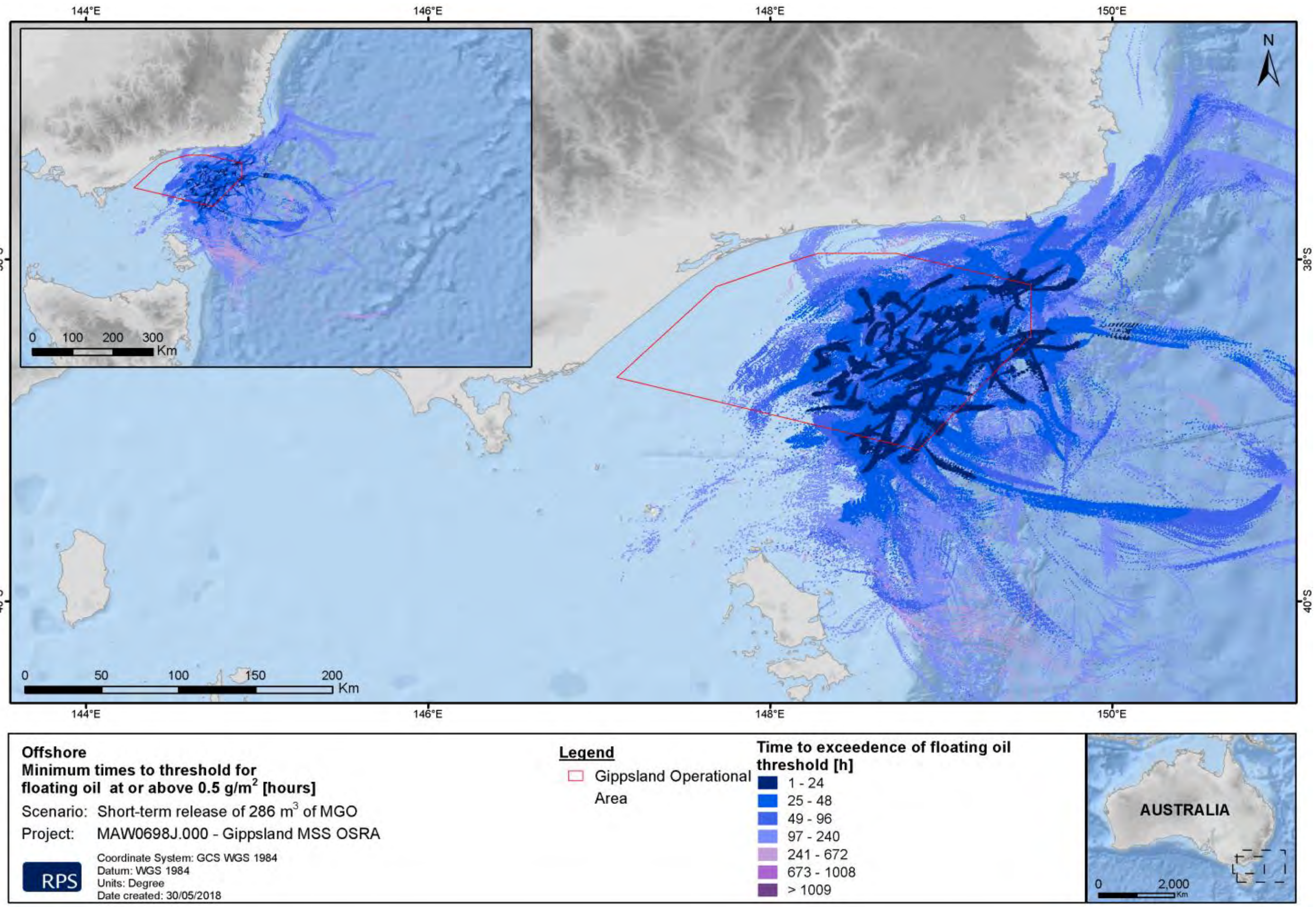

Figure 5.35: Predicted minimum time of floating oil concentration at or above 0.5 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

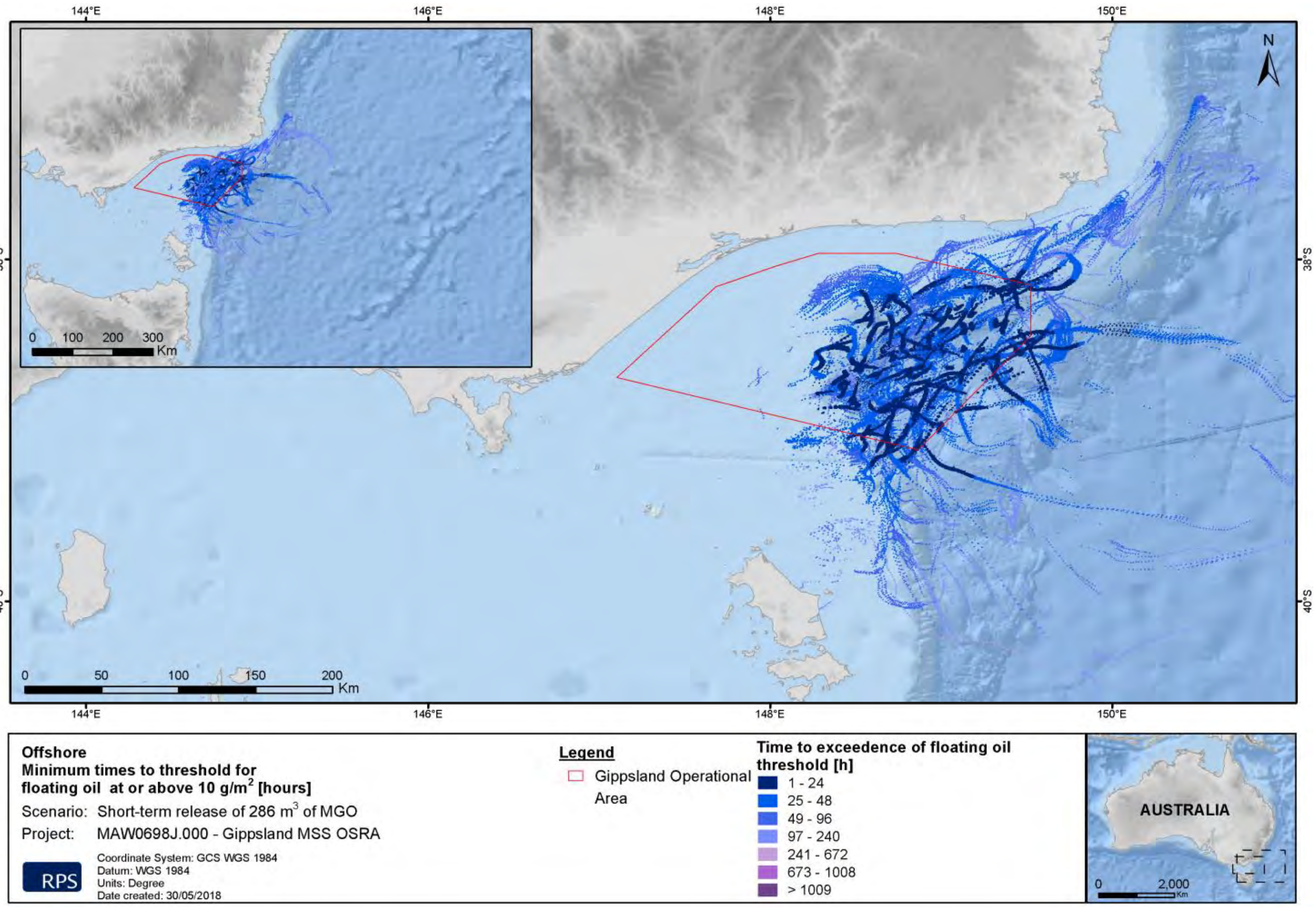

Figure 5.36: Predicted minimum time of floating oil concentration at or above 10 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

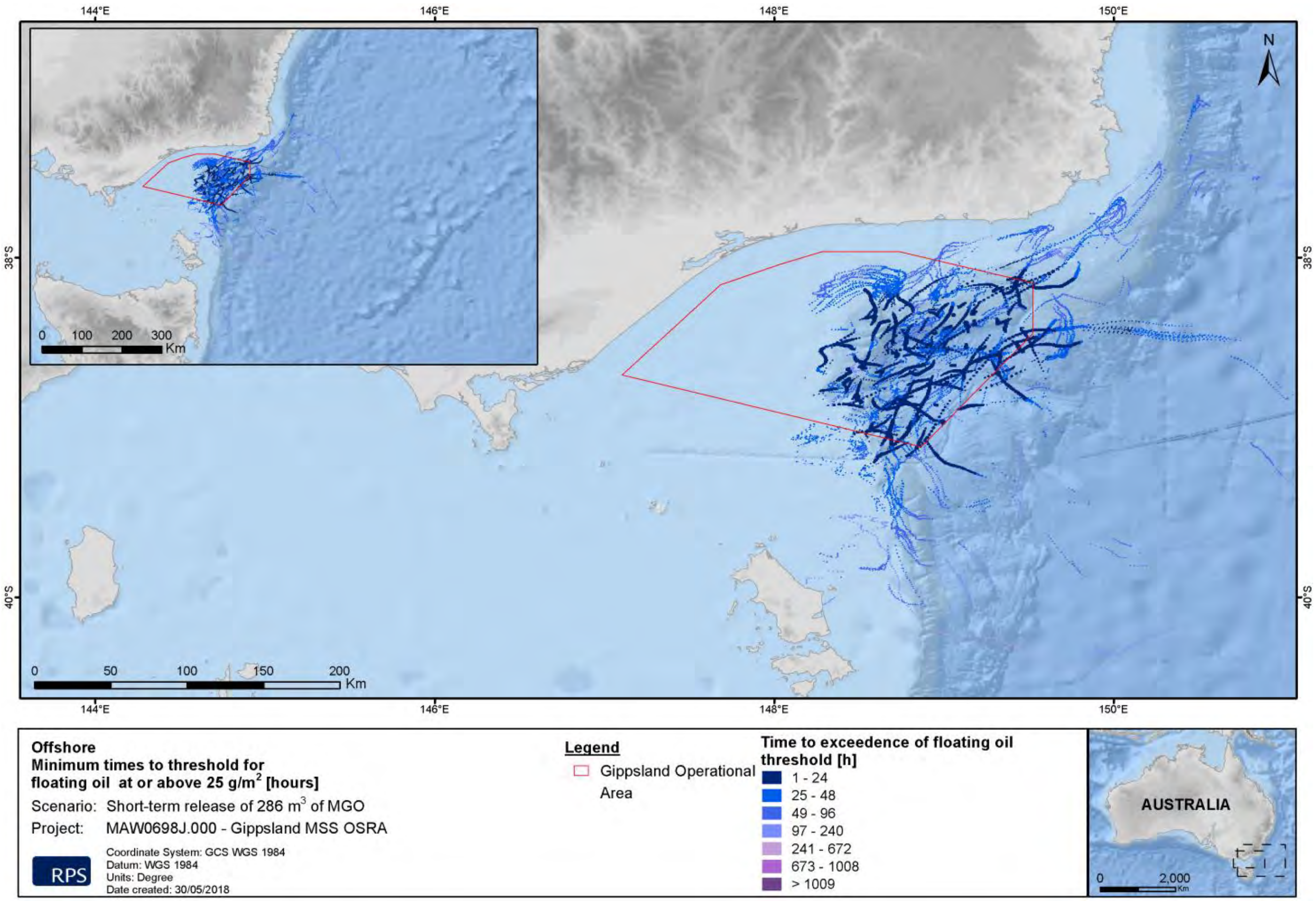

Figure 5.37: Predicted minimum time of floating oil concentration at or above 25 g/m² for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

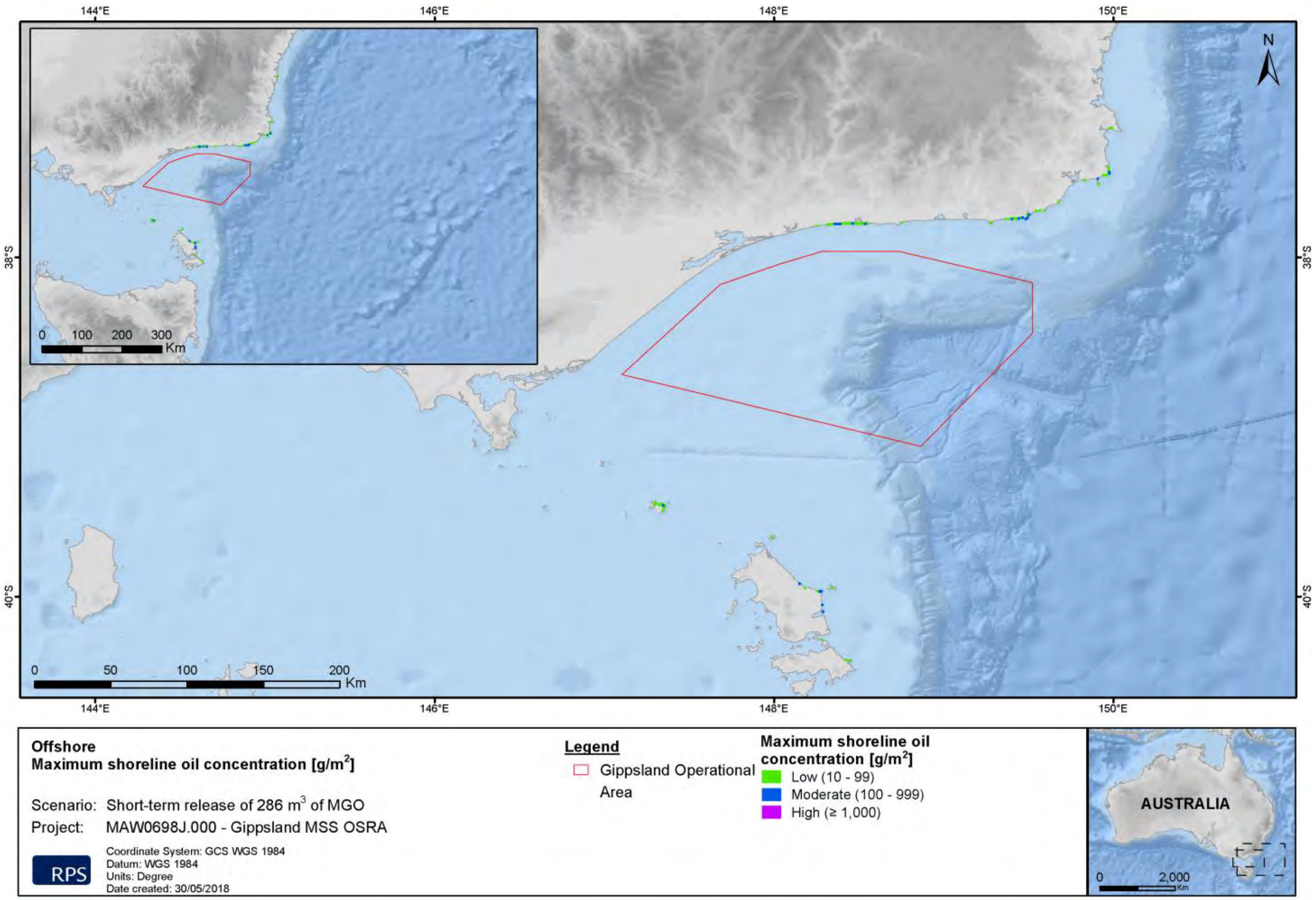

Figure 5.38: Predicted maximum shoreline oil concentration for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

RPS

5.4.2 Instantaneous Entrained Oil

Table 5.11: Expected entrained oil outcomes at sensitive receptors for a short-term release of 286 m^3 of MGO within the offshore part of the operational area.

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC	NC	NC	NC
Clarke Island	<1	<1	<1	NC	NC	NC	NC	NC
Boxen Island	<1	<1	<1	NC	NC	NC	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC	NC	NC	NC
Vansittart Island	2	1	<1	158	256	NC	3	250
East Kangaroo Island	<1	<1	<1	NC	NC	NC	NC	NC
Big green Island	<1	<1	<1	NC	NC	NC	NC	NC
Reef Island	<1	<1	<1	NC	NC	NC	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC	NC	<1	8
Badger Island	<1	<1	<1	NC	NC	NC	NC	NC
Cape Barren Osland	2	2	<1	167	180	NC	6	453
Flinders Island	2	1	1	108	132	137	7	657
Babel Island	3	1	1	110	114	119	15	1,373
Pasco Group	1	<1	<1	192	NC	NC	<1	52
Pyramid Island	1	1	<1	201	331	NC	2	113
Inner Sister Island	1	<1	<1	101	NC	NC	<1	97
Craggy Island	2	<1	<1	178	NC	NC	<1	32
Outer Sister Island	1	1	1	91	92	105	6	572
Seal Islands	<1	<1	<1	NC	NC	NC	NC	NC
Kent Island Group	2	1	<1	127	137	NC	3	241
Curtis Island	<1	<1	<1	NC	NC	NC	NC	NC
Moncoeur Islands	<1	<1	<1	NC	NC	NC	NC	NC
Hogan Island Group	<1	<1	<1	NC	NC	NC	NC	NC
Rodondo Island	<1	<1	<1	NC	NC	NC	NC	NC
Glennie Group	<1	<1	<1	NC	NC	NC	NC	NC
Norman Island	<1	<1	<1	NC	NC	NC	NC	NC
Montague Island	1	1	<1	280	284	NC	3	290

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Anser Island	<1	<1	<1	NC	NC	NC	NC	NC
Kanowna Island	<1	<1	<1	NC	NC	NC	NC	NC
Skull Rock	<1	<1	<1	NC	NC	NC	NC	NC
Martins Island	<1	<1	<1	NC	NC	NC	NC	NC
Gabo Island	5	1	<1	139	163	NC	3	118
South Gippsland	<1	<1	<1	NC	NC	NC	NC	NC
Wellington	<1	<1	<1	NC	NC	NC	NC	NC
Bega Valley	2	<1	<1	142	NC	NC	<1	61
Eurobodalla	1	1	<1	278	286	NC	4	385
Shoal Haven	<1	<1	<1	NC	NC	NC	NC	NC
Cape Howe / Mallacoota	4	1	<1	140	169	NC	2	119
Croajingolong (East)	2	1	<1	153	165	NC	2	123
Croajingolong (West)	5	3	<1	94	103	NC	8	431
Point Hicks	7	3	<1	115	121	NC	9	439
Sydenham Inlet	7	2	<1	145	210	NC	3	179
Cape Conran	5	1	<1	160	232	NC	4	167
Marlo	5	2	<1	181	204	NC	5	241
Corringle	2	1	<1	193	202	NC	3	177
Lake Tyers Beach	<1	<1	<1	NC	NC	NC	<1	7
Lakes Entrance	<1	<1	<1	NC	NC	NC	NC	NC
Lakes Entrance (West)	<1	<1	<1	NC	NC	NC	NC	NC
Ocean Grange	<1	<1	<1	NC	NC	NC	NC	NC
Golden Beach	<1	<1	<1	NC	NC	NC	NC	NC
Seaspray	<1	<1	<1	NC	NC	NC	NC	NC
Woodside Beach	<1	<1	<1	NC	NC	NC	NC	NC
McLoughlins Beach	<1	<1	<1	NC	NC	NC	NC	NC
Clonmel Island	<1	<1	<1	NC	NC	NC	NC	NC
Snake Island	<1	<1	<1	NC	NC	NC	NC	NC
Port Welshpool	<1	<1	<1	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	NC	NC
Wilsons Promontory (NE)	<1	<1	<1	NC	NC	NC	NC	NC
Wilsons Promontory (East)	<1	<1	<1	NC	NC	NC	NC	NC

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Wilsons Promontory (West)	<1	<1	<1	NC	NC	NC	NC	NC
Tasmania State Waters	4	2	1	90	92	93	19	1,855
Victoria State Waters	10	4	1	77	81	227	11	603
New South Wales	4	1	<1	137	260	NC	5	411
Australian Exclusive Economic Zone	26	14	7	1	1	1	114	9,632
Cutter Rock	<1	<1	<1	NC	NC	NC	NC	NC
Endeavour Reef	3	1	<1	254	302	NC	3	170
Wright Rock	3	1	<1	260	287	NC	3	175
Wakitipu Rock	1	<1	<1	294	NC	NC	<1	41
Warrego Rock	1	<1	<1	319	NC	NC	<1	54
New Zealand Star Bank	9	3	<1	119	141	NC	7	322
Beware Reef	5	1	<1	170	231	NC	4	159
Beware Reef Marine Sanctuary	5	1	<1	169	225	NC	4	199
East Gippsland AMP	10	4	2	14	15	15	49	3,409
Flinders AMP	16	4	1	82	85	94	15	1,237
Freycinet AMP	4	2	1	141	142	145	7	587
Beagle AMP	3	1	<1	118	127	NC	4	283
Batemans Bay Marine Park	1	1	<1	274	276	NC	5	411
Murramarang Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC	NC	<1	4

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Brou Beach Sanctuary Zone	1	<1	<1	303	NC	NC	<1	23
Bullengella Lake - Corunna Lake Sanctuary Zone	1	1	<1	282	283	NC	3	290
Montague Island South Sanctuary Zone	1	1	<1	282	286	NC	2	168
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC	NC	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	<1
Mullimburra South Habitat Protection Zone	1	<1	<1	305	NC	NC	<1	18
Montague Island Habitat Protection Zone	1	1	<1	278	281	NC	5	406
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	NC	NC	NC	<1	3
North Head Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC	NC	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	NC	NC	NC	NC	NC
Corner Inlet	<1	<1	<1	NC	NC	NC	NC	NC
Gippsland Lakes	<1	<1	<1	NC	NC	NC	NC	NC
Seamounts South and east of Tasmania	1	1	<1	228	233	NC	3	224
Upwelling East of Eden	22	11	4	1	1	1	114	6,461
Big Horseshoe Canyon	17	8	4	7	8	8	47	3,518
Canyons on the eastern continental slope	<1	<1	<1	NC	NC	NC	<1	2
Shelf rocky reefs	<1	<1	<1	NC	NC	NC	<1	10

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Antipodean Albatross - Foraging	26	14	7	1	1	1	114	9,632
Black Petrel - Foraging	1	1	<1	263	265	NC	5	499
Black-browed Albatross - Foraging	26	14	7	1	1	1	114	9,632
Black-faced Cormorant - Foraging	3	2	<1	176	177	NC	6	453
Crested Tern - Breeding	1	1	<1	278	282	NC	5	406
Crested Tern - Foraging	1	1	<1	265	268	NC	5	499
Bullers Albatross - Foraging	26	14	7	1	1	1	114	9,632
Campbell Albatross - Foraging	26	14	7	1	1	1	114	9,632
Flesh-footed Shearwater - Foraging	1	1	<1	263	265	NC	5	499
Great-winged Petrel - Foraging	1	<1	<1	293	NC	NC	<1	11
Grey Nurse Shark - Foraging	3	1	<1	151	219	NC	5	499
Grey Nurse Shark - Migration	5	2	1	93	128	218	6	575
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	5	1	<1	136	260	NC	5	411
Indian Yellow-nosed Albatross - Foraging	26	14	7	1	1	1	114	9,632
Little Penguin - Foraging	9	3	2	88	92	92	21	2,076
Little Penguin - Breeding	1	1	<1	93	278	NC	5	410
Northern Giant Petrel - Foraging	1	<1	<1	293	NC	NC	<1	11
Sooty Shearwater - Breeding	1	<1	<1	283	NC	NC	<1	45
Sooty Shearwater - Foraging	5	3	1	62	63	64	8	575

RPS

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Short-tailed Shearwater - Foraging	25	14	7	1	1	1	97	7,302
Short-tailed Shearwater - Breeding	2	<1	<1	93	NC	NC	<1	68
Shy Albatross - Foraging	26	14	7	1	1	1	114	9,632
Wedge-tailed Shearwater - Breeding	1	<1	<1	283	NC	NC	<1	45
Southern Giant Petrel - Foraging	1	<1	<1	293	NC	NC	<1	11
Wedge-tailed Shearwater - Foraging	15	8	2	42	42	43	22	1,095
Wandering Albatross - Foraging	26	14	7	1	1	1	114	9,632
White Shark - Foraging	16	8	2	19	20	20	38	3,230
White Shark - Distribution	26	14	7	1	1	1	114	9,632
White Shark - Breeding	3	1	<1	172	294	NC	3	146
Wilsons Storm Petrel - Migration	1	<1	<1	293	NC	NC	<1	11
Black-faced Cormorant - Breeding	<1	<1	<1	NC	NC	NC	NC	NC
White-faced Storm-petrel - Breeding	3	1	<1	145	165	NC	5	499
White-faced Storm-petrel - Foraging	23	12	7	1	1	1	109	9,632
Common Diving-petrel - Breeding	<1	<1	<1	NC	NC	NC	NC	NC
Common Diving-petrel - Foraging	26	14	7	1	1	1	114	9,632
White-fronted Tern - Foraging	3	2	1	138	143	150	8	707
Pygmy Blue Whale - Foraging	25	12	7	1	1	1	114	7,302
White-capped Albatross - Foraging	1	<1	<1	293	NC	NC	<1	11

	Probability (%) of entrained hydrocarbon concentration contact			Minimum time to receptor waters (hours)			Maximum entrained hydrocarbon concentration (ppb), at any depth	
	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	≥ 10 ppb	≥ 100 ppb	≥ 500 ppb	Mean	Peak
Humpback Whale - Foraging	10	5	1	48	48	49	13	987
Southern Right Whale - Migration	22	12	7	1	2	2	97	7,302
Southern Right Whale - Connecting Habitat	3	2	1	92	100	124	12	1,163
Pygmy Blue Whale - Distribution	22	12	7	1	1	1	96	7,002

NC: No contact to receptor predicted for specified threshold.

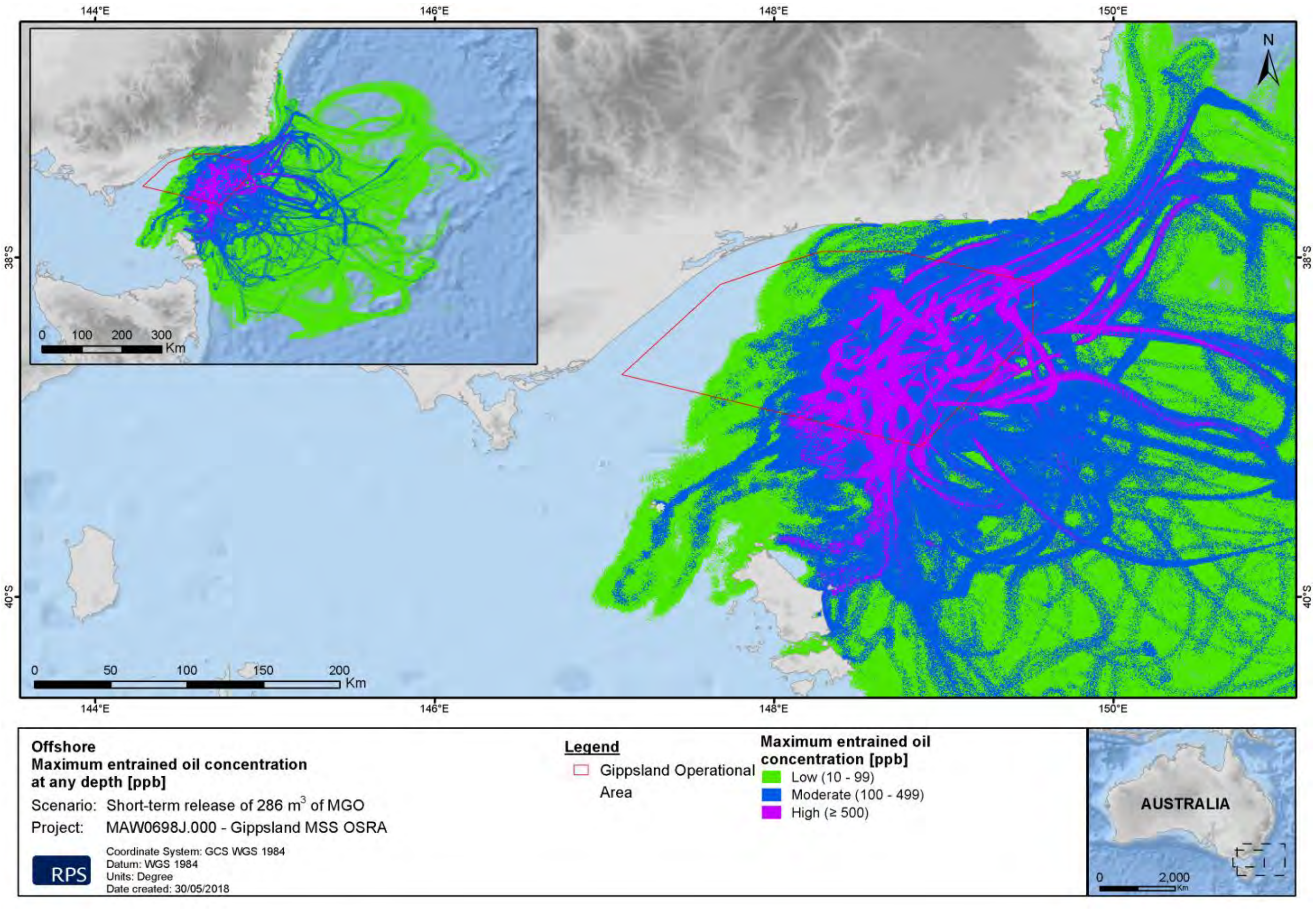

Figure 5.39: Predicted maximum of entrained oil concentration for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

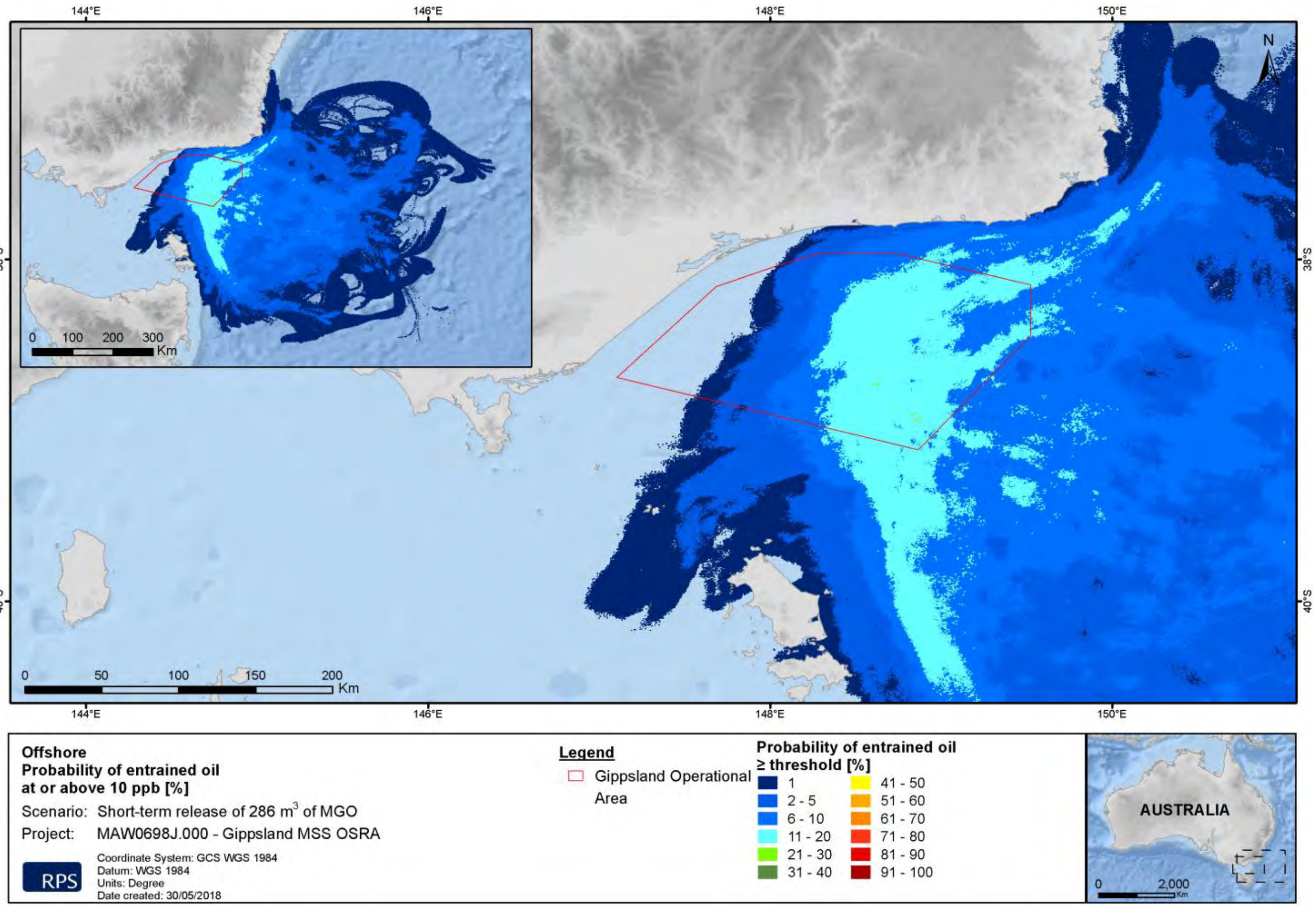

Figure 5.40: Predicted probability of entrained oil concentration at or above 10 ppb for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

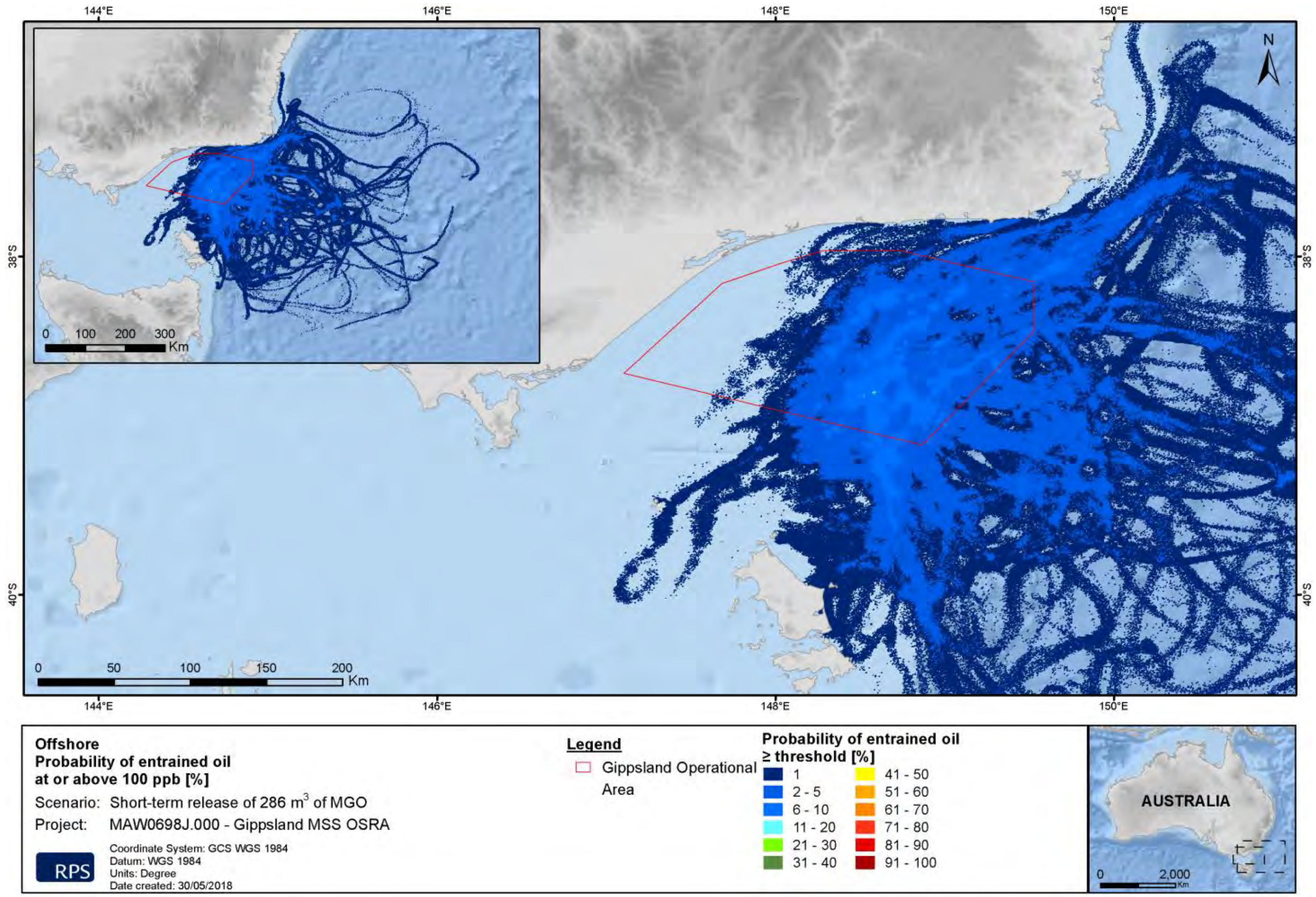

Figure 5.41: Predicted probability of entrained oil concentration at or above 100 ppb for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

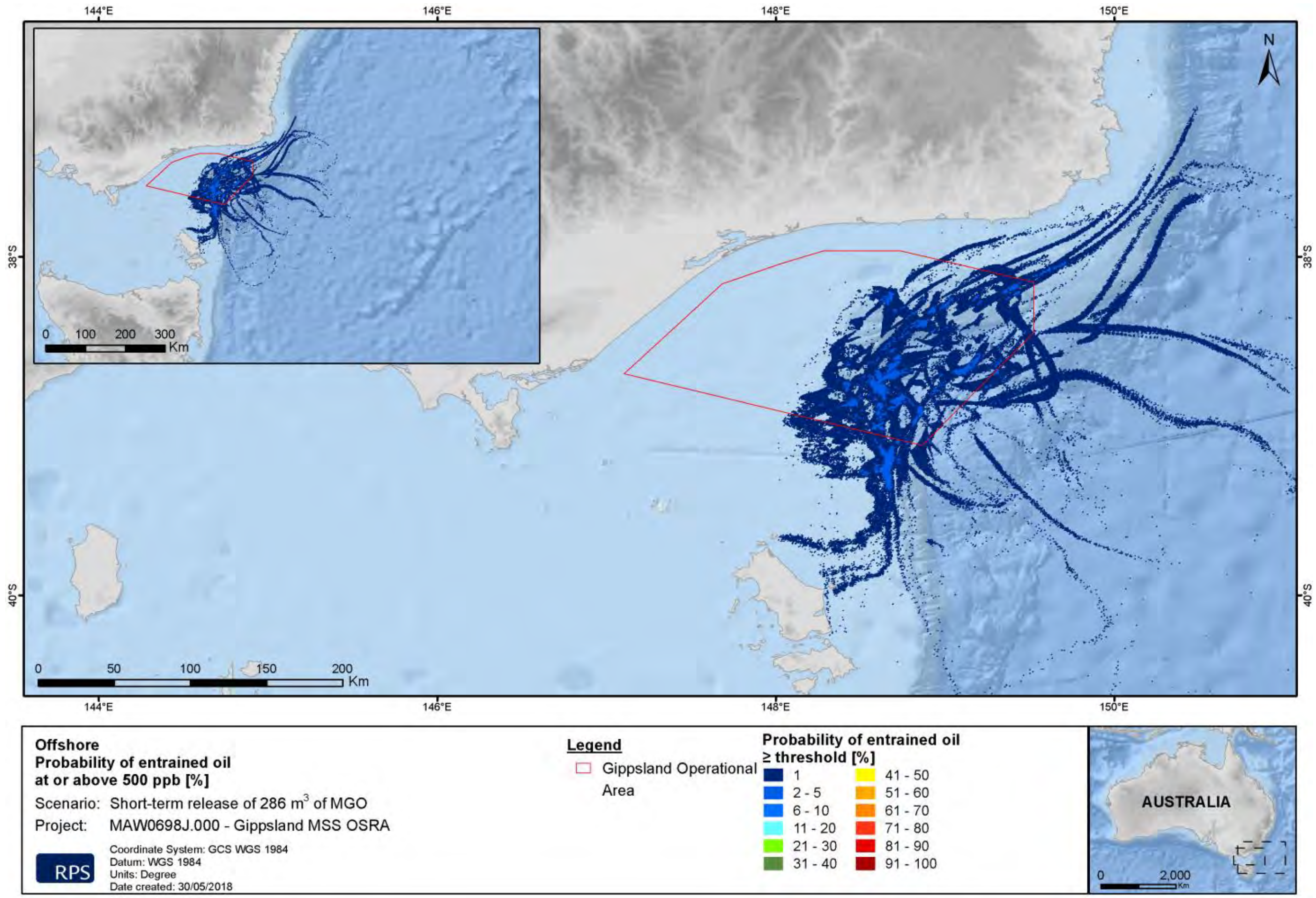

Figure 5.42: Predicted probability of entrained oil concentration at or above 500 ppb for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

RPS

5.4.3 Instantaneous Dissolved Aromatic Hydrocarbon

Table 5.12: Expected dissolved aromatic hydrocarbon outcomes at sensitive receptors for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Preservation Island	<1	<1	<1	NC	NC
Clarke Island	<1	<1	<1	NC	NC
Boxen Island	<1	<1	<1	NC	NC
Mount Chappell Island	<1	<1	<1	NC	NC
Vansittart Island	1	<1	<1	<1	12
East Kangaroo Island	<1	<1	<1	NC	NC
Big green Island	<1	<1	<1	NC	NC
Reef Island	<1	<1	<1	NC	NC
Prime Seal Island	<1	<1	<1	NC	NC
Badger Island	<1	<1	<1	NC	NC
Cape Barren Osland	1	<1	<1	<1	8
Flinders Island	1	<1	<1	<1	12
Babel Island	1	<1	<1	<1	13
Pasco Group	<1	<1	<1	NC	NC
Pyramid Island	<1	<1	<1	<1	3
Inner Sister Island	<1	<1	<1	<1	<1
Craggy Island	<1	<1	<1	<1	4
Outer Sister Island	<1	<1	<1	<1	<1
Seal Islands	<1	<1	<1	NC	NC
Kent Island Group	1	<1	<1	<1	11
Curtis Island	<1	<1	<1	NC	NC
Moncoeur Islands	<1	<1	<1	NC	NC
Hogan Island Group	<1	<1	<1	NC	NC
Rodondo Island	<1	<1	<1	NC	NC
Glennie Group	<1	<1	<1	NC	NC
Norman Island	<1	<1	<1	NC	NC
Montague Island	<1	<1	<1	<1	4
Anser Island	<1	<1	<1	NC	NC
Kanowna Island	<1	<1	<1	NC	NC
Skull Rock	<1	<1	<1	NC	NC
Martins Island	<1	<1	<1	NC	NC
Gabo Island	1	<1	<1	<1	12
South Gippsland	<1	<1	<1	NC	NC
Wellington	<1	<1	<1	NC	NC
Bega Valley	<1	<1	<1	<1	<1

RPS

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Eurobodalla	<1	<1	<1	<1	4
Shoal Haven	<1	<1	<1	NC	NC
Cape Howe / Mallacoota	1	<1	<1	<1	12
Croajingolong (East)	1	<1	<1	<1	8
Croajingolong (West)	<1	<1	<1	<1	6
Point Hicks	1	<1	<1	<1	9
Sydenham Inlet	<1	<1	<1	<1	6
Cape Conran	1	<1	<1	<1	16
Marlo	<1	<1	<1	<1	3
Corringle	<1	<1	<1	<1	2
Lake Tyers Beach	<1	<1	<1	<1	<1
Lakes Entrance	<1	<1	<1	NC	NC
Lakes Entrance (West)	<1	<1	<1	NC	NC
Ocean Grange	<1	<1	<1	NC	NC
Golden Beach	<1	<1	<1	NC	NC
Seaspray	<1	<1	<1	NC	NC
Woodside Beach	<1	<1	<1	NC	NC
McLoughlins Beach	<1	<1	<1	NC	NC
Clonmel Island	<1	<1	<1	NC	NC
Snake Island	<1	<1	<1	NC	NC
Port Welshpool	<1	<1	<1	NC	NC
Corner Inlet	<1	<1	<1	NC	NC
Wilsons Promontory (NE)	<1	<1	<1	NC	NC
Wilsons Promontory (East)	<1	<1	<1	NC	NC
Wilsons Promontory (West)	<1	<1	<1	NC	NC
Tasmania State Waters	2	<1	<1	<1	25
Victoria State Waters	2	<1	<1	<1	25
New South Wales	1	<1	<1	<1	9
Australian Exclusive Economic Zone	9	2	<1	3	264
Cutter Rock	<1	<1	<1	NC	NC
Endeavour Reef	1	<1	<1	<1	11
Wright Rock	1	<1	<1	<1	7
Wakitipu Rock	<1	<1	<1	<1	<1
Warrego Rock	<1	<1	<1	<1	2
New Zealand Star Bank	2	<1	<1	<1	12
Beware Reef	<1	<1	<1	<1	4
Beware Reef Marine Sanctuary	<1	<1	<1	<1	4
East Gippsland AMP	3	1	<1	2	159

RPS

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Flinders AMP	3	<1	<1	<1	44
Freycinet AMP	2	<1	<1	<1	27
Beagle AMP	1	<1	<1	<1	13
Batemans Bay Marine Park	1	<1	<1	<1	9
Murramarang Sanctuary Zone	<1	<1	<1	NC	NC
Tomaga River Habitat Protection Zone	<1	<1	<1	NC	NC
Wallaga Lake Entrance Habitiat Protection Zone	<1	<1	<1	<1	<1
Brush Island Sanctuary Zone	<1	<1	<1	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC
Mullimburra Sanctuary Zone	<1	<1	<1	NC	NC
Brou Beach Sanctuary Zone	<1	<1	<1	<1	<1
Bullengella Lake - Corunna Lake Sanctuary Zone	<1	<1	<1	<1	4
Montague Island South Sanctuary Zone	<1	<1	<1	<1	2
Batemans Bay Habitat Protection Zone	<1	<1	<1	NC	NC
Mullimburra North Habitat Protection Zone	<1	<1	<1	NC	NC
Mullimburra South Habitat Protection Zone	<1	<1	<1	<1	<1
Montague Island Habitat Protection Zone	1	<1	<1	<1	7
Burrewarra Point Sanctuary Zone	<1	<1	<1	NC	NC
Tuross Lake Habitat Protection Zone	<1	<1	<1	<1	<1
North Head Sanctuary Zone	<1	<1	<1	NC	NC
Tollgate Islands Sanctuary Zone	<1	<1	<1	NC	NC
Broulee Island Sanctuary Zone	<1	<1	<1	NC	NC
Cornler Inlet Marine National Park	<1	<1	<1	NC	NC
Corner Inlet	<1	<1	<1	NC	NC
Gippsland Lakes	<1	<1	<1	NC	NC
Seamounts South and east of Tasmania	<1	<1	<1	<1	5
Upwelling East of Eden	8	2	<1	3	219
Big Horseshoe Canyon	7	2	<1	2	128
Canyons on the eastern continental slope	<1	<1	<1	NC	NC
Shelf rocky reefs	<1	<1	<1	<1	<1
Antipodean Albatross - Foraging	9	2	<1	3	261
Black Petrel - Foraging	1	<1	<1	<1	9

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
Black-browed Albatross - Foraging	9	2	<1	3	264
Black-faced Cormorant - Foraging	1	<1	<1	<1	8
Crested Tern - Breeding	<1	<1	<1	<1	5
Crested Tern - Foraging	1	<1	<1	<1	9
Bullers Albatross - Foraging	9	2	<1	3	264
Campbell Albatross - Foraging	9	2	<1	3	264
Flesh-footed Shearwater - Foraging	1	<1	<1	<1	9
Great-winged Petrel - Foraging	<1	<1	<1	NC	NC
Grey Nurse Shark - Foraging	1	<1	<1	<1	12
Grey Nurse Shark - Migration	1	<1	<1	<1	20
Indo-Pacific/Spotted Bottlenose Dolphin - Breeding	1	<1	<1	<1	9
Indian Yellow-nosed Albatross - Foraging	9	2	<1	3	264
Little Penguin - Foraging	3	<1	<1	<1	22
Little Penguin - Breeding	1	<1	<1	<1	9
Northern Giant Petrel - Foraging	<1	<1	<1	NC	NC
Sooty Shearwater - Breeding	<1	<1	<1	<1	2
Sooty Shearwater - Foraging	2	<1	<1	<1	35
Short-tailed Shearwater - Foraging	8	2	<1	3	247
Short-tailed Shearwater - Breeding	<1	<1	<1	<1	2
Shy Albatross - Foraging	9	2	<1	3	264
Wedge-tailed Shearwater - Breeding	<1	<1	<1	<1	2
Southern Giant Petrel - Foraging	<1	<1	<1	NC	NC
Wedge-tailed Shearwater - Foraging	4	<1	<1	<1	46
Wandering Albatross - Foraging	9	2	<1	3	264
White Shark - Foraging	5	1	<1	2	127
White Shark - Distribution	9	2	<1	3	264
White Shark - Breeding	<1	<1	<1	<1	2
Wilsons Storm Petrel - Migration	<1	<1	<1	NC	NC
Black-faced Cormorant - Breeding	<1	<1	<1	NC	NC
White-faced Storm-petrel - Breeding	1	<1	<1	<1	17
White-faced Storm-petrel - Foraging	8	2	<1	3	261
Common Diving-petrel - Breeding	<1	<1	<1	NC	NC
Common Diving-petrel - Foraging	9	2	<1	3	264
White-fronted Tern - Foraging	1	<1	<1	<1	16
Pygmy Blue Whale - Foraging	8	2	<1	3	264

	Probability (%) of dissolved aromatic concentration			Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 50 ppb	≥ 400 ppb	Mean	Peak
White-capped Albatross - Foraging	<1	<1	<1	NC	NC
Humpback Whale - Foraging	2	<1	<1	<1	35
Southern Right Whale - Migration	7	2	<1	3	264
Southern Right Whale - Connecting Habitat	1	<1	<1	<1	13
Pygmy Blue Whale - Distribution	8	2	<1	3	264

NC: No contact to receptor predicted for specified threshold.

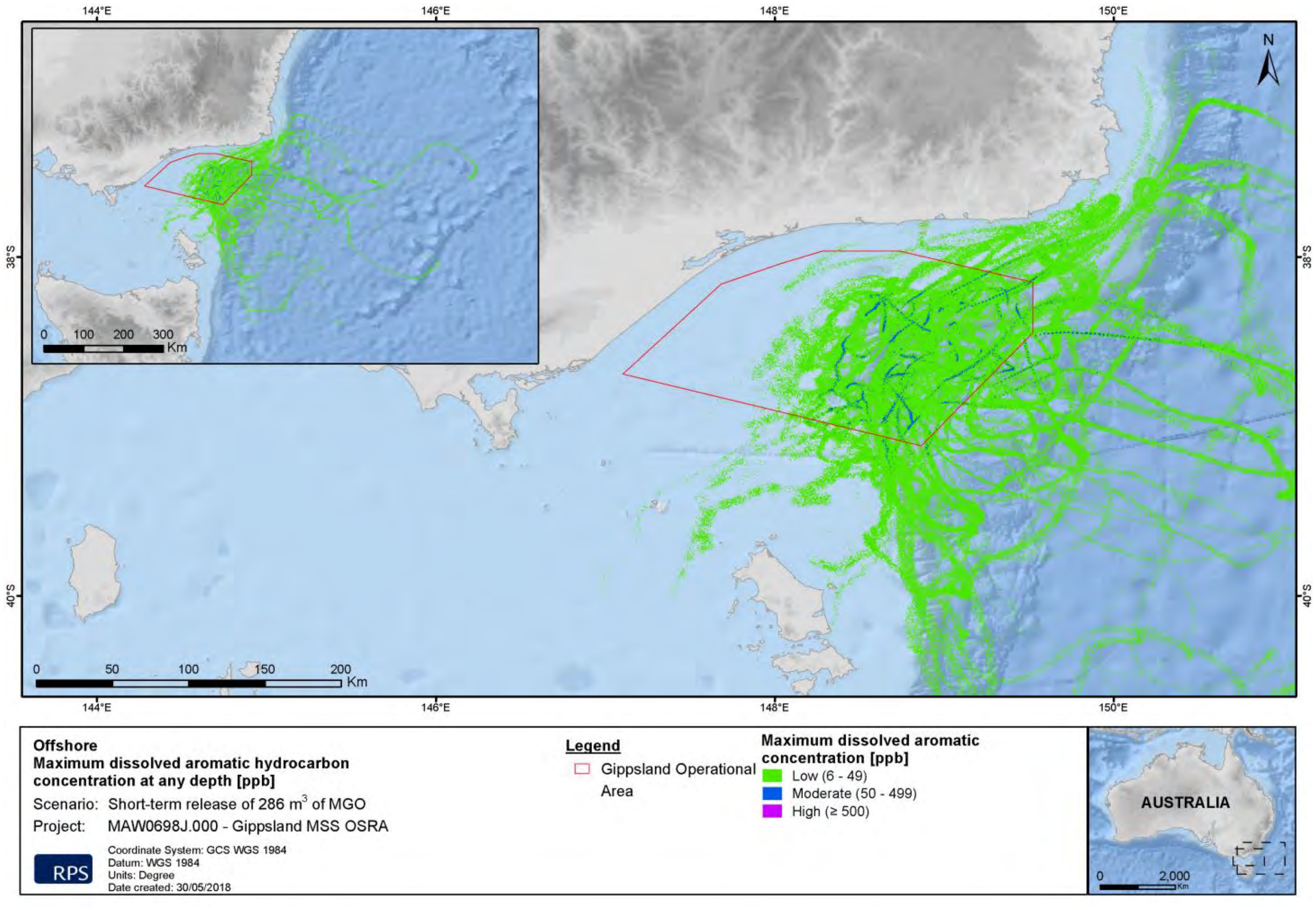

Figure 5.43: Predicted maximum of dissolved aromatic hydrocarbon concentration for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

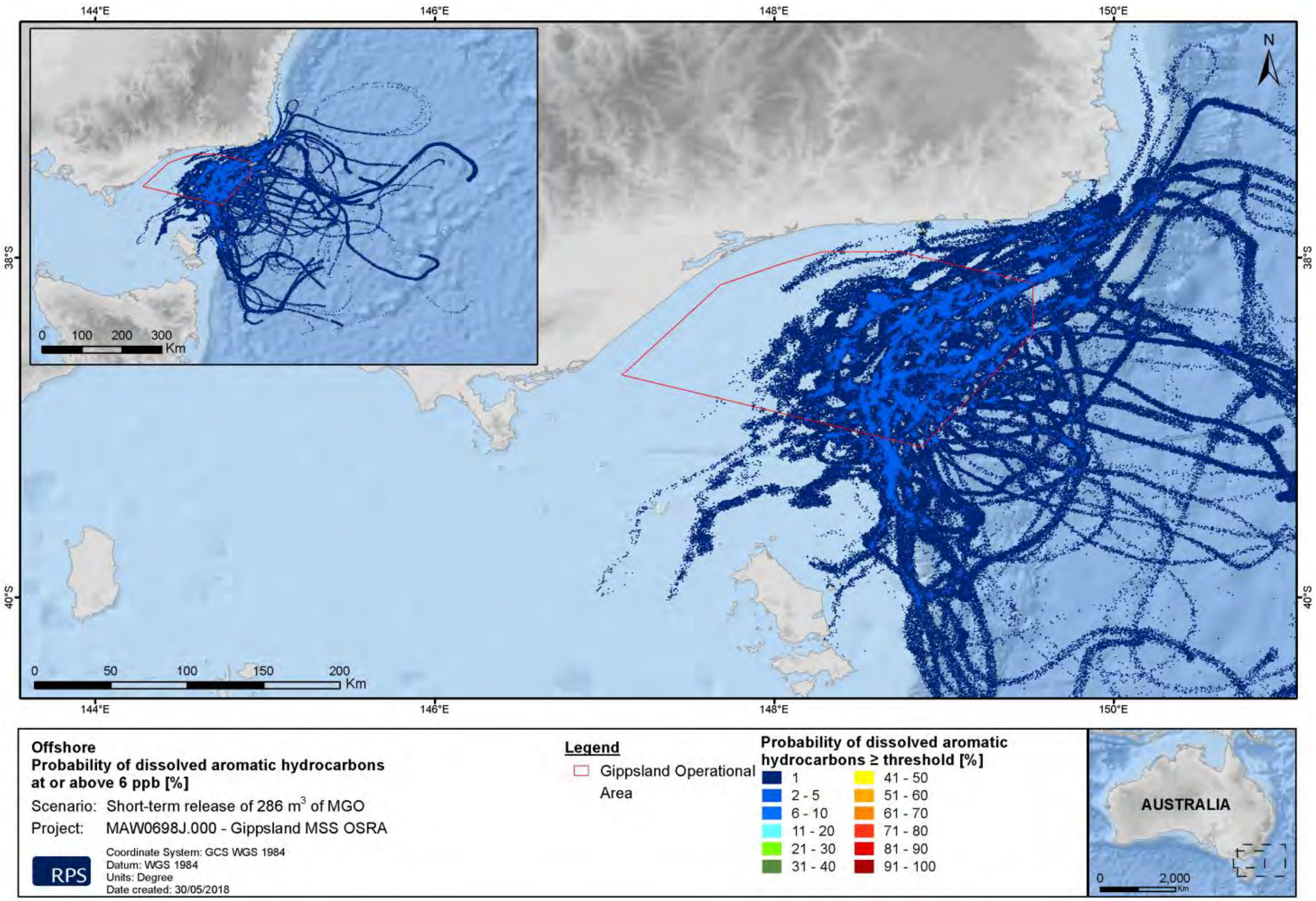

Figure 5.44: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 6 ppb for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

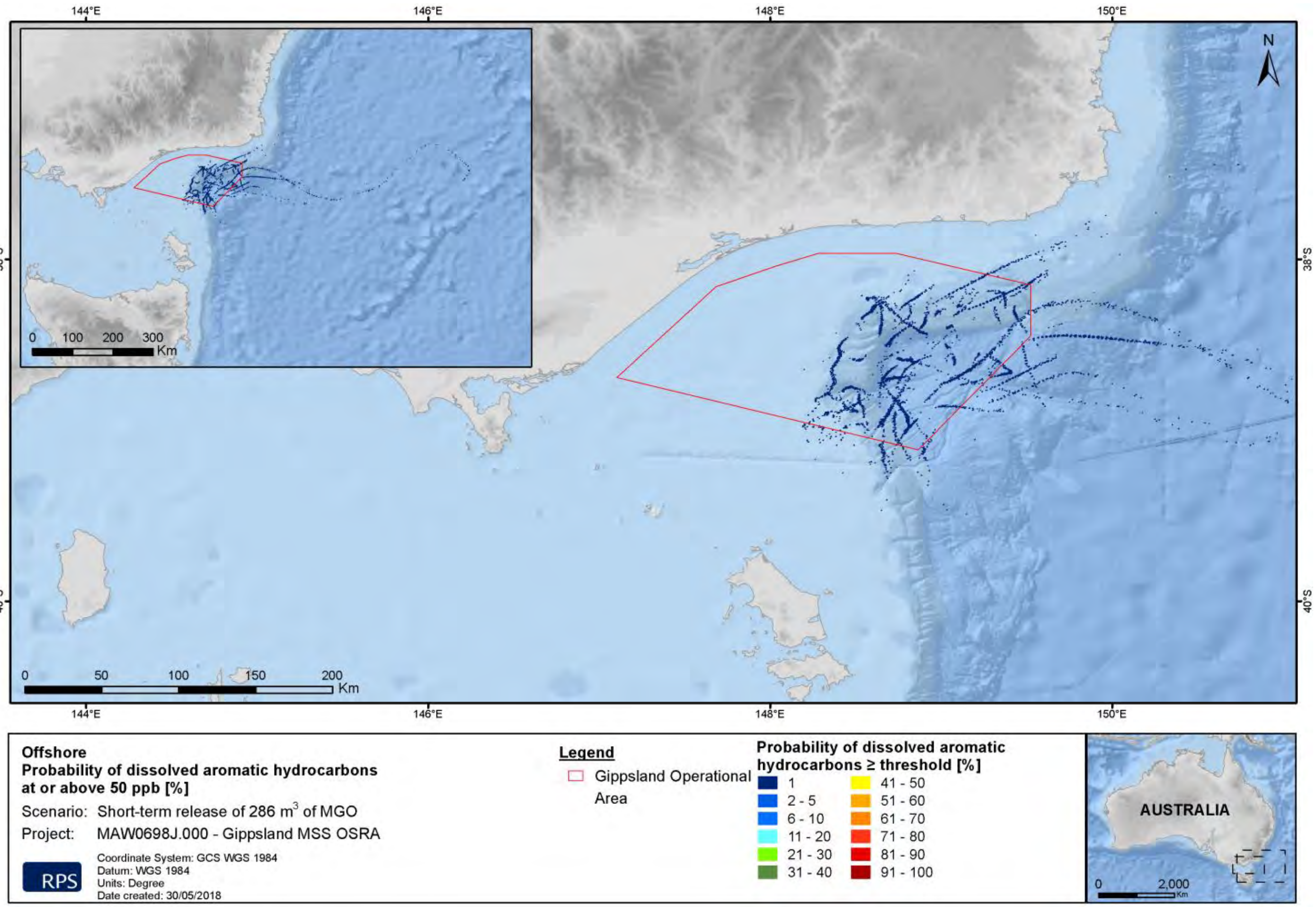

Figure 5.45: Predicted probability of dissolved aromatic hydrocarbon concentration at or above 50 ppb for a short-term release of 286 m³ of MGO within the offshore part of the operational area.

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RPS

Appendix D

Underwater noise modelling report

Underwater Acoustic Modelling for 3D Seismic Survey in the Gippsland Basin

For CGG Services (Australia) Pty Ltd

Report No. JAT10425-REPT-01-R0

17 August 2018

Quality Management

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Tables, Figures and Appendices

Tables

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1 Introduction

1.1 CGG Services (Australia) Pty Ltd (CGG) proposes to undertake a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 16,850 km^2 including approximately 13,000 km^2 where seismic data would be acquired. The survey vessel will be at least 12 km offshore in Commonwealth waters. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2,676 m in the Bass Canyon. The location of the survey areas is illustrated in Figure 1.1.

1.2 Noise is readily transmitted underwater and there is potential for sound emissions from the survey to affect marine mammals and turtles. At long ranges the introduction of additional noise could potentially cause short-term behavioural changes, for example to the ability of cetaceans to communicate and to determine the presence of predators, food, underwater features and obstructions. At close ranges and with high noise source levels, permanent or temporary hearing damage may occur, while at very close range, gross physical trauma is possible. This report provides an overview of the potential effects due to underwater noise from the survey on the surrounding marine environment.

1.3 The primary purpose of this underwater noise study is to predict the likely range of onset for potential injury (i.e. permanent threshold shifts in hearing) and behavioural effects.

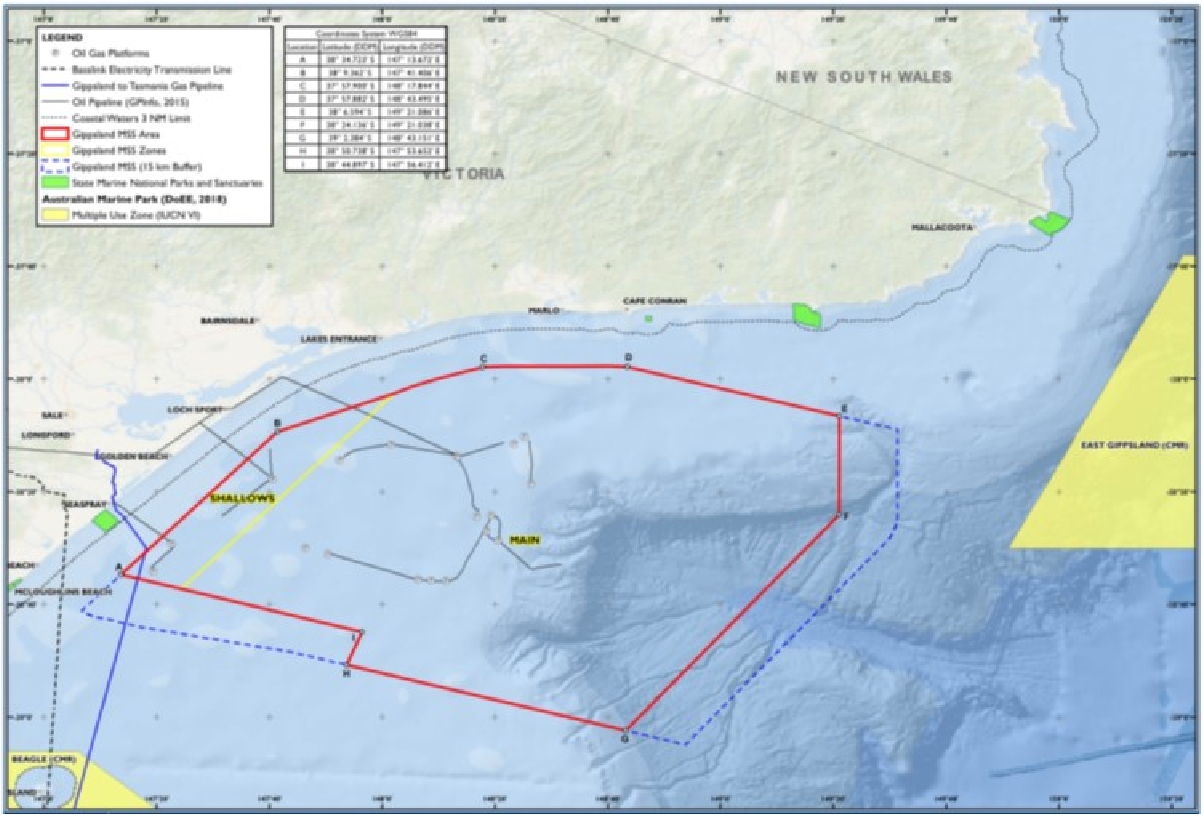

Figure 1.1 Location of survey area

2 Acoustic Assessment Criteria

Introduction

2.1 Underwater noise has the potential to affect marine life in different ways depending on its noise level and characteristics. Richardson *et al.* (1995) defined four zones of noise influence which vary with distance from the source and level. These are:

- **The zone of audibility:** this is the area within which the animal is able to detect the sound. Audibility itself does not implicitly mean that the sound will have an effect on the marine mammal.
- **The zone of masking:** This is defined as the area within which noise can interfere with detection of other sounds such as communication or echolocation clicks. This zone is very hard to estimate due to a paucity of data relating to how marine mammals detect sound in relation to masking levels (for example, humans are able to hear tones well below the numeric value of the overall noise level).
- **The zone of responsiveness:** this is defined as the area within which the animal responds either behaviourally or physiologically. The zone of responsiveness is usually smaller than the zone of audibility because, as stated previously, audibility does not necessarily evoke a reaction.
- **The zone of injury / hearing loss:** this is the area where the sound level is high enough to cause tissue damage in the ear. At even closer ranges, and for very high intensity sound sources (e.g. underwater explosions), physical trauma or even death are possible.

2.2 For this study, it is the zones of injury and disturbance (i.e. responsiveness) that are of concern (there is insufficient scientific evidence to properly evaluate masking, especially for impulsive sound sources). In order to determine the potential spatial range of injury and disturbance, a review has been undertaken of available evidence, including international guidance and scientific literature. The following sections summarise the relevant thresholds for onset of effects and describe the evidence base used to derive them.

Injury (Physiological Damage) to Mammals

2.3 Sound propagation models can be constructed to allow the received noise level at different distances from the source to be calculated. To determine the consequence of these received levels on any marine mammals which might experience such noise emissions, it is necessary to relate the levels to known or estimated impact thresholds. The injury criteria proposed by (NMFS 2018) are based on a combination of linear (i.e. un-weighted) peak pressure levels and mammal hearing weighted sound exposure levels (SEL). The hearing weighting function is designed to represent the bandwidth for each group within which acoustic exposures can have auditory effects. The categories include:

- **low-frequency (LF) cetaceans** (i.e. marine mammal species such as baleen whales with an estimated functional hearing range between 7 Hz and 35 kHz);
- **mid-frequency (MF) cetaceans** (i.e. marine mammal species such as dolphins, toothed whales, beaked whales and bottlenose whales with an estimated functional hearing range between 150 Hz and 160 kHz);
- **high-frequency (HF) cetaceans** (i.e. marine mammal species such as true porpoises, Kogia, river dolphons and cephalorhynchid with an estimated functional hearing range between 275 Hz and 160 kHz);
- **phocid pinnipeds** (PW) (i.e. true seals with an estimated functional hearing range between 50 Hz and 86 kHz); and
- **otariid pinnipeds** (OW) (i.e. sea lions and fur seals with an estimated functional hearing range between 60 Hz and 39 kHz).

2.4 These weightings have therefore been used in this study and are shown in Figure 2.1.

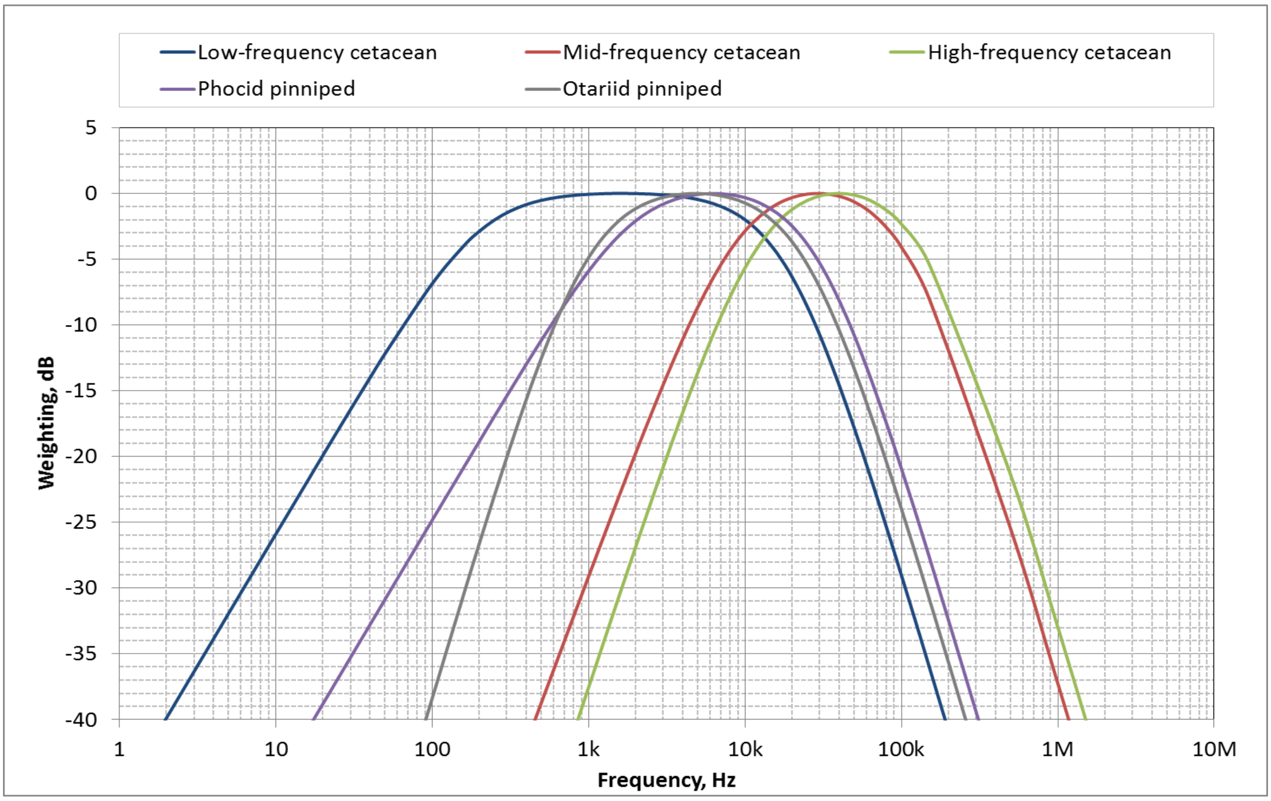

Figure 2.1 Hearing weighting functions for pinnipeds and cetaceans (NMFS 2018)

2.5 Injury criteria are proposed in NMFS (2018) are for two different types of sound as follows:

- **Impulsive sounds** which are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005). This category includes sound sources such as seismic surveys, impact piling and underwater explosions; and

- **Non-impulsive sounds** which can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998). This category includes sound sources such as continuous running machinery, sonar and vessels.

2.6 The criteria for impulsive sound has been adopted for this study given the nature of the sound source used during seismic surveys, where the sound source is activated at regular intervals as a seismic vessel traverses along a pre-determined data acquisition sail-line. Since noise from the vessel is of significantly lower magnitude than noise emitted by the airguns, and since the two noise sources would not act additively to result in increased noise emissions compared to the airguns themselves, noise emissions from the vessel are not considered in the modelling.

2.7 The relevant criteria proposed by NMFS (2018) are as summarised in Table 2.1.

Table 2.1 Summary of PTS onset acoustic thresholds (NMFS 2018)

Hearing Group	Parameter	Impulsive
Low-frequency (LF) cetaceans	Peak, unweighted	219
	SEL, LF weighted	183
Mid-frequency (MF) cetaceans	Peak, unweighted	230
	SEL, MF weighted	185
High-frequency (HF) cetaceans	Peak, unweighted	202
	SEL, HF weighted	155
Phocid pinnipeds (PW)	Peak, unweighted	218
	SEL, PW weighted	185
Otariid pinnipeds (OW)	Peak, unweighted	232
	SEL, OW weighted	203

2.8 In addition, EPBC Act Policy Statement 2.1 determines suitable exclusion zones with an unweighted single shot SEL threshold of 160 dB re 1 μPa^2s (DEWHA 2008). The policy statement is only relevant for baleen and large toothed whales, and does not apply to smaller dolphins and porpoises (DEWHA 2008). This threshold has also been applied to the assessment in this report.

Disturbance to Mammals

2.9 Beyond the area in which injury may occur, the effect on marine mammal behaviour is the most important measure of impact. Significant disturbance may occur when there is a risk of a significant group of animals incurring sustained or chronic disruption of behaviour or when a significant group of animals are displaced from an area, with subsequent redistribution being significantly different from that occurring due to natural variation.

2.10 To consider the possibility of disturbance resulting from the proposed seismic operations, it is necessary to consider both the likelihood that the sound could cause disturbance and the likelihood that the sensitive receptors (marine mammals) will be exposed to that sound. Southall *et al*. (2007) recommended that the only currently feasible way to assess whether a specific sound could cause disturbance is to compare the circumstances of the situation with empirical studies. The more severe the response on the scale, the lower the amount of time that the animals will tolerate it before there could be significant negative effects on life functions.

2.11 Southall *et al.* (2007) present a summary of observed behavioural responses during various seismic surveys. However, although these datasets contain much relevant data for low-frequency cetaceans, there is no strong data for mid-frequency or high-frequency cetaceans. Low-frequency cetaceans other than bow-head whales were typically observed to respond significantly at a received level of 140 to 160 dB re 1 μPa (rms). Behavioural changes at these levels during multiple pulses of the source may have included visible startle response, extended cessation or modification of vocal behaviour, brief cessation of reproductive behaviour or brief / minor separation of females and dependent offspring.

2.12 The data that are available for mid-frequency cetaceans indicate that some significant response was observed at a sound pressure level of 120 - 130 dB re 1μPa (rms), however the majority of cetaceans in this category did not display behaviours of this severity until exposed to a level of 170 to 180 dB re 1μPa (rms). Furthermore, other mid-frequency cetaceans within the same study were observed to have no behavioural response even when exposed to a level of 170 – 180 dB re 1μPa (rms).

2.13 According to Southall *et al*. (2007) there is a general paucity of data relating to the effects of sound on pinnipeds in particular. One study using ringed, bearded and spotted seals (Harris *et al*., 2001) found onset of a significant response at a received sound pressure level of 160 to 170 dB re 1 μPa (rms), although larger numbers of animals showed no response at noise levels of up to 180 dB re 1 μPa (rms). It is only at much higher sound pressure levels in the range of 190 to 200 dB re 1 μPa (rms) that significant numbers of seals were found to exhibit a significant response. For non-pulsed sound, one study elicited a significant response on a single harbour seal at a received level of 100 to 110 dB re 1 μPa (rms), although other studies found no response or non-significant reactions occurred at much higher received levels of up to 140 dB re 1 μPa (rms). No data are available for higher noise levels and the low number of animals observed in the various studies means that it is difficult to make any firm conclusions from these studies.

2.14 Southall *et al*. (2007) also notes that, due to the uncertainty over whether high-frequency cetaceans may perceive certain sounds and due to paucity of data, it was not possible to present any data on responses of high frequency-cetaceans. However, Lucke *et al*. (2008) showed a single harbour porpoise consistently showed aversive behavioural reactions at received sound pressure levels above 174 dB re 1 μPa (peak-peak) or a SEL of 145 dB re 1 μPa^{2}s, equivalent to an estimated[1] rms sound pressure level of 166 dB re 1 μPa.

[1] *Based on an analysis of the time history graph in Lucke et al. (2007) the T90 period is approximately 8 ms, resulting in a correction of 21 dB applied to the SEL to derive the rms T90 sound pressure level. However, the T90 was not directly reported in the paper.*

2.15 The NMFS (2018) revised acoustic thresholds do not suggest a revised approach to the Southall *et al.* (2007) suggested criteria for behavioural disturbance

2.16 Clearly, there is much intra-category and perhaps intra-species variability in behavioural response. Therefore, this assessment adopts a conservative approach and uses the US National Marine Fisheries Service (NMFS 2005) Level B harassment threshold of 160 dB re 1 µPa (rms) for impulsive sound. Level B Harassment is defined as having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

2.17 It is important to understand that exposure to sound levels in excess of the behavioural change threshold stated above does not necessarily imply that the sound will result in significant disturbance. As noted previously, it is also necessary to assess the likelihood that the sensitive receptors will be exposed to that sound and whether the numbers exposed are likely to be significant at the population level.

2.18 If an animal experiences a temporary threshold shift (TTS) this can lead to hearing recovery where the animal is able to reduce its exposure by moving away from the source. TTS can therefore be used to define the onset of a fleeing response and for this reason can also be grouped within the zone of responsiveness (i.e. where all animals exposed would be displaced from the ensonified area). The NMFS (2018) criteria for onset of TTS have therefore been used to estimate the zone of responsiveness in this study.

Marine Mammal Criteria Summary

2.19 The criteria used in this assessment are summarised in Table 2.2.

Table 2.2 Proposed criteria for marine mammals

Effect	Criteria		
Behavioural change	Exceedance of criteria in NMFS (2005) for impulsive sound: Strong disturbance: rms sound pressure level greater than 160 dB re 1 μPa		
Behavioural change (zone of responsiveness) and temporary injury (TTS)	Exceedance of NMFS (2018) criteria for TTS due to impulsive sound:		
	Low-frequency (LF) cetaceans	peak pressure level	213 dB re 1 μPa
		Weighted cumulative SEL	168 dB re 1 μPa^2s
	Mid-frequency (MF) cetaceans	peak pressure level	224 dB re 1 μPa
		Weighted cumulative SEL	170 dB re 1 μPa^2s
	High-frequency (HF) cetaceans	peak pressure level	196 dB re 1 μPa
		Weighted cumulative SEL	140 dB re 1 μPa^2s
	Phocid pinnipeds (PW)	peak pressure level	212 dB re 1 μPa
		Weighted cumulative SEL	170 dB re 1 μPa^2s
	Otariid pinnipeds (OW)	peak pressure level	226 dB re 1 μPa
		Weighted cumulative SEL	188 dB re 1 μPa^2s
Physiological damage (PTS)	Exceedance of NMFS (2018) criteria for PTS due to impulsive sound:		
	Low-frequency (LF) cetaceans	peak pressure level	219 dB re 1 μPa
		Weighted cumulative SEL	183 dB re 1 μPa^2s
	Mid-frequency (MF) cetaceans	peak pressure level	230 dB re 1 μPa
		Weighted cumulative SEL	185 dB re 1 μPa^2s
	High-frequency (HF) cetaceans	peak pressure level	202 dB re 1 μPa
		Weighted cumulative SEL	155 dB re 1 μPa^2s
	Phocid pinnipeds (PW)	peak pressure level	218 dB re 1 μPa
		Weighted cumulative SEL	185 dB re 1 μPa^2s
	Otariid pinnipeds (OW)	peak pressure level	232 dB re 1 μPa
		Weighted cumulative SEL	203 dB re 1 μPa^2s
DEWHA (2008)	Low-frequency (LF) cetaceans	Single pulse unweighted SEL	160 dB re 1 μPa^2s
	Mid-frequency (MF) cetaceans		
	High-frequency (HF) cetaceans		

Injury and Disturbance to Fish

2.20 The thresholds for harm to fish species have been based on the sound exposure guidelines for fish proposed by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper *et al.* 2014). The guidelines represent the Working Group's consensus efforts to establish broadly applicable guidelines for fish and sea turtles, with specific criteria relating to mortality and potential mortal injury, recoverable injury and TTS. The Working Group defines the criteria for injury and TTS as follows:

- mortality and mortal injury – immediate or delayed death
- recoverable injury – injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries is likely to result in mortality
- TTS – short or long-term changes in hearing sensitivity that may or may not reduce fitness (defined as any persistent change in hearing of 6 dB or greater).

2.21 The ASA criteria for fish are summarised in Table 2.3.

Table 2.3 Summary of Fish Injury Exposure Criteria for Seismic Airguns (Popper *et al.* 2014)

Type of animal	Parameter	Mortality and potential mortal injury	Impairment	
			Recoverable injury	TTS
Fish: no swim bladder (particle motion detection)	SEL, dB re 1 µPa²s	-	-	186
	Peak, dB re 1 µPa	213	213	-
Fish: swim bladder is not involved in hearing (particle motion detection)	SEL, dB re 1 µPa²s	-	-	186
	Peak, dB re 1 µPa	207	207	-
Fish: swim bladder involved in hearing (primarily pressure detection)	SEL, dB re 1 µPa²s	-	-	186
	Peak, dB re 1 µPa	207	207	-
Fish: eggs and larvae	Peak, dB re 1 µPa	207	-	-

2.22 In the Popper et al. (2005) study, the experimental design was based on five exposures to the airgun at 40 second intervals so that the fish were exposed to a steady sound level. The authors note that in contrast, a normal seismic survey might present signals as often as every 10 seconds; however several contributing factors are described in the paper that lead the study authors to conclude that, although these factors do not compensate for the more frequent exposure in an actual seismic survey, their experiments exposed fish with an approximate ‘‘worst case’’ with regard to seismic stimulation (Popper et al. 2005). These factors include that as the survey vessel is moving, a stationary fish subject would be exposed to the maximum level only once in a sequence of exposures. Further, that the majority of exposed fishes during a seismic survey are likely to be at greater distances from the source than those in the Popper et al. (2005) study (i.e. 13 and 17 m) and would therefore receive a lower sound level. The guideline level for TTS proposed by Popper et al. (2014) derived from the results of the experiments conducted by Popper et al. (2005) are based on TTS responses from a hearing specialist fish species (i.e. those with the highest sensitivity to sound). This guideline level can also be considered worst case in this respect for the fish species assessed within this EP.

Injury and Disturbance to Sea Turtles

2.23 The most relevant criteria for injury are considered to be those contained in the recent Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al*., 2014). The guidelines set out criteria for injury due to different sources of noise. Those relevant to this project are considered to be those for injury due to seismic noise[2]. The criteria include a range of indices including SEL, rms and peak sound pressure levels.

2.24 The injury criteria used in this noise assessment are given in Table 2.4.

Table 2.4 Criteria for injury to turtles due to seismic airguns (Popper *et al*., 2014)

Type of animal	Parameter	Mortality and potential mortal injury
Sea turtles	Peak, dB re 1 μPa	>207

Invertebrates and Plankton

2.25 There are no peer reviewed and/or recognised sound exposure guidelines/criteria for invertebrate species. Day *et al.* (2016) assessed the impact of seismic sound on rock lobsters, scallops and their larvae. The outcomes of the study have been used to develop a comparative sound exposure level for lobster (crustaceans) and scallops (bivalves), for the assessment of impacts associated with the received sound levels predicted by the underwater noise modelling.

2.26 The criteria used in this assessment for invertebrates and plankton is shown in Table 2.5, based on peak-to-peak sound pressure levels.

Table 2.5 Comparison received levels for invertebrates and plankton

Type of animal	Day *et al.*, 2016	McCauley *et al.*, 2017
Invertebrates (scallops/bivalves)	191 dB re 1 μPa (pk-pk)	n/a
Invertebrates (lobster/crustaceans)	209 dB re 1 μPa (pk-pk)	n/a
Plankton	n/a	178 dB re 1 μPa (pk-pk)

[2] *Guideline exposure criteria for explosions, piling, continuous sound and low and mid-frequency naval sonar are also presented though are not applicable to this Project.*

3 Assessment Methodology

Source Term Derivation for Seismic Source Array

3.1 Source sound levels are usually described in dB re 1 µPa at 1 m (as if measured at 1 m from the source). In practice, it is not usually possible to measure at 1 m from an active seismic source that is physically distributed over an area of typically tens of square metres, but this method allows different source levels to be compared and reported on a like-for-like basis. Far-field source modelling is typically based on the following basic assumptions:

- at some far distance from the source (typically vertically downwards) the energy from the source elements add constructively; and
- the source level is derived by back projecting a far field calculation to 1 m.

3.2 Output from the source array modelling software model of the array has been provided as source data. A key assumption is that the source data accurately reflects the source level of the array in practice, as encountered in the far field of the source. The source array modelling output is summarised as follows:

- Source array volume : 3,000 cu in;
- peak to peak pressure level : 118.1 bar-m.
- peak to peak sound pressure level : 261.4 dB re 1 µPa re 1 m

3.3 The airgun array signature is shown in Figure 3.1.

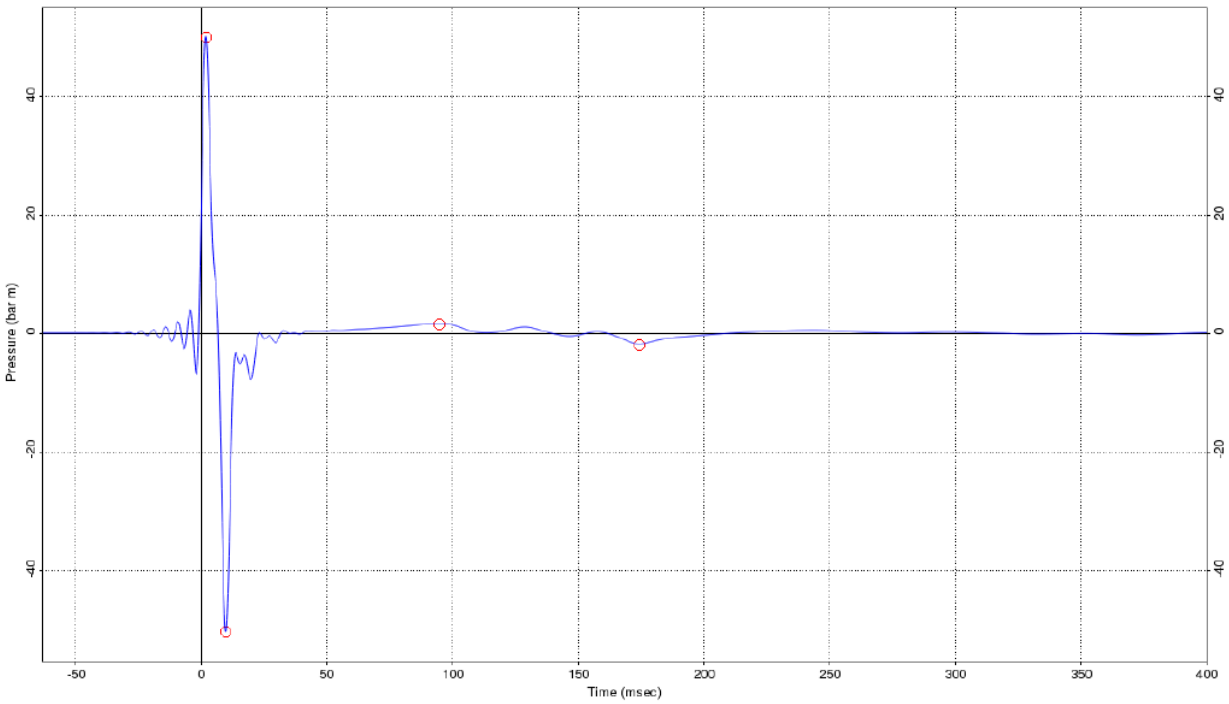

Figure 3.1 Airgun array source time signature

3.4 The supplied source data also includes information of the source frequency characteristics (Figure 3.2) but for a limited frequency range of up to 500 Hz. Although the highest sound pressure levels (in terms of un-weighted levels) are generated in this bandwidth, significant energy is also generated by seismic source arrays at much higher frequencies which are within the hearing sensitivities of marine mammals.

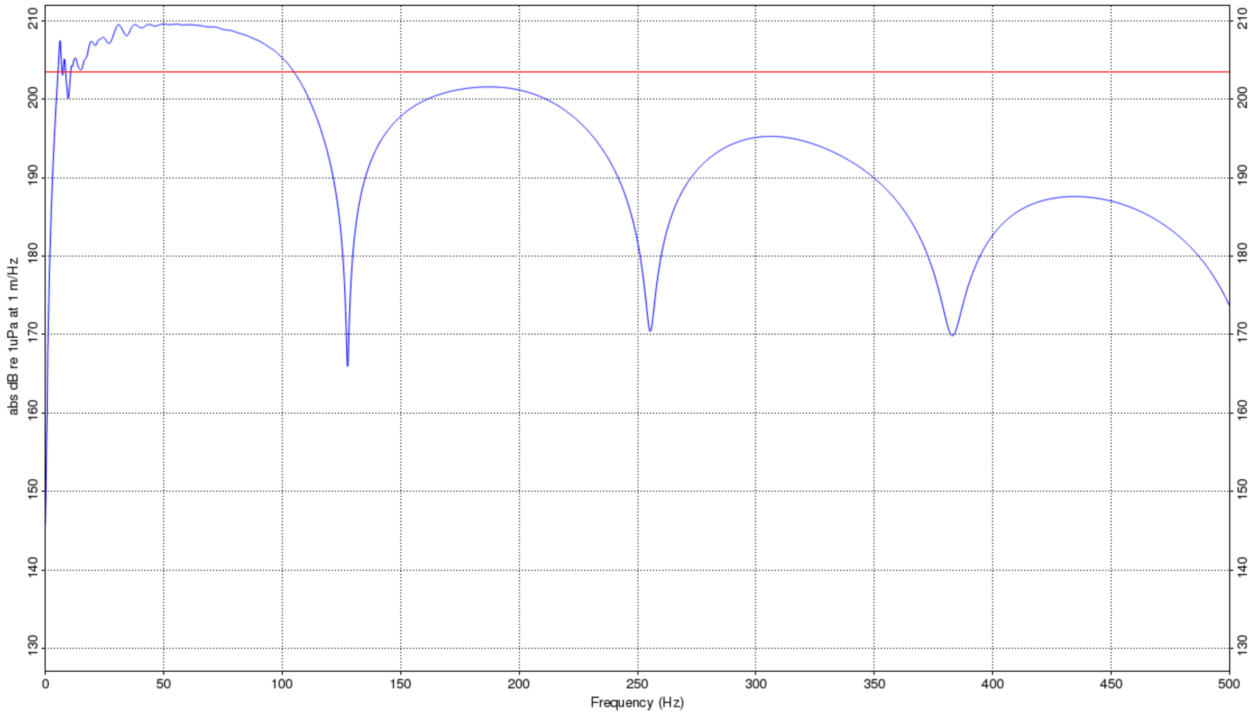

Figure 3.2 Source frequency characteristics (250 Hz low-pass filtered)

3.5 It is a common miscomprehension that seismic sound does not contain high frequency energy above a few hundred Hz. Seismic source arrays contain significant (unwanted) high frequency energy although this is often not shown in source array modelling reports due to the sampling rate of the software and the source filtering applied – this is because it is the low frequency energy content of the signature that is of interest for geophysical analysis. The miscomprehension is not helped by the way that frequency spectrum plots are often represented by use of power spectrum density. Because these plots effectively describe the power present in the signal as a function of frequency, per unit frequency, the slope of the curve can be misinterpreted as meaning that there is less high frequency content.

3.6 Inspection of the NMFS (2018) hearing weighting curves shown in Figure 2.1 shows that the majority of energy contributing to the hearing weighted SELs is well above the source modelling frequency of 500 Hz for the majority of hearing groups. Indeed, the source modelling frequency range does not cover *any* of the sound energy within the high and mid frequency cetacean weighting curves.

3.7 For this study, the source sound levels have been based on a combination of those provided by the source array model, supplemented by measured sound data from other studies over a much wider bandwidth (Breitzke et al., 2008; Tolstoy et al., 2009; Richardson et al., 1995) in order to produce low- and mid-frequency data. The low- and mid-frequency data has been extrapolated to derive the third-octave frequency spectra at higher frequencies (>500 Hz) based on the gradient of the power spectral density[3] and third-octave band plots. Sound levels at frequencies greater than 1 kHz have been assigned based on broadband field measurement data. The resultant third octave band spectrum shape is shown in Figure 3.3.

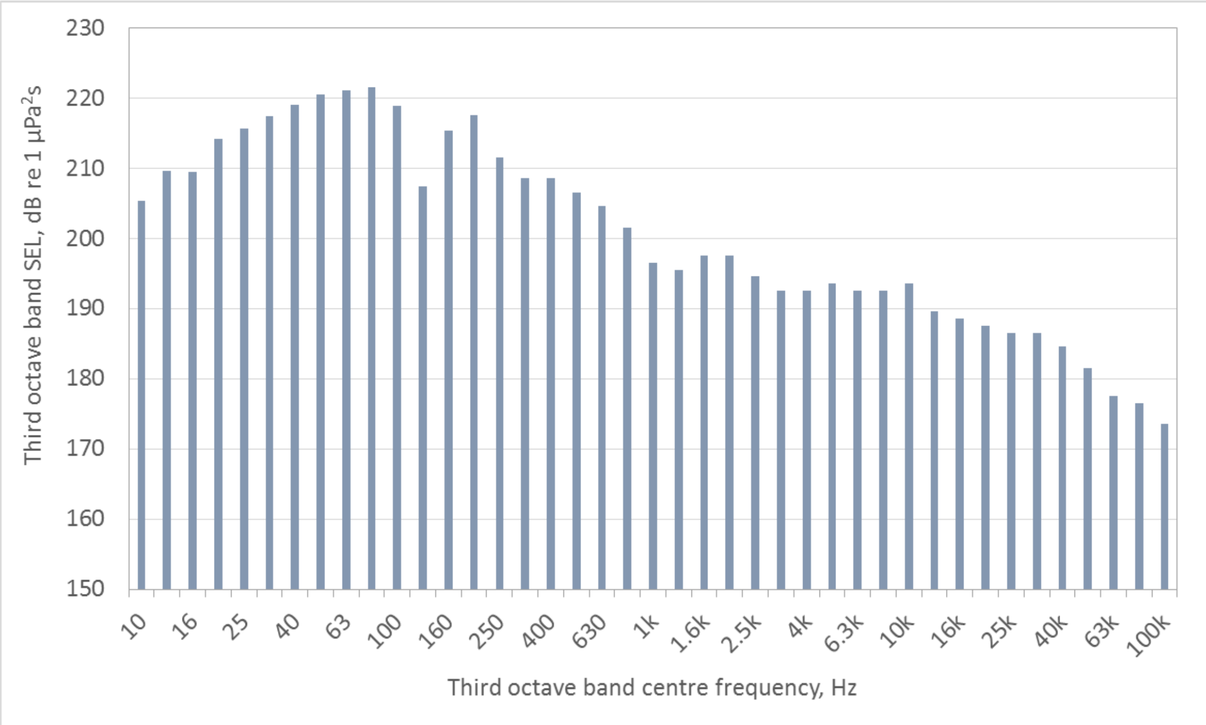

Figure 3.3 Third octave band spectrum shape used in model

3.8 The SEL represents the total energy of an event or number of events normalised to a standardised one second interval. This allows a comparison of the total energy of different sounds lasting for different time periods. As a pressure pulse from a source array propagates towards the receiver, the duration of the pulse increases. Thus the relationship between the peak sound pressure level and the SEL changes with distance. The peak level from the source array software model was converted to an SEL based on the gun signature time history graph and compared to measured data from Patterson *et al.* (2007). The single pulse SEL values have been combined for each pulse as part of the various cumulative SEL modelling scenarios.

3.9 It is important to note that the rms sound pressure level will depend upon the integration window used or, in other words, the measurement time for the rms. Using a longer duration measurement would result in a lower rms sound pressure level than using a shorter one. Therefore, the rms sound pressure source level has been calculated by scanning the source array model time history

[3] The power spectral density (PSD) is the power carried by the wave, per unit frequency of the signal.

plot in order to re-calculate the rms sound pressure level using the relevant T90 time period (i.e. the interval which contains 90% of the sound energy). This integration procedure gives a more relevant and consistent value for comparison between various studies and is the suggested metric in Southall *et al.* (2007).

3.10 An additional phenomenon occurs where the seismic waveform elongates with distance from the source due to a combination of dispersion and multiple reflections. Measurements presented by Breitzke *et al*. (2008) indicate elongation of the T90 window up to approximately 800 ms at 1,000 m. This temporal "smearing" reduces the rms and peak amplitude with distance (because the rms window is longer) and has been included within the disturbance modelling scenarios. Since the ear of most marine mammals integrates low frequency sound over a window of around 200 ms (Madsen et al. 2006), this duration was used as a maximum integration time for the received rms sound pressure level.

3.11 The source levels stated above are likely to be overestimated in the near-field as the modelled back projection to 1 m does not consider the interaction between the source elements. This in turn overestimates near-field received levels, which are then compared to animal thresholds. In reality, near-field source sound levels will be lower than that predicted by this vertical far-field calculation.

3.12 Another important factor affecting the received sound pressure level from seismic source arrays is the source directivity characteristics. Source arrays are designed so that the majority of acoustic energy is directed downwards towards the ocean bottom. Therefore, the amount of energy emitted horizontally will be significantly less than directed downwards. The directivity plots are shown in Figure 3.4.

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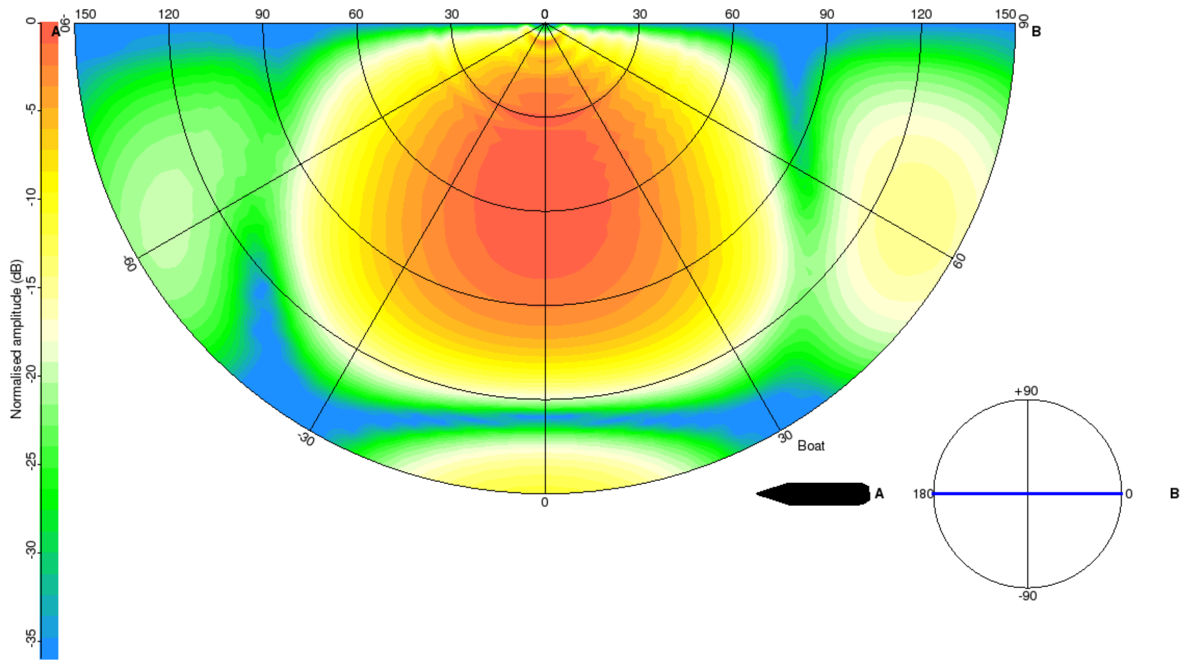

Azimuth: 90 deg

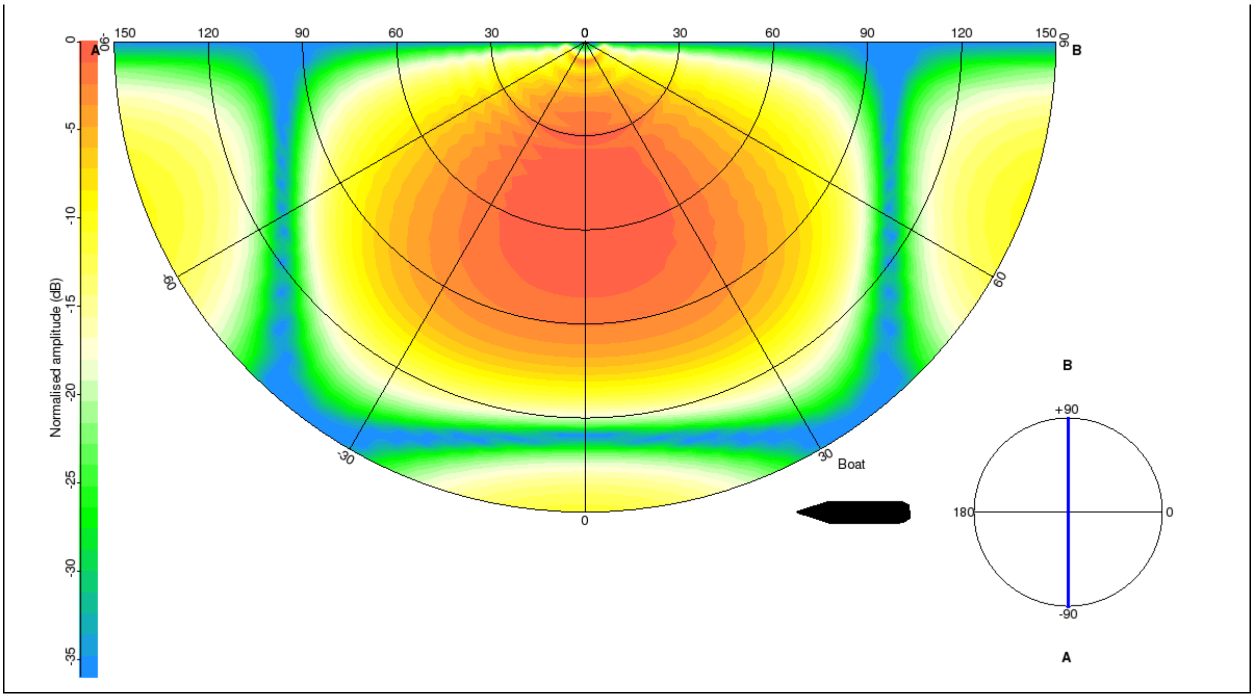

Figure 3.4 Directivity plots for source array

3.13 An example SPL plot showing this directivity effect directly under a source array is shown in Figure 3.5 (the directivity figures are for illustrative purposes only and not specific to the source array proposed for this survey). From the figure, it can clearly be seen that an animal swimming in deeper water would be subject to higher sound exposure levels than one in shallow water at the same aerial distance from the source array.

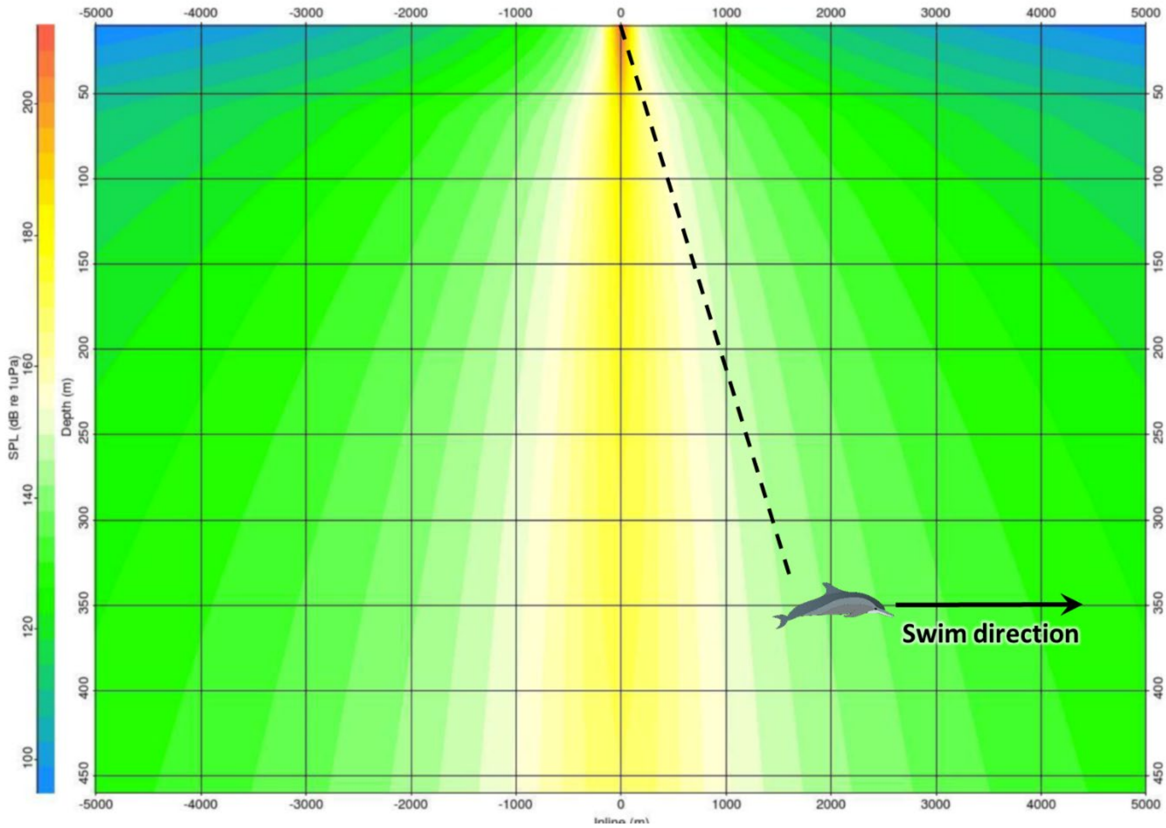

Figure 3.5 Example inline SPL showing array directivity

3.14 Directivity is a frequency dependent effect and is more pronounced at higher frequencies than at lower frequencies. Directivity corrections have been applied to the source sound level data based on supplied directivity characteristics for the proposed array. Directivity factors were derived based on source take-off angle for an animal on the bottom of the ocean, assuming that the receiver is to the side of the array (as opposed to in front of or behind the array). This results in a greater correction (reduction in level) due to directivity at distances further from the source than for receivers close to the source.

3.15 At distances closer to the source (i.e. less than the water depth), no directivity correction is made because the animal could be directly underneath the array. This scenario is shown illustratively in Figure 3.6. It should be noted that these figures and examples are illustrative and simplified scenarios in order to demonstrate the principal of take-off angles.

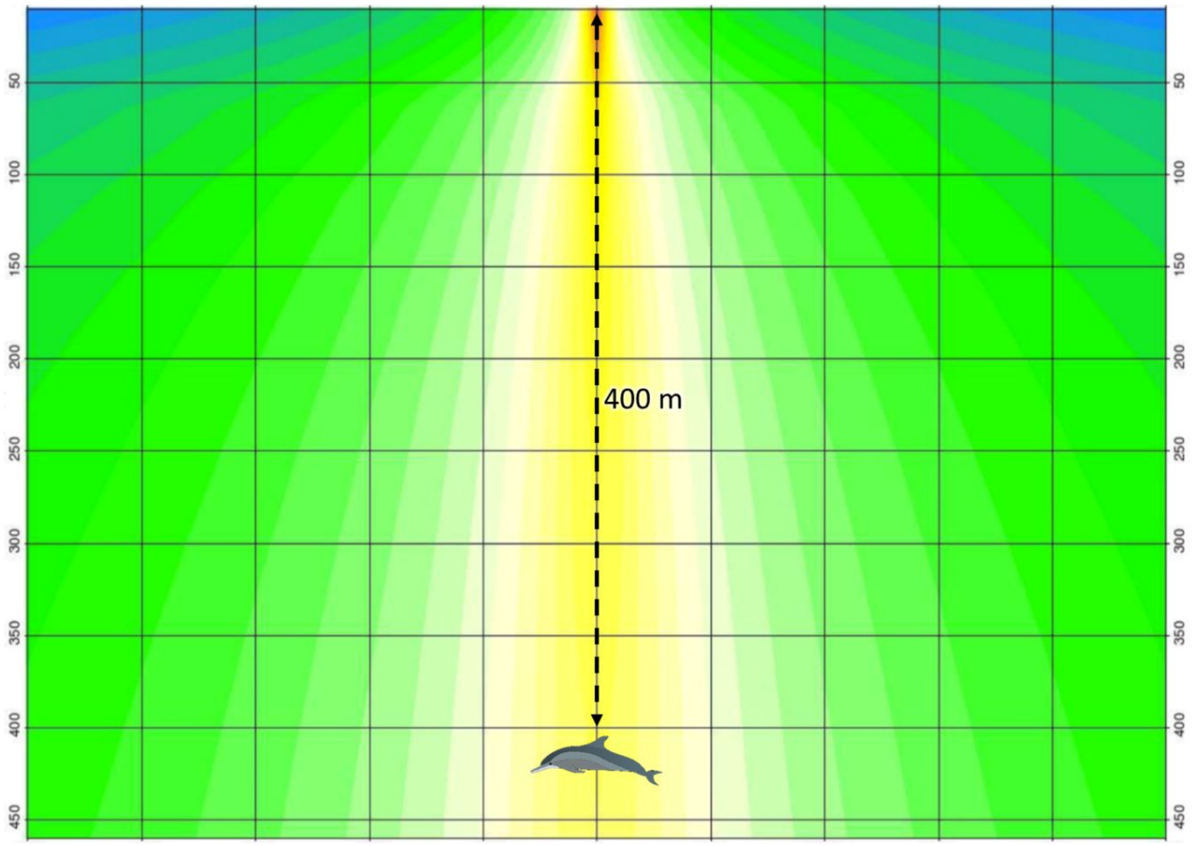

Figure 3.6 Example showing injury range less than water depth

3.16 As the injury range increases, the take-off angle between the source array and animal becomes larger. Hence, when the injury range is large in comparison to the water depth, the effects of the source array's directivity will have a much greater bearing on the received sound level. Once the injury range becomes larger than the water column depth then the array directivity effects will become increasingly important. Figure 3.7 shows an example where the injury range is slightly larger than the water column depth.

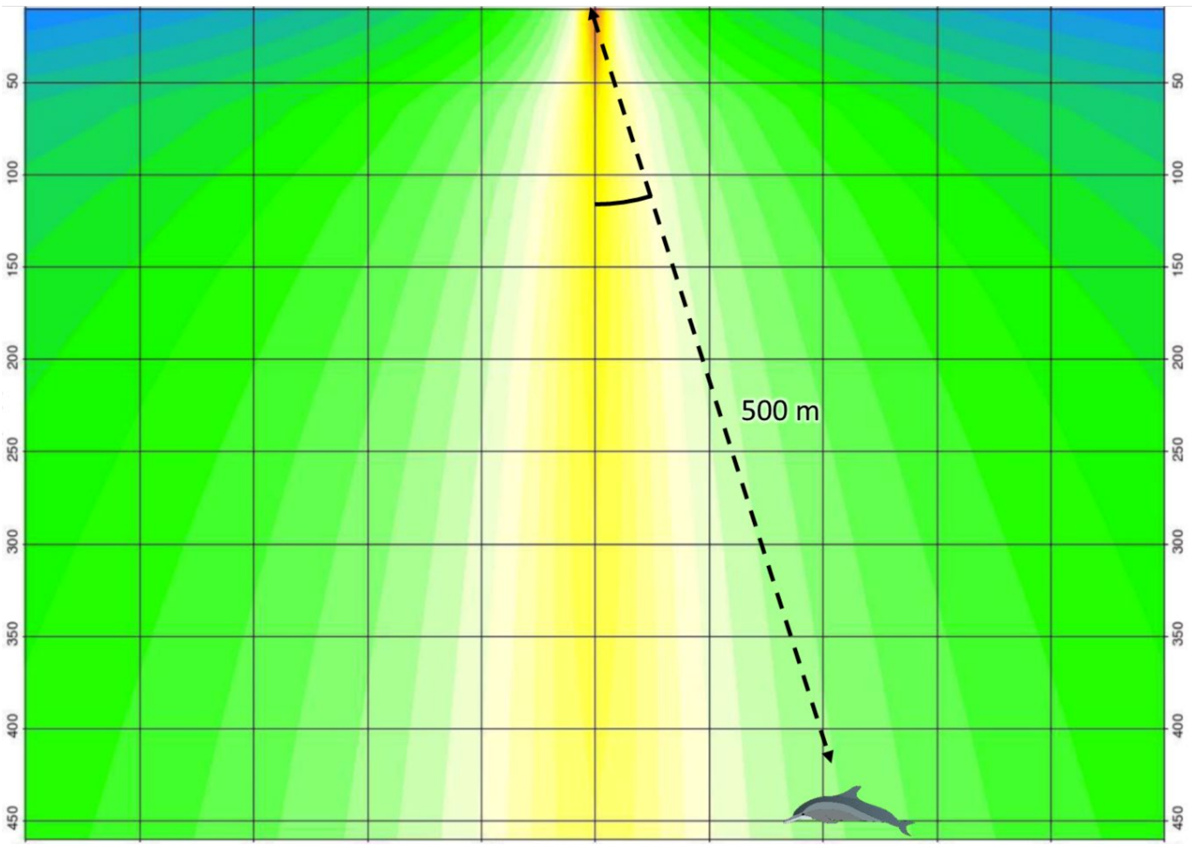

Figure 3.7 Example showing injury range slightly larger than water depth

3.17 For injury ranges which are much larger than the water column depth the effects of directivity will be much more significant. This is shown illustratively in Figure 3.8.

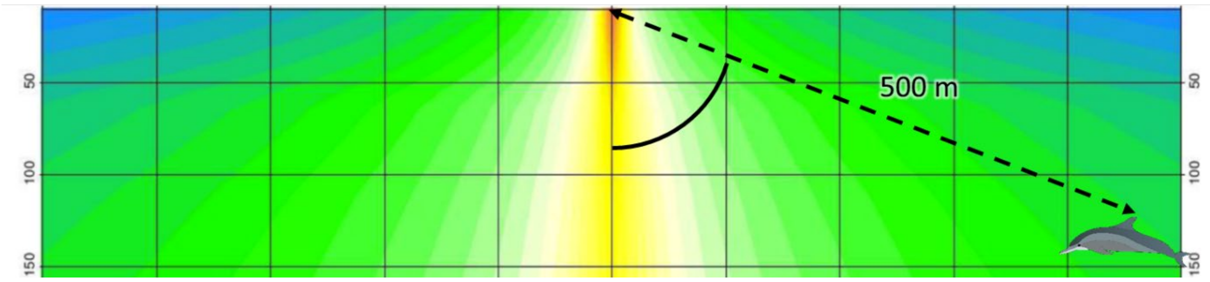

Figure 3.8 Example showing injury range much larger than water depth

3.18 It should be noted that the disturbance ranges reported in this report do not take the directivity into account due to the larger ranges and associated uncertainty over directivity effects at much larger ranges. It is considered that this approach represents a worst case precautionary assessment.

Propagation Model

3.19 Increasing the distance from the sound source usually results in the level of sound becoming lower, due primarily to the spreading of the sound energy with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in, in combination with attenuation due to absorption of sound energy by molecules in the water. This latter mechanism is more important for higher frequency sound than for lower frequencies.

3.20 The way that the sound spreads (geometrical divergence) will depend upon several factors such as water column depth, pressure, temperature gradients, salinity as well as water surface and bottom (i.e. seabed) conditions. Thus, even for a given locality, there are temporal variations to the way that sound will propagate. However, in simple terms, the sound energy may spread out in a spherical pattern (close to the source) or a cylindrical pattern (much further from the source), although other factors mean that decay in sound energy may be somewhere between these two simplistic cases.

3.21 In acoustically shallow waters[4] in particular, the propagation mechanism is coloured by multiple interactions with the seabed and the water surface; Kinsler et al. 1999). Whereas in deeper waters, the sound will propagate further without encountering the surface or bottom of the sea, in shallower waters the sound may be reflected from either or both boundaries (potentially more than once).

3.22 At the sea surface, the majority of sound is reflected back in to the water due to the difference in acoustic impedance (i.e. sound speed and density) between air and water. However, scattering of sound at the surface of the sea can be an important factor with respect to the propagation of sound. In an ideal case (i.e. for a perfectly smooth sea surface), the majority of sound wave energy will be reflected back into the sea. However, for rough seas, much of the sound energy is scattered (e.g. Eckart 1953; Fortuin 1970; Marsh, Schulkin, and Kneale 1961; Urick and Hoover 1956). Scattering can also occur due to bubbles near the surface such as those generated by wind or fish or due to suspended solids in the water such as particulates and marine life. Scattering is more pronounced for higher frequencies than for low frequencies and is dependent on the sea state (i.e. wave height). However, the various factors affecting this mechanism are complex.

3.23 Because surface scattering results in differences in reflected sound, its effect will be more important at longer ranges from the source sound and in acoustically shallow water (i.e. where there are multiple reflections between the source and receiver). The degree of scattering will depend upon the sea state/wind speed, water depth, frequency of the sound, temperature gradient, grazing angle and range from source. It should be noted that variations in propagation due to scattering will vary temporally within an area primarily due to different sea-states / wind speeds at different times. However, over shorter ranges (e.g. several hundred meters or less) the sound will experience fewer reflections and so the effect of scattering should not be significant.

3.24 When sound waves encounter the bottom, the amount of sound reflected will depend on the geoacoustic properties of the bottom (e.g. grain size, porosity, density, sound speed, absorption coefficient and roughness) as well as the grazing angle and frequency of the sound (Cole 1965; Hamilton 1970; Mackenzie 1960; McKinney and Anderson 1964; Etter 2013; Lurton 2002; Urick

[4] *Acoustically, shallow water conditions exist whenever the propagation is characterised by multiple reflections with both the sea surface and bottom (Etter 2013). Consequently, the depth at which water can be classified as acoustically deep or shallow depends upon numerous factors including the sound speed gradient, water depth, frequency of the sound and distance between the source and receiver.*

1983). Thus, bottoms comprising primarily mud or other acoustically soft sediment will reflect less sound than acoustically harder bottoms such as rock or sand. This will also depend on the profile of the bottom (e.g. the depth of the sediment layer and how the geoacoustic properties vary with depth below the sea floor). The effect is less pronounced at low frequencies (a few kHz and below). A scattering effect (similar to that which occurs at the surface) also occurs at the bottom (Essen 1994; Greaves and Stephen 2003; McKinney and Anderson 1964; Kuo 1992), particularly on rough substrates (e.g. pebbles).

3.25 Another phenomenon is the waveguide effect, which means that shallow water columns do not allow the propagation of low frequency sound (Urick 1983; Etter 2013). The cut-off frequency of the lowest mode in a channel can be calculated based on the water depth and knowledge of the sediment geoacoustic properties. Any sound below this frequency will not propagate far due to energy losses through multiple reflections.

3.26 Another important factor is the sound speed gradient. Changes in temperature and pressure with depth mean that the speed of sound varies throughout the water column. This can lead to significant variations in sound propagation and can also lead to sound channels, particularly for high frequency sound. Sound can propagate in a duct-like manner within these channels, effectively focussing the sound, and conversely they can also lead to shadow zones. The frequency at which this occurs depends on the characteristics of the sound channel but, for example, a 25 m thick layer would not act as a duct for frequencies below 1.5 kHz. The temperature gradient can vary throughout the year and thus there will be potential variation in sound propagation depending on the season.

3.27 Sound energy is also absorbed due to interactions at the molecular level converting the acoustic energy into heat. This is another frequency dependent effect with higher frequencies experiencing much higher losses than lower frequencies.

3.28 There are several methods available for modelling the propagation of sound between a source and receiver ranging from very simple models which simply assume spreading according to a 10 log (r) or 20 log (r) relationship (as discussed above) to full acoustic models (e.g. ray tracing, normal mode, parabolic equation, wavenumber integration and energy flux models). In addition, semi-empirical models are available which lie somewhere in between these two extremes in terms of complexity.

3.29 In choosing which propagation model to employ, it is important to ensure that it is fit for purpose and produces results with a suitable degree of accuracy for the application in question, taking into account the context (as detailed in Monitoring Guidance for Underwater Noise in European Seas Part III, NPL Guidance and Farcas *et al.*, 2016). Thus, in some situations (e.g. low risk due to underwater noise, range dependent bathymetry is not an issue, non-impulsive sound) a simple (N log R) model will be sufficient, particularly where other uncertainties outweigh the uncertainties due to modelling. On the other hand, some situations (e.g. very high source levels, impulsive sound, complex source and propagation path characteristics, highly sensitive receivers and low uncertainties in assessment criteria) warrant a more complex modelling methodology.

3.30 The first step in choosing a propagation model is therefore to examine these various factors, such as set out below:

- balancing of errors / uncertainties;
- range dependant bathymetry;
- frequency dependence; and
- source characteristics.

3.31 For impulsive sound, such as that produced by a seismic survey source array, the sound propagation is rather more complex than can be modelled using a simple N log (R) relationship.

3.32 For example, the rms sound pressure level of an impulsive sound wave will depend upon the integration window used or, in other words, the measurement time for the rms. The use of a longer duration measurement would result in a lower rms sound pressure level than using a shorter one. An additional phenomenon occurs where the seismic waveform elongates with distance from the source due to a combination of dispersion and multiple reflections. This temporal "smearing" can significantly affect the peak pressure level and reduces the rms amplitude with distance (because the rms window is longer). Furthermore, source levels stated in the source array modelling reports are likely to be overestimated in the near-field as the modelled back projection to 1 m does not consider the interaction between the source elements. This in turn overestimates near-field received levels, which are then compared to animal thresholds. In reality, near-field source sound levels will be lower than that predicted by this vertical far-field calculation. Another important factor affecting the received sound pressure level from seismic source arrays is the source directivity characteristics. Source arrays are designed so that the majority of acoustic energy is directed downwards towards the ocean bottom. Therefore, the amount of energy emitted horizontally will be significantly less than directed downwards. This is a frequency dependent effect and is more pronounced at higher frequencies than at lower frequencies.

3.33 In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang *et al.* (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, as described above, the seismic source will contain a significant amount of energy above this frequency. As discussed previously, inspection of the NMFS (2018) hearing weighting curves shows that the majority of energy contributing to the hearing weighted SELs is above this frequency for the majority of hearing groups (excluding low-frequency cetaceans). Indeed, the suitable frequency range for parabolic equation models would not cover *any* of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals. For this reason, it is concluded that parabolic equation modelling is not the most suitable method for assessing the effects of the seismic source signature on marine mammals.

3.34 Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchmarked against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been benchmarked, with good agreement, against other transmission loss models (e.g. Toso *et al.,* 2014; Etter 2013; Schulkin and Mercer 1985).

3.35 RPS has carried out additional benchmarking tests using the extended Rogers propagation model in comparison to other propagation models. Figure 3.9 shows a comparison of the Rogers model against the Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model for a sample transect for the source operating in waters approximately 1,800 m deep. The results of the Normal Mode and Ray Tracing combined model are shown as maximum SEL values over the water depth as well as logarithmically averages values over the water depth. The grey line shows the bathymetry along the transect.

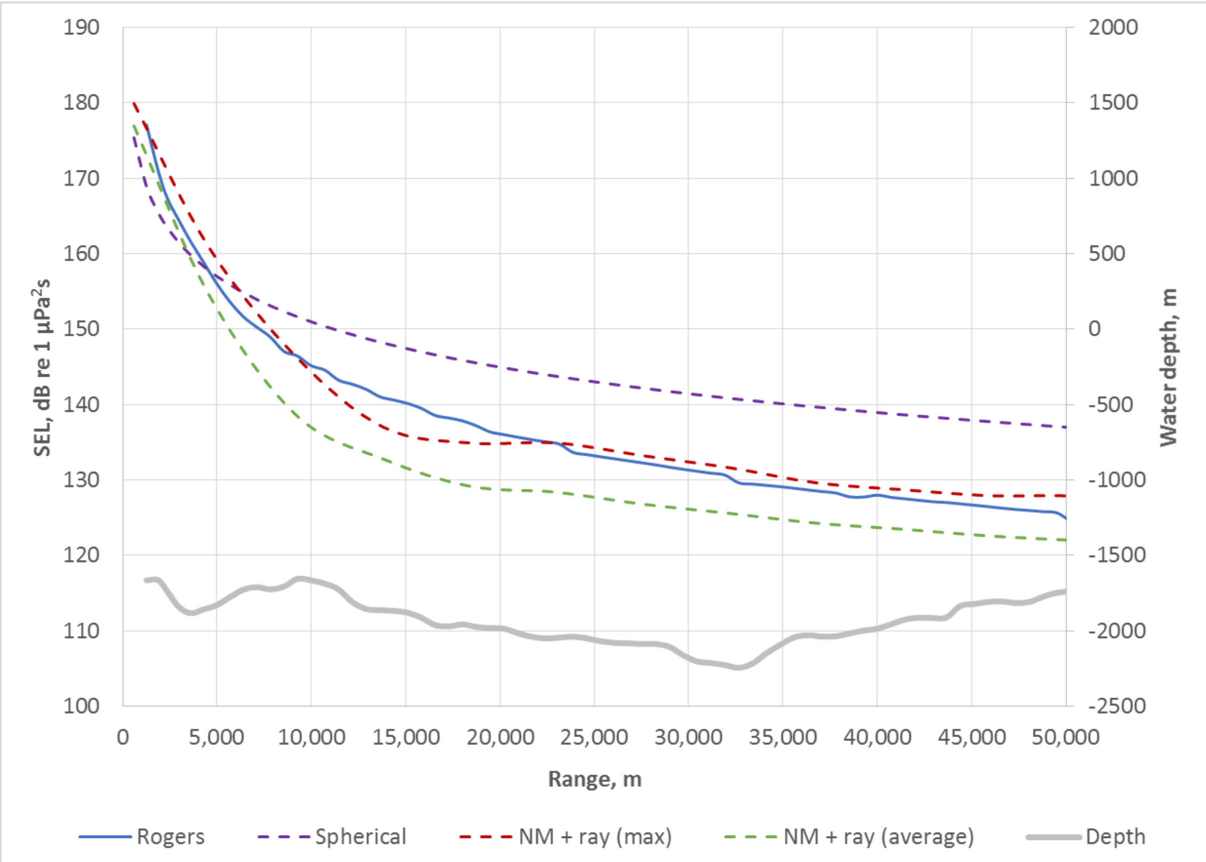

Figure 3.9 Comparison between propagation models for transect

3.36 Although there are differences between the model outputs (e.g. up to 5 dB over prediction in the range 10 to 20 km), these are considered insignificant in comparison to potential errors and uncertainty in assumptions about animal behaviour and injury thresholds.

3.37 The following inputs are required for the model:

- third-octave band source sound level data;
- range (distance from source to receiver);
- water column depth (input as bathymetry data grid);
- sediment type;
- sediment and water sound speed profiles and densities;
- sediment attenuation coefficient; and
- source directivity characteristics.

3.38 The propagation loss is calculated using the formula:

$$TL = 15log_{10}R + 5\log_{10}(H\beta) + \frac{\beta R\theta_L^2}{4H} - 7.18 + \alpha_w R$$

Where R is the range, H the water depth, β the bottom loss, $\theta_L$the limiting angle and α_w the absorption coefficient of sea water (α_w is a frequency dependant term which is calculated based on Ainslie and McColm, 1998).

3.39 The limiting angle, θ_L is the larger of θ_g and θ_c where θ_g is the maximum grazing angle for a skip distance and θ_c is the effective plane wave angle corresponding to the lowest propagating mode.

$$\theta_g = \sqrt{\frac{2Hg}{c_w}} \qquad \theta_c = \frac{c_w}{2fH}$$

Where g is the sound speed gradient in water and f is the frequency.

3.40 The bottom loss β is approximated as:

$$\beta \approx \frac{0.477(\rho_s/\rho_w)(c_w/c_s)K_s}{[1-(c_w/c_s)^2]^{3/2}}$$

Where ρ_s is the density of sediment, ρ_w the density of water, c_s the sound speed in the sediment, c_w the sound speed in water and K_s is the sediment attenuation coefficient.

3.41 The propagation model also takes into account the depth dependent cut-off frequency for propagation of sound (i.e. the frequency below which sound does not propagate):

$$f_{cut-off} = \frac{c_w}{4h\sqrt{1-\frac{c_w^2}{c_s^2}}}$$

Where c_s and c_w are the sound propagation speeds in the substrate and water.

3.42 The propagation and sound exposure calculations were conducted over a range of water column depths in order to determine the likely range for injury and disturbance. It should be noted that the effect of directivity has a strong bearing on the calculated zones for injury and disturbance because a marine mammal could be directly underneath an array for greater distances in deep water compared to shallow water.

3.43 It should be borne in mind that noise levels (and associated range of effects) will vary depending on actual conditions at the time (day-to-day and season-to-season) and that the model predicts a typical worst case scenario. Taking into account factors such as animal behaviour and habituation, any injury and disturbance ranges should be viewed as indicative and probabilistic ranges to assist in understanding potential impacts on marine life rather than lines either side of which an impact definitely will or will not occur. (This is a similar approach to that adopted for airborne noise where a typical worst case is taken, though it is known that day to day levels may vary to those calculated by 5 - 10 dB depending on wind direction etc.).

3.44 The survey area seabed primarily consists of terrigenous sand. The following geoacoustic parameters for the bottom have been utilised in the noise model (Hamilton 1970, 1980; Jensen 1994):

- sediment sound speed cs = 1,720 m/s
- density of sediment ρs = 2.01 kg/m^3
- sediment attenuation coefficient Ks = 0.21 dB/m/kHz

3.45 The sound speed gradient used in the model has been based on a summer sound speed gradient as a worst case assumption, as shown in Figure 3.10.

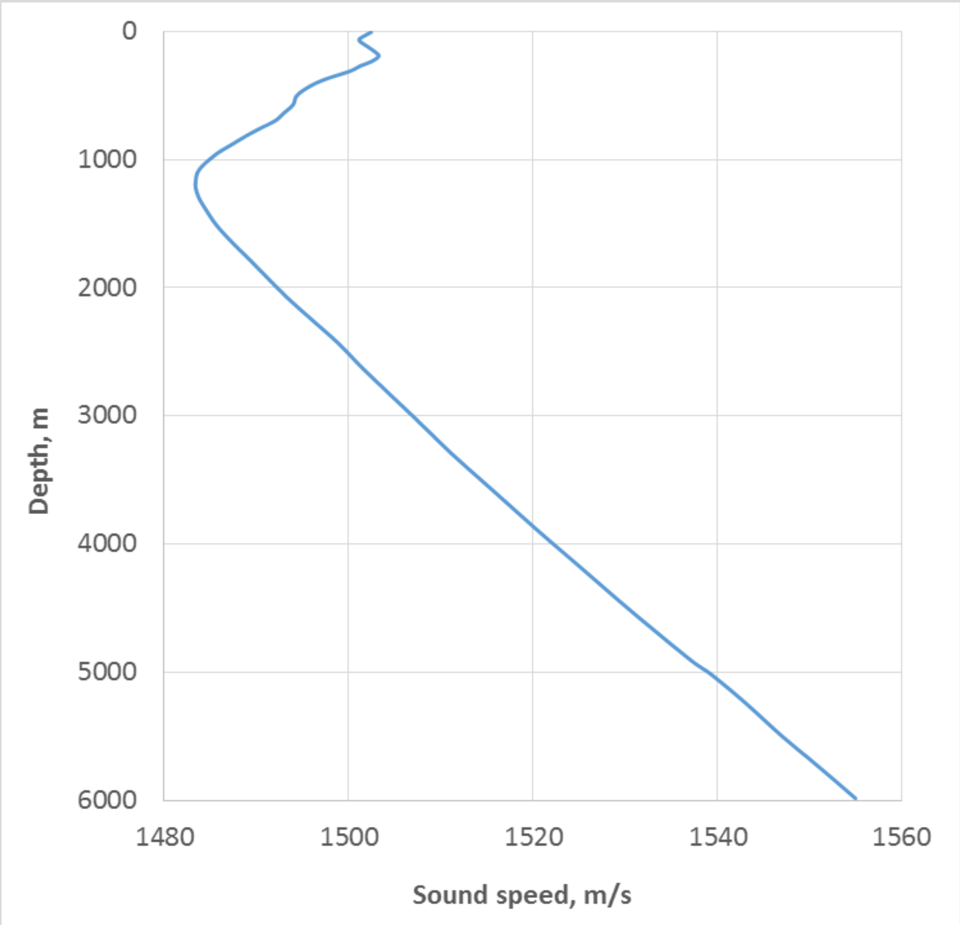

Figure 3.10 Summer sound speed profile

3.46 The bathymetry of the survey area and surrounding area is shown in Figure 3.11. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2,676 m in the Bass Canyon. Bathymetry has been included in the model using the GEBCO database bathymetry grid.

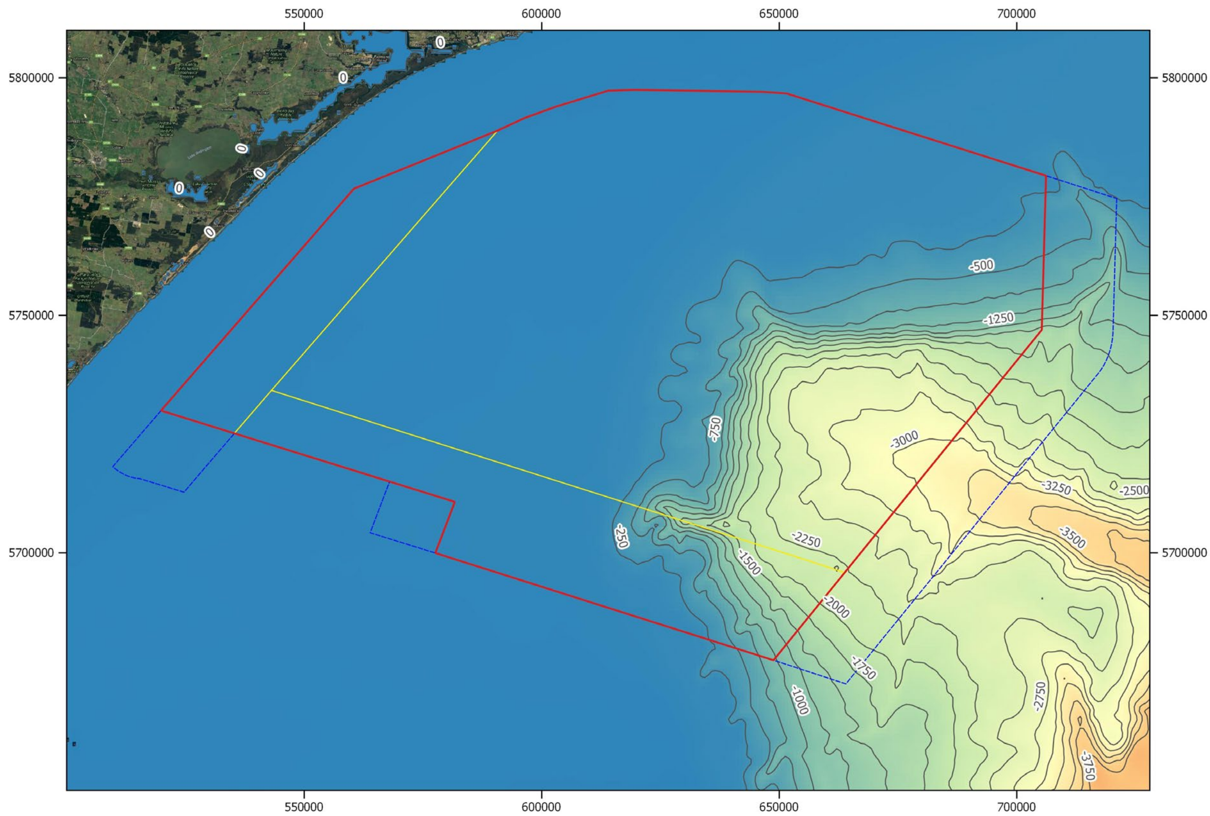

Figure 3.11 Bathymetry in and around the survey area

3.47 It has been assumed that the same sound speed profile and bottom conditions apply over the entire area modelled.

3.48 Field measurements show that the rms T90 increases significantly at distances of even a few hundred metres from the source array due to both multiple reflections and dispersion. This is taken into account in the model empirically using measured in-field data (Breitzke et al. 2008) to derive a correction to the "source T90" as shown in Figure 3.12.

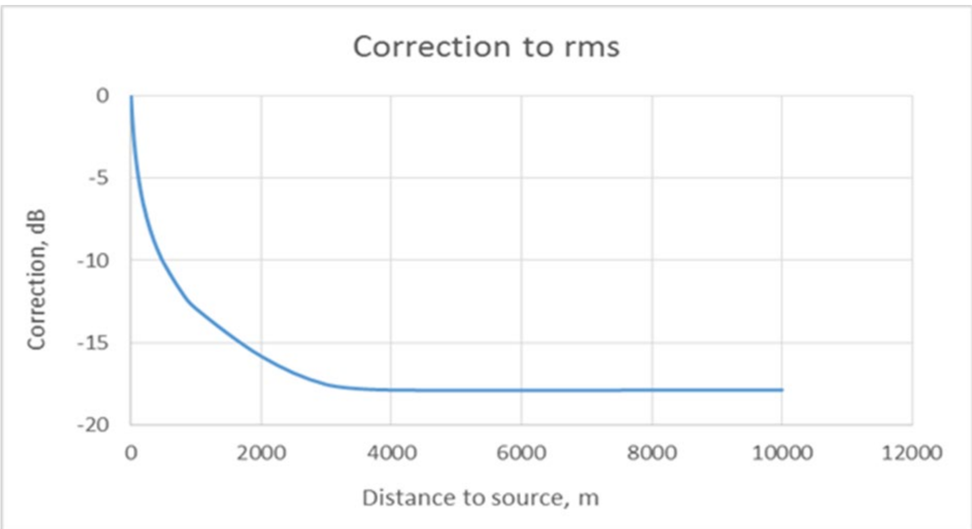

Figure 3.12 T90 correction vs distance

Exposure Calculations

3.49 As well as calculating the un-weighted rms and peak sound pressure levels at various distances from the source, it is also necessary to calculate the SEL for a mammal using the relevant hearing weightings described above taking into account the number of pulses to which it is exposed. For operation of the source array, the SEL sound data for a single pulse was utilised, along with the maximum number of pulses expected to be received by marine mammals in order to calculate cumulative exposure.

3.50 Exposure modelling was based on the assumption of a stationary mammal and moving seismic source.

3.51 The above cases were modelled for a range of start distances (initial or closest passing distance between the animal and vessel) in order to calculate cumulative exposure for a range of scenarios. In each case, the pulses to which the mammal is exposed in closest proximity to the vessel dominate the sound exposure. This is due to the logarithmic nature of sound energy summation. The scenario modelled was based on a marine mammal being at a point equidistant between the start and finish of a sail line as this represents a worst-case precautionary assessment. Cumulative SELs were modelled for a range of start distances (initial or closest passing distance between the animal and vessel) in order to calculate cumulative exposure over a 24 hour period.

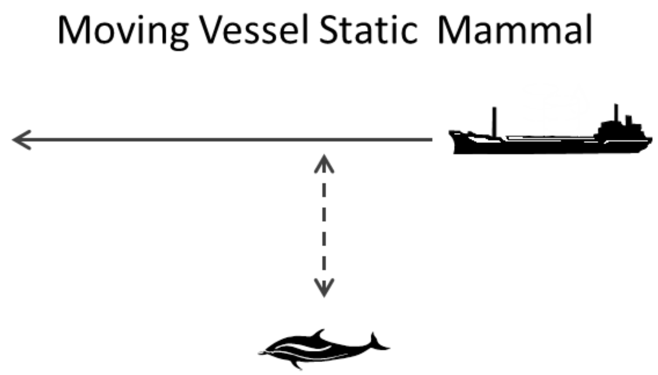

Figure 3.13 Sound exposure modelling scenario

3.52 Figure 3.14 shows a generic example of how the single pulse and cumulative SELs are calculated for a sail line.

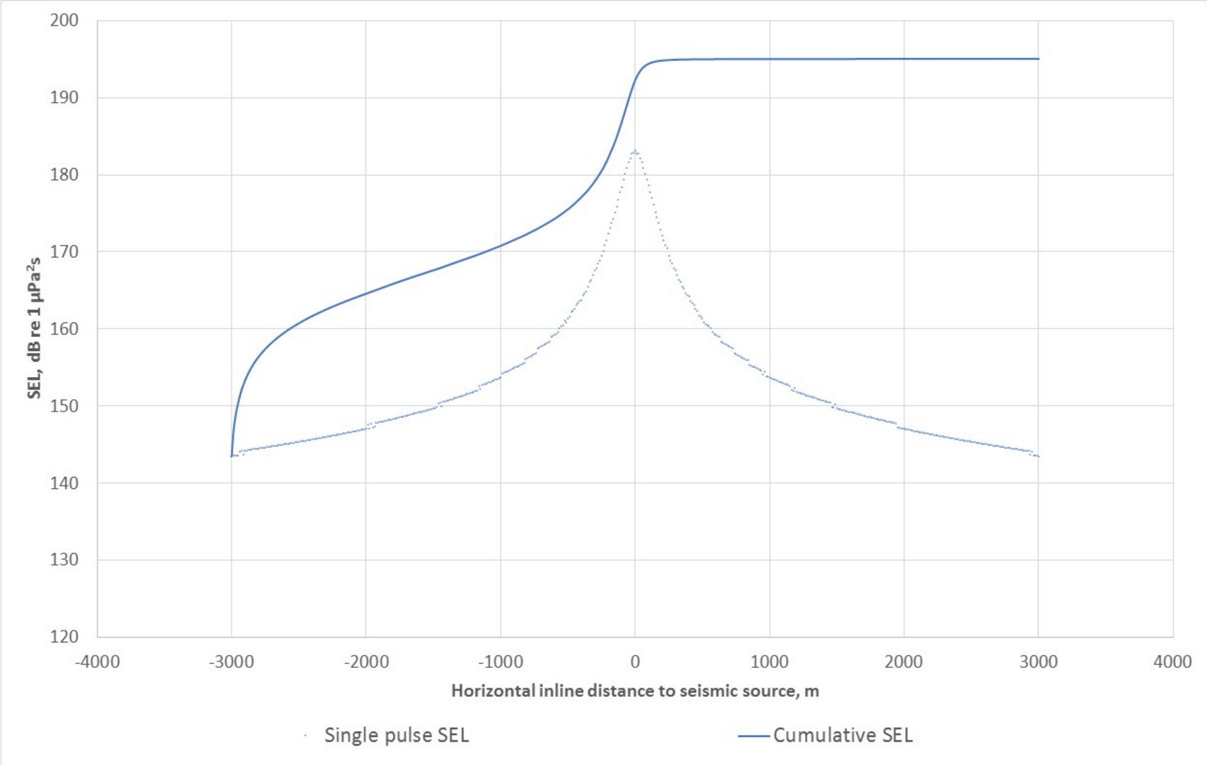

Figure 3.14 Discrete pulse SEL and cumulative SEL

3.53 It should be noted that the sound exposure calculations are based on the simplistic assumption that the seismic source is active continuously over a period of up to 24 hours, being activated at the same interval. The real world situation is more complex; typically a vessel would traverse each sail-line in turn with a line-change between sail-lines when the source is not active. The exposure calculations do not take these breaks in activity into account and are therefore a worst-case precautionary assessment.

3.54 Furthermore, the multiple pulse sound criteria described in the NMFS (2018) guidelines assume that the animal does not recover hearing between each pulse or series of pulses. It is likely that both the intervals between pulses and the breaks in operations for line changes could allow some recovery from temporary hearing threshold shifts for animals exposed to the sound and, therefore, the assessment of sound exposure level is considered to be conservative. This over-estimate is, however, considered to be small because, as stated previously, the majority of sound energy to which an animal is exposed occurs when it is at the closest distance to the source, with subsequent exposure at greater ranges making an insignificant contribution to the overall exposure.

3.55 Sound emissions due to the survey vessel are considered negligible when compared with the source array, so have not been included for purposes of the sound exposure calculation.

4 Sound Modelling Results

Marine Mammals

4.1 Based on the results of the propagation and exposure modelling, the expected PTS SEL injury zones are shown in Table 4.1. Results presented in the table include the SEL static mammal injury range. It should be noted that the calculated sound pressure level in the near-field will be overestimated, as discussed in Section 4. The distances presented in the table reflect the start point of the mammal relative to the source when the source first starts up.

Table 4.1 SEL PTS injury ranges for marine mammals (N/E = criteria not exceeded)

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
SEL Static Mammals:			
Low frequency cetacean	183 - 306	265 - 445	653 - 985
Mid frequency cetacean	9 - 11	N/E	N/E
High frequency cetacean	178 - 285	252 - 397	537 - 682
Phocid pinniped	38 - 53	38 - 40	22 - 33
Otariid pinniped	N/E	N/E	N/E

4.2 It is important to note that injury ranges are based on the worst case take-off angle between the animal and the source array. In other words, for an injury range which is less than the water depth, the assumption is that a marine mammal could be directly underneath the source array, meaning that the effects of directivity are minimal. This results in some cases in the potential radius of effect being larger in deep water than in shallow water. In reality, it is more likely that the animal would be some distance away horizontally from the source array, in which case directivity effects would mean that their sound exposure would be significantly lower than predicted in this worst case modelling scenario. The scenario of a marine mammal being directly under the array during start-up is considered unlikely, even if it is theoretically possible. It can therefore be concluded that the ranges presented for injury and disturbance and very precautionary and overly pessimistic.

4.3 The expected PTS injury zones with and without mitigation in place are shown in Table 4.2 based on the instantaneous peak pressure injury range. It should be noted that the peak pressure injury range only applies during the soft start period.

Table 4.2 Peak pressure PTS injury ranges for marine mammals (N/E = criteria not exceeded)

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
Peak Mammals:			
Low frequency cetacean	61 - 83	75 - 83	52 - 67
Mid frequency cetacean	23 - 23	17 - 21	10 - 14
High frequency cetacean	194 - 291	392 - 541	516 - 571
Phocid pinniped	66 - 93	86 - 94	60 - 76
Otariid pinniped	18 - 19	13 - 16	8 - 10

4.5 The expected TTS injury zones are shown in Table 4.3 based on exceedance of SEL criteria for marine mammals.

Table 4.3 SEL TTS injury ranges for marine mammals (N/E = criteria not exceeded)

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
SEL Static Mammals:			
Low frequency cetacean	13,866 – 23,823	12,620 – 14,964	12,403 – 34,738
Mid frequency cetacean	381 – 680	672 – 1,133	1,012 – 1,448
High frequency cetacean	3,692 – 5,847	4,611 – 5,426	8,652 – 9,638
Phocid pinniped	590 – 1,132	788 – 1,442	867 – 1,527
Otariid pinniped	81 – 133	476 – 553	939 – 1,322

4.6 The expected TTS injury zones are shown in Table 4.4 based on exceedance of peak pressure criteria.

Table 4.4 Peak pressure TTS injury ranges for marine mammals (N/E = criteria not exceeded)

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
Peak Mammals:			
Low frequency cetacean	92 - 142	160 - 165	106 - 148
Mid frequency cetacean	42 - 48	39 - 45	21 - 34
High frequency cetacean	311 - 434	584 - 854	1,039 – 1,089
Phocid pinniped	97 - 153	181 - 181	124 - 168
Otariid pinniped	36 - 38	30 - 35	16 - 25

4.8 The modelled behavioural change ranges (based on exceedance of the rms sound pressure criteria) and DEWHA guidelines, based on single pulse SEL, are shown in Table 4.5. It should be noted that the rms values use the estimated T90 time window at various distances from the source, up to a maximum value of 200 ms.

Table 4.5 Behavioural change and DEWHA ranges for marine mammals

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
Behavioural Change:			
Strong disturbance 160 dB re 1 µPa (rms_{T90})	1,152 – 1,197	1,422 – 1,984	2,608 – 3,896
DEWHA (2008)			
Range of 160 dB re 1 µPa^{2}s (SEL)	1,286 – 1,365	1,582 – 2,180	2,769 – 3,337

4.9 The potential ranges presented for injury and disturbance are not a hard and fast 'line' where an impact will occur on one side and not on the other. Potential impact is more probabilistic than that; dose dependency in TTS/PTS onset, individual variations and uncertainties regarding behavioural response and swim speed/direction all mean that in reality it is much more complex than drawing a contour around a location. These ranges are designed to provide an understandable way in which a wider audience can understand the potential spatial extent of the impact.

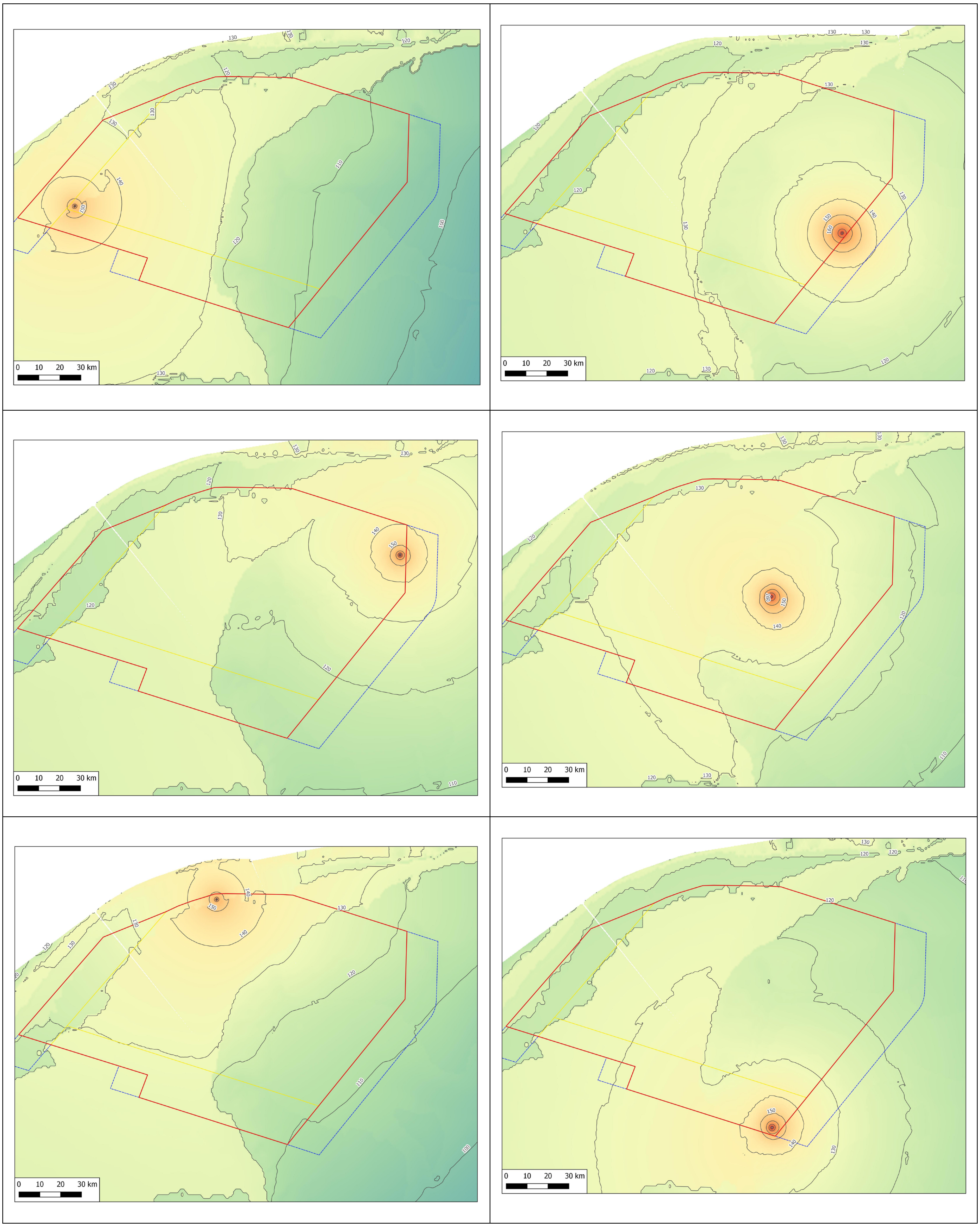

Figure 4.1 Unweighted single pulse un-weighted SEL noise contours, dB re 1 μPa^2s

Fish, Turtles, Invertebrates and Plankton

4.10 The ranges of effect for fish, turtles, invertebrates and plankton are shown in Table 4.6. The presented ranges are aerial radii within the water column.

Table 4.6 Noise modelling results for fish, turtles, invertebrates and plankton

Scenario	Range of effect, m		
	Shallow water (35 m - 200 m)	Mid depth waters (200 m - 1,000 m)	Deep waters (1,000 m - 2,650 m)
Fish:			
TTS All fish (186 dB re 1 µPa^{2}s SEL)	406 - 506	695 – 1,075	1,389 – 1,456
Mortality No swim bladder (particle motion detection) (213 dB re 1 µPa pk)	72 - 81	93 - 113	113 - 121
Impairment No swim bladder (particle motion detection) (213 dB re 1 µPa pk)	72 - 81	93 - 113	113 - 121
Mortality Swim bladder not involved in hearing (particle motion detection) (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Impairment Swim bladder not involved in hearing (particle motion detection) (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Mortality Swim bladder involved in hearing (primarily pressure detection) (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Impairment Swim bladder involved in hearing (primarily pressure detection) (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Mortality Fish eggs and larvae (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Turtles:			
Mortality (207 dB re 1 µPa pk)	132 - 146	168 - 210	230 - 232
Other Animals:			
Invertebrates (scallops/bivalves) (191 dB re 1 µPa pk-pk)	595 - 624	705 - 875	771 – 1,211
Invertebrates (lobster/crustaceans) (209 dB re 1 µPa pk-pk)	41 - 92	124 - 158	179 - 183
Invertebrates (squid/octopus) – Strong avoidance (162 dB re 1 µPa^{2}s SEL)	1,286 – 1,365	1,582 – 2,180	2,769 – 3,337

Comparison of Modelled with Measured Results

4.11 The modelled results were compared with historic seismic survey data analysed from previous surveys that overlap the Gippsland MSS Acquisition Area (described in detail in Section 6.1.3 of the EP). These measured levels were compared with the predicted sound levels from the underwater sound propagation modelling to provide some form of validation of the modelled levels. The measured levels are generated as single shot or peak SPLs or SELs and therefore it is only possible to compare with the corresponding peak SPL thresholds for marine mammals for injury (PTS) and recoverable injury (TTS) (Table 4.7). It is clear that the modelled results (Table 4.2 and Table 4.4) overestimate the measured received sound levels, and can therefore be considered as precautionary and conservative.

Table 4.7 Measured peak pressure PTS and TTS injury ranges for marine mammals

Scenario	Exposure Level (dB re 1µPa SPL Lpk)	Range of effect, m All water depths (0 to 2,500)
PTS Peak Mammals:		
Low frequency cetacean	219	NE
Mid frequency cetacean	230	NE
High frequency cetacean	202	NE
Phocid pinniped	218	NE
TTS Peak Mammals:		
Low frequency cetacean	213	NE
Mid frequency cetacean	224	NE
High frequency cetacean	196	<50 m
Phocid pinniped	212	NE

NE = criteria not exceeded

5 Conclusions

5.1 Based on the propagation and sound exposure modelling carried out for this assessment, it is concluded that:

- There is potential for injury to low frequency cetaceans at ranges of up to 306 m in shallow water, 445 m in mid-depth waters and 985 km in deep waters within the survey area.
- For mid frequency cetaceans, injury could occur at ranges of up to 11 m in shallow water but is unlikely to occur in deeper survey areas.
- For high frequency cetaceans, injury could occur at ranges of up to 285 m in shallow water, 397 m in mid-depth waters and 682 m in deep waters.
- TTS could occur at distances up to 34.7 km for low frequency cetaceans, 1.5 km for mid frequency cetaceans and 9.7 km for high frequency cetaceans.
- Strong behavioural disturbance to marine mammals could occur at distances of up to 1.2 km in shallow water, 2km in mid-depth water and 3.9 km in deep water.
- Fish could experience TTS at distances of up to 1.5 km. Fish with no swim bladder could experience mortality or impairment at distances of up to 121 m and other fish could experience mortality or impairment at distances of up to 232 m.
- Mortality in turtles could occur at ranges of up to 232 m.
- Scallops and bivalves could be injured at ranges of up to 1.2 km in deep water and lobsters and crustaceans could be injured at a range of up to 183 m.

5.2 The modelled results grossly overestimate the measured received sound levels, and can therefore be considered as precautionary and conservative. Measured data predicts no exceedance of peak PTS thresholds for all cetacean groups, and exceedance of the high frequency cetacean TTS threshold only within 50 m of the seismic source.

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Appendix A

Acoustic Concepts and Terminology

5.3 Sound travels through the water as vibrations of the fluid particles in a series of pressure waves. The waves comprise a series of alternating compressions (positive pressure variations) and rarefactions (negative pressure fluctuations). Because sound consists of variations in pressure, the unit for measuring sound is usually referenced to a unit of pressure, the Pascal (Pa). The unit usually used to describe sound is the decibel (dB) and, in the case of underwater sound, the reference unit is taken as 1 µPa, whereas airborne sound is usually referenced to a pressure of 20 µPa. To convert from a sound pressure level referenced to 20 µPa to one referenced to 1 µPa, a factor of 20 log (20/1) i.e. 26 dB has to be added to the former quantity. Thus 60 dB re 20 µPa is the same as 86 dB re 1 µPa, although differences in sound speed and densities mean that the difference in sound intensity is much more than this from air to water. All underwater sound pressure levels in this report are described in dB re 1 µPa. In water the strength of a sound source is usually described by its sound pressure level in dB re 1 µPa, referenced back to a representative distance of 1 m from an assumed (infinitesimally small) point source. This allows calculation of sound levels in the far-field. For large distributed sources, the actual sound pressure level in the near-field will be lower than predicted.

5.4 There are several descriptors used to characterise a sound wave. The difference between the lowest pressure variation (rarefaction) and the highest pressure variation (compression) is the peak to peak (or pk-pk) sound pressure level. The difference between the highest variation (either positive or negative) and the mean pressure is called the peak pressure level. Lastly, the root mean square (rms) sound pressure level is used as a description of the average amplitude of the variations in pressure over a specific time window. These descriptions are shown graphically in **Error! Reference source not found.**.

5.5 The rms sound pressure level (SPL) is defined as follows:

$$SPL_{rms} = 10log_{10}\left(\frac{1}{T}\int_{0}^{T}\left(\frac{p^2}{p_{ref}^2}\right)dt\right)$$

5.6 The magnitude of the rms sound pressure level for an impulsive sound (such as that from a seismic source array) will depend upon the integration time, T, used for the calculation (Madsen 2005). It has become customary to utilise the T90 time period for calculating and reporting rms sound pressure levels. This is the interval over which the cumulative energy curve rises from 5% to 95% of the total energy and therefore contains 90% of the sound energy.

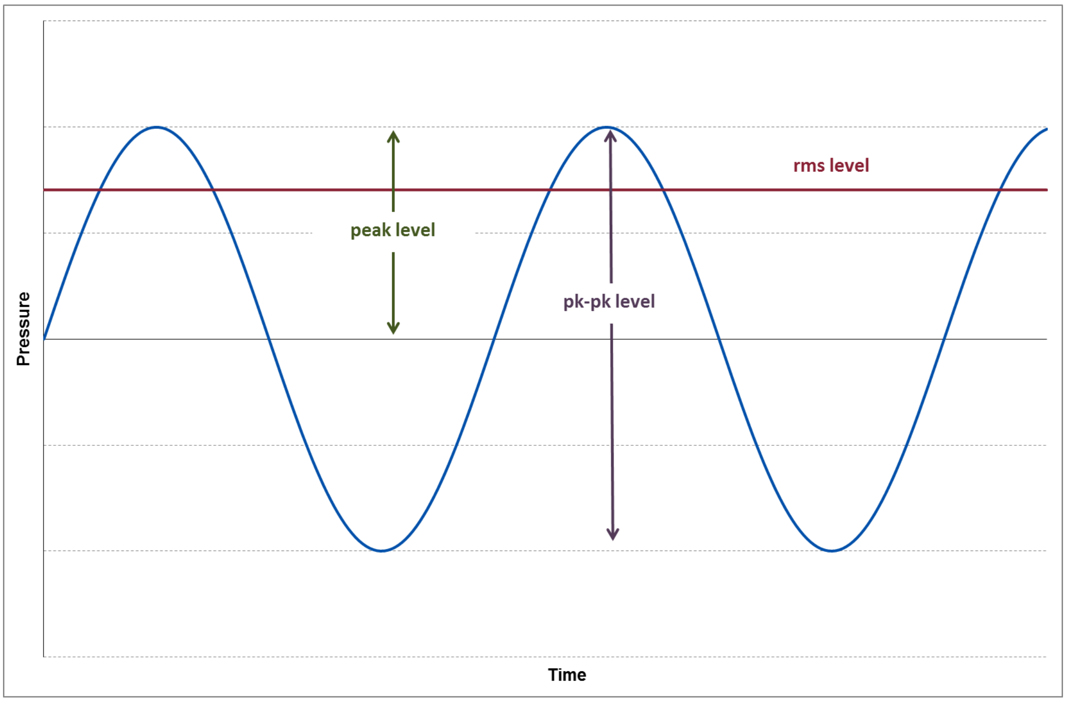

Figure 5.1 Graphical representation of acoustic wave descriptors

5.7 Another useful measure of sound used in underwater acoustics is the Sound Exposure Level, or SEL. This descriptor is used as a measure of the total sound energy of an event or a number of events (e.g. over the course of a day) and is normalised to one second. This allows the total acoustic energy contained in events lasting a different amount of time to be compared on a like for like basis[5]. The SEL is defined as follows:

$$SEL = 10log_{10}\left(\int_{0}^{T}\left(\frac{p^2(t)}{p_{ref}^2 t_{ref}}\right)dt\right)$$

5.8 The frequency, or pitch, of the sound is the rate at which these oscillations occur and is measured in cycles per second, or Hertz (Hz). When sound is measured in a way which approximates to how a human would perceive it using an A-weighting filter on a sound level meter, the resulting level is described in values of dBA. However, the hearing faculty of marine mammals is not the same as humans, with marine mammals hearing over a wider range of frequencies and with a different sensitivity. It is therefore important to understand how an animal's hearing varies over the entire frequency range in order to assess the effects of sound on marine mammals. Consequently, use can be made of frequency weighting scales to determine the level of the sound in comparison with the auditory response of the animal concerned. A comparison between the typical hearing response curves for fish, humans and marine mammals is shown in **Error! Reference source not found.**. (It is worth noting that hearing thresholds are sometimes shown as audiograms with sound

[5] Historically, use was primarily made of rms and peak sound pressure level metrics for assessing the potential effects of sound on marine life. However, the SEL is increasingly being used as it allows exposure duration and the effect of exposure to multiple events to be taken into account.

level on the y axis rather than sensitivity, resulting in the graph shape being the inverse of the graph shown.)

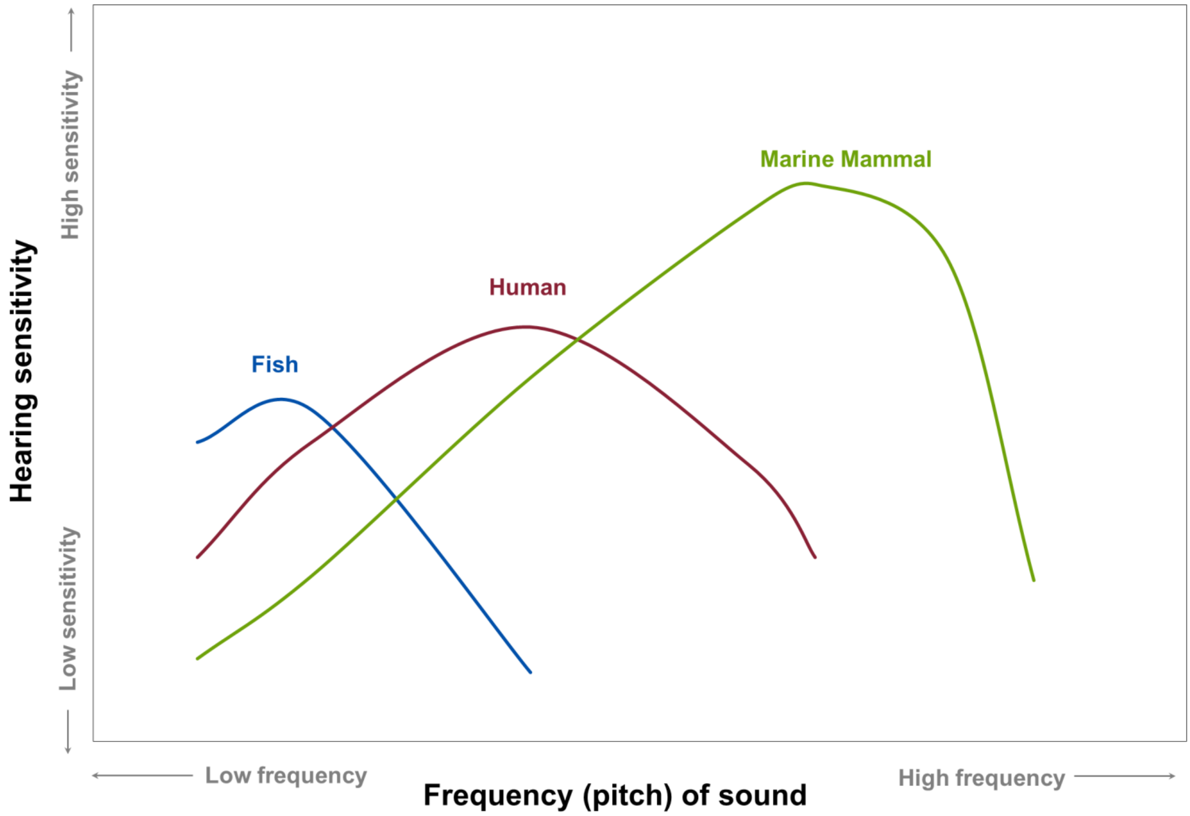

Figure 5.2 Comparison between hearing thresholds of different animals

Monitoring Received Sound Levels from Seismic Data

An approach to monitoring received SPL and SEL using field seismic data

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17-Oct-2016

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Summary

- CGG has developed a method for calculating SPL and SEL dB levels from conventional streamer seismic data.
- Results have been tied to both Nucleus modelling and ocean bottom recordings.
- Results are in line with more sophisticated modelling techniques which take into account water bottom conditions.[1]
- Results are in agreement with CMST measurements. [2]
- Approach has been peer reviewed by external reviewer. [3]
- Has been demonstrated over the variable water depths over our existing Davros surveys.
- Will allow CGG to monitor amplitudes up to a cable length away – typically 7- 8 Km.
- Allows CGG to predict amplitudes ahead of surveying in any particular area by using legacy data.
- A management plan has been implemented to monitor and manage dB output levels if predicted levels are exceeded.

[1] Propagation and Inversion of Airgun Signals in Shallow Water over a Limestone Seabed

[2] CMST Logger data

[3] Dr Alexander Gavrilov, Curtain University Centre for Marine Science and Technology.

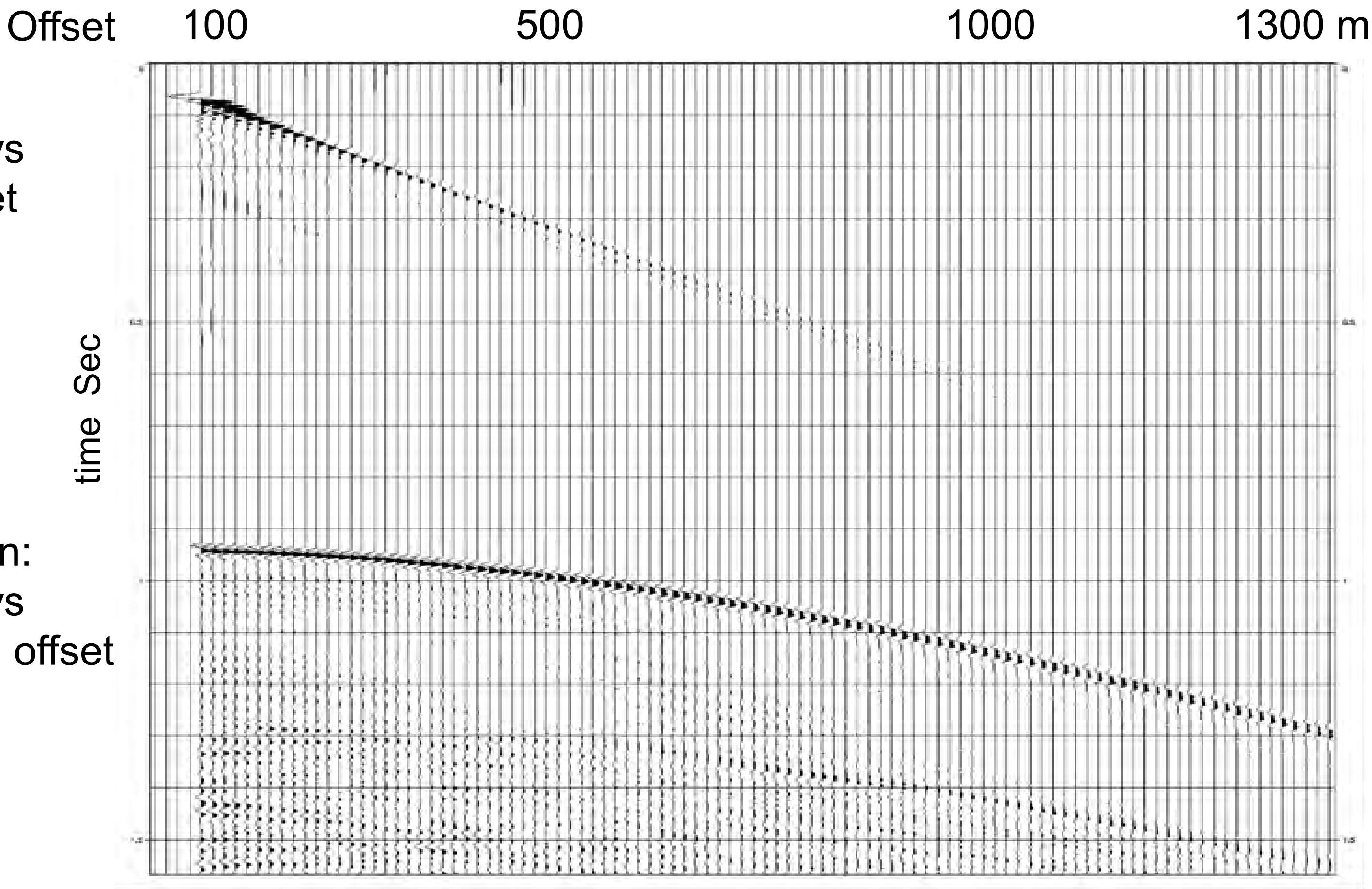
Introduction

- The traditional approach to managing the impact of the sound levels of seismic surveys has been to use modelling to determine the output level of the seismic signal. The modelling software, such as Nucleus, does produce very accurate estimations for the direct arrival signal based on the characteristics of the source array. However, it has been noted that this type of modelling does not account for the interaction of the sound waves with environment and the effective noise levels due to reflection, refraction, mode conversion etc.
- The methodology described here uses the seismic records acquired during the survey to determine the sound levels (SPL and SEL) in the environment. There is very good agreement using this method with Nucleus modelling and also with ocean bottom node surveys. The results are also in line with more sophisticated modelling approaches and independent monitoring studies.

Deep water field record illustrating direct arrival and reflection sound

Direct arrival: Amplitude decays rapidly with offset

Seabed reflection: Amplitude decays more slowly with offset



Nucleus model

Field record

distance (m)

Depth (m)

Row Labels	-500	-450	-400	-350	-300	-250	-200	-150	-100	-50	0	50	100	150	200	250	300	350	400	450	500
1	133	135	137	139	142	145	149	153	160	170	199	170	160	153	149	145	142	139	137	135	133
6	149	150	152	155	157	160	164	169	175	185	218	185	175	169	164	160	157	155	153	151	149
11	154	156	158	160	162	165	169	174	179	189	210	189	179	174	169	165	162	160	158	156	154
16	157	159	161	163	165	168	172	176	182	191	209	191	182	176	172	168	165	163	161	159	157
21	159	161	163	165	167	170	174	178	183	192	207	192	183	178	174	171	168	165	163	161	159
26	161	162	164	167	169	172	175	179	184	193	206	193	184	179	175	172	169	167	165	163	161
31	162	164	166	168	170	173	176	180	185	193	205	193	185	180	176	173	170	168	166	164	162
36	163	165	167	169	171	174	177	180	186	192	204	192	186	180	177	174	171	169	167	165	163
41	164	166	168	170	172	174	177	181	186	192	203	192	186	181	177	175	172	170	168	166	165
46	165	167	168	170	173	175	178	181	187	192	202	192	187	182	178	175	173	171	169	167	165
51	166	167	169	171	173	175	178	182	187	193	201	193	187	182	178	176	173	171	169	168	166
56	166	168	170	171	173	176	178	182	187	193	200	193	187	183	179	176	174	172	170	168	167
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66	167	169	170	172	174	176	179	183	186	193	199	193	186	183	180	177	174	173	171	169	168
71	168	169	171	173	174	177	180	183	186	193	198	193	186	183	180	177	175	173	171	169	168
76	168	170	171	173	175	177	180	183	186	193	197	193	186	183	180	177	175	173	171	170	168
81	168	170	171	173	175	177	180	183	186	192	197	193	186	183	180	178	175	173	172	170	169
86	[illegible]																				
91	[illegible]																				
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101	[illegible]																				
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141	[illegible]																				
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151	[illegible]																				
156	171	173	174	176	177	179	180	183	187	189	191	189	187	183	180	179	177	176	174	173	171
161	171	173	174	176	177	178	180	183	187	189	191	189	187	183	180	178	177	176	174	173	172
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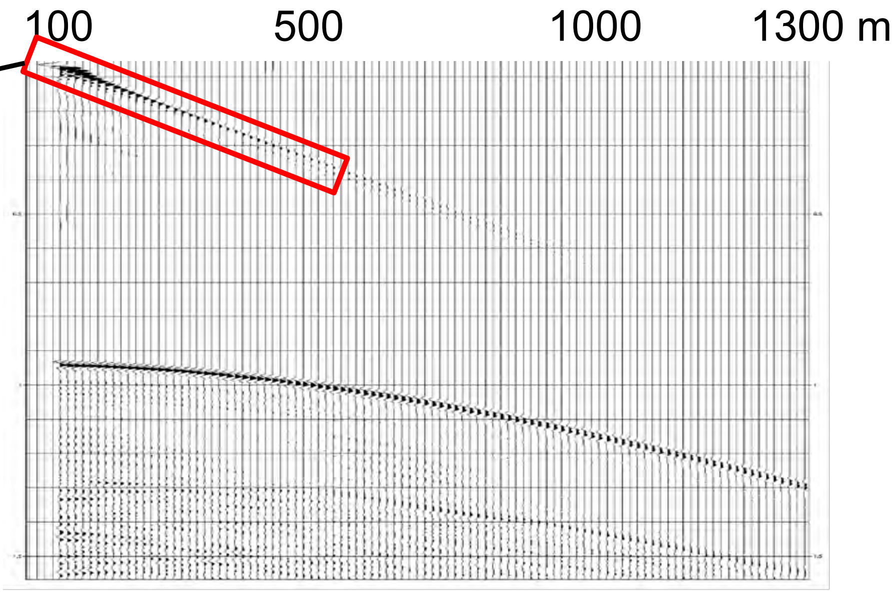
201	172	174	175	176	177	178	181	183	186	188	189	188	186	183	181	178	177	176	175	174	172

0	50	100	150	200	250	300	350	400	450	500
199	170	160	153	149	145	142	139	137	135	133
218	185	175	169	164	160	157	155	153	151	149
210	189	179	174	169	165	162	160	158	156	154
209	191	182	176	172	168	165	163	161	159	157
207	192	183	178	174	171	168	165	163	161	159
206	193	184	179	175	172	169	167	165	163	161



Nucleus output for a 4630 cu in BroadSource

Field record showing direct arrivals and water bottom reflection

Nucleus model predicts direct arrival amplitudes but does not account for reflection energy.

Process

1. Remove swell noise

   Low frequency signal, not emitted by the airguns, needs to be removed. This includes

   – pressure variations due to depth changes brought about by swells passing over the cable.
   – vibrations generated by vortices arising from differential water velocity over the cable.
   – strum noise caused by tugging from the cables keeping the streamer in position.

2. Correct for array effects

   Receiver arrays attenuate horizontally travelling sound: this needs to be reversed or we will underestimate the amplitudes detected by a single receiver. This principally effects the direct arrival energy as most of the recorded energy is near vertically traveling reflections. It is a straight forward process to calculate the array effect and generate a correction filter.

3. Convert seismic recording to envelope amplitude

   This avoids zero amplitude values, an issue with conventional RMS approach. The well known Hilbert transform is used generate the envelope amplitude.

4. Convert from recorded amplitude on tape to Pa:

   This is a simple mathematical process where the amplitudes are multiplied by the 100/hydrophone sensitivity.

   The entire trace is now a dB record, making it easy to check for anomalies or to make it easy to interpret amplitude variation patterns.

5. Compute SEL from for each trace

   The sound exposure level is derived by $SEL = 10 * \log10 (\Sigma (P^2(t)))$ where t is the pulse length covering the time between the 5% and 95% points of the cumulative energy curve.

6. Graph SPL and SEL for each trace

   These values are captured for graphing in whatever format is most convenient. It results in two values for each trace.

Verification

The process outlined is verified against:

1. Nucleus model

   Direct arrival on both streamer record and ocean bottom records are compared with Nucleus modelling. This is found to be in very good agreement.

2. Ocean bottom record

   Streamer cable records at conventional (7 m depth) and BroadSeis (7-50 m depth) are compared against Ocean bottom recodings. There is little difference between the two cable depths and we see a small (~4dB) difference between ocean bottom recording and cable recording in a water depth range of 160-385 m for offsets ranging from 500 m to 7500 m.

3. Ocean floor modelling

   More sophisticated modelling of sound waves predict an offset dependent increase in amplitude up to a critical angle that depends on grazing amplitude and sea floor substrate. On recorded data the same pattern is observed.

4. Field measurements from noise loggers (CMST data)

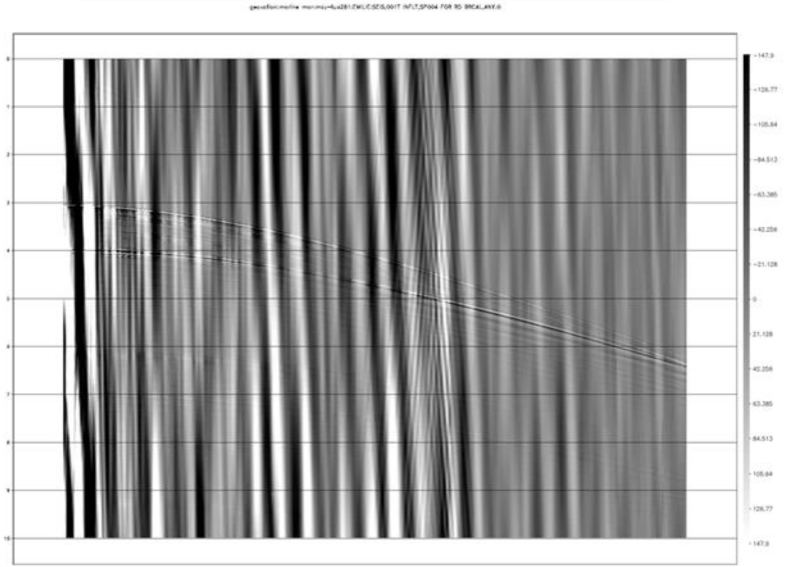
   The amplitudes produced by this method correspond closely to the measured levels for large source arrays by CMST ocean bottom loggers out to the maximum offset of our recording, 17 km.

Methodology

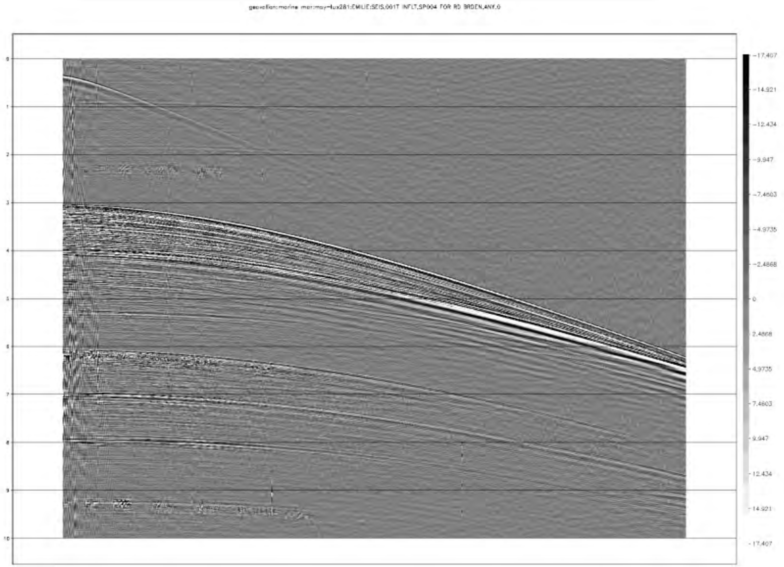
1. Remove swell noise (low cut filtering)
2. Correct for array effects
3. Convert seismic recording to envelope amplitude (avoids zero values)
4. Convert from recorded amplitude on tape to Pa:
5. Compute SEL from for each trace
6. Graph SPL and SEL for record

1 Remove swell noise (low cut filtering)

before



after low cut filter 2.5Hz

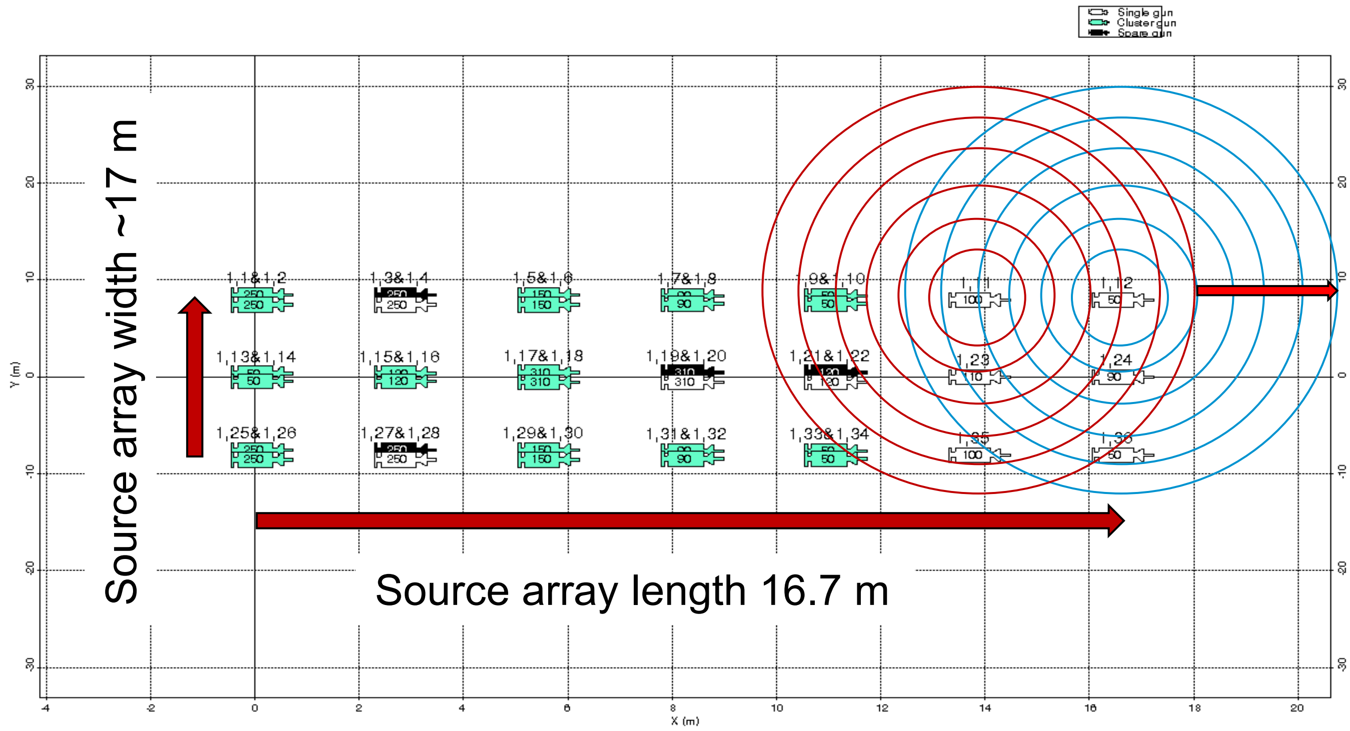


Note: pressure variation due to swells passing over the cable almost swamps signal from seismic source.
This low frequency “noise” needs to be filtered out before we can use the seismic records.
Note, air guns cannot produce signals in this frequency range.

Methodology

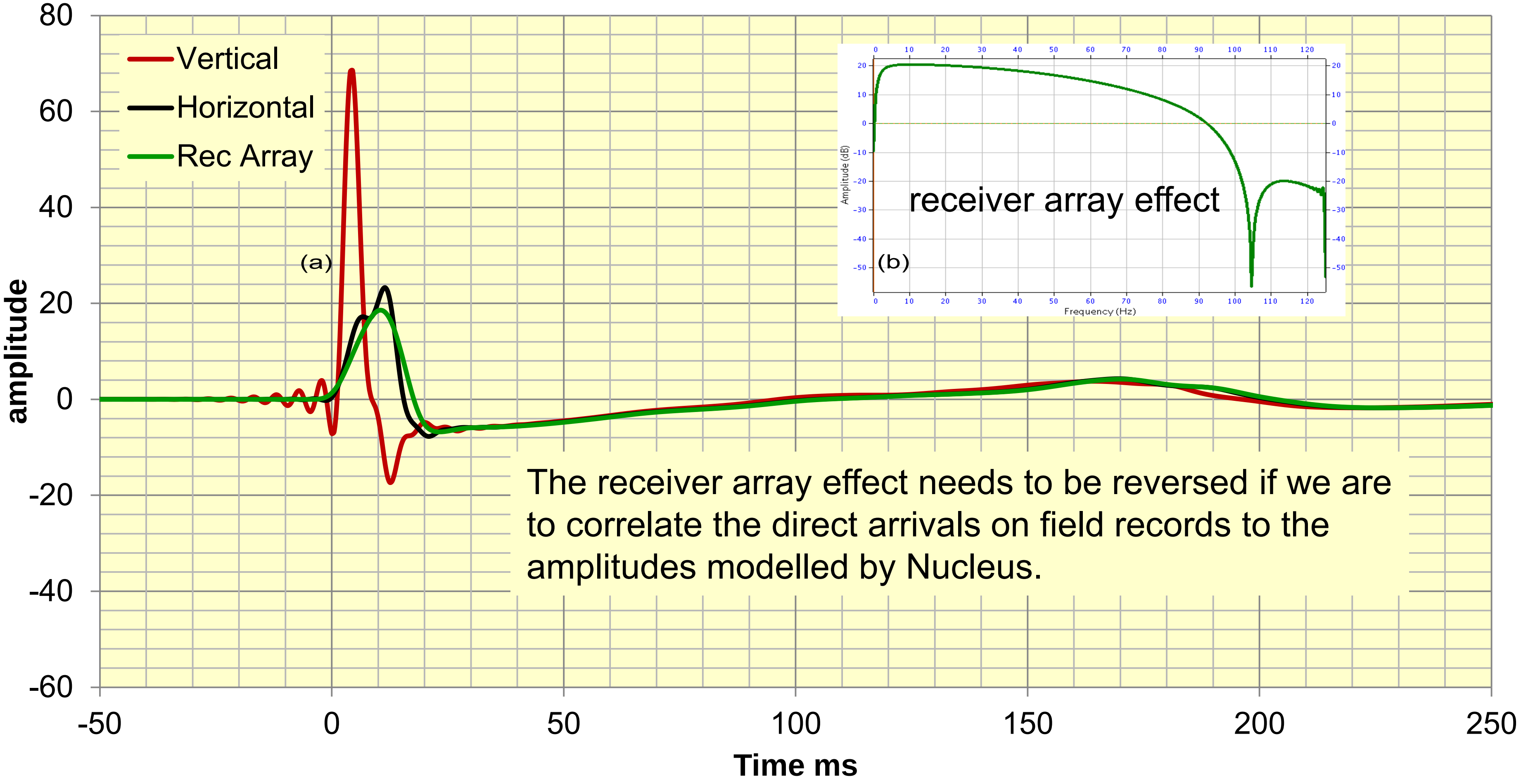
1. Remove swell noise (low cut filtering)
2. Correct for array effects
3. Convert seismic recording to envelope amplitude
4. Convert from recorded amplitude on tape to Pa:
5. Compute SEL from for each trace
6. Graph SPL and SEL for record

2 Array effects: BroadSource



Signal from different gun elements will arrive at different times horizontally

2 Array effects: Receiver



Methodology

1. Remove swell noise (low cut filtering)
2. Correct for array effects
3. Convert seismic recording to envelope amplitude (avoids zero values)
4. Convert from recorded amplitude on tape to Pa:
5. Compute SEL from for each trace
6. Graph SPL and SEL for record

Representation in dB

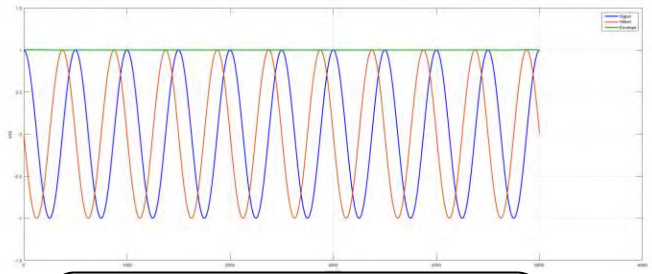
- Propose to represent the seismic trace in dB using envelope computation (via Hilbert transform) and sensitivity correction.

- Hilbert transformation:

  Quadratic filter with 90 degree phase shift:
  cos(ωt+ϕ) => cos(ωt+ϕ+π/2)

  x(t) = Hilbert transform => y(t)

  Complex trace: $z(t) = x(t) + i\, y(t)$
  Envelop: $\sqrt{(x^2(t) + y^2(t))}$



SIGNAL .i.e x
HILBERT i.e. y
ENVELOP

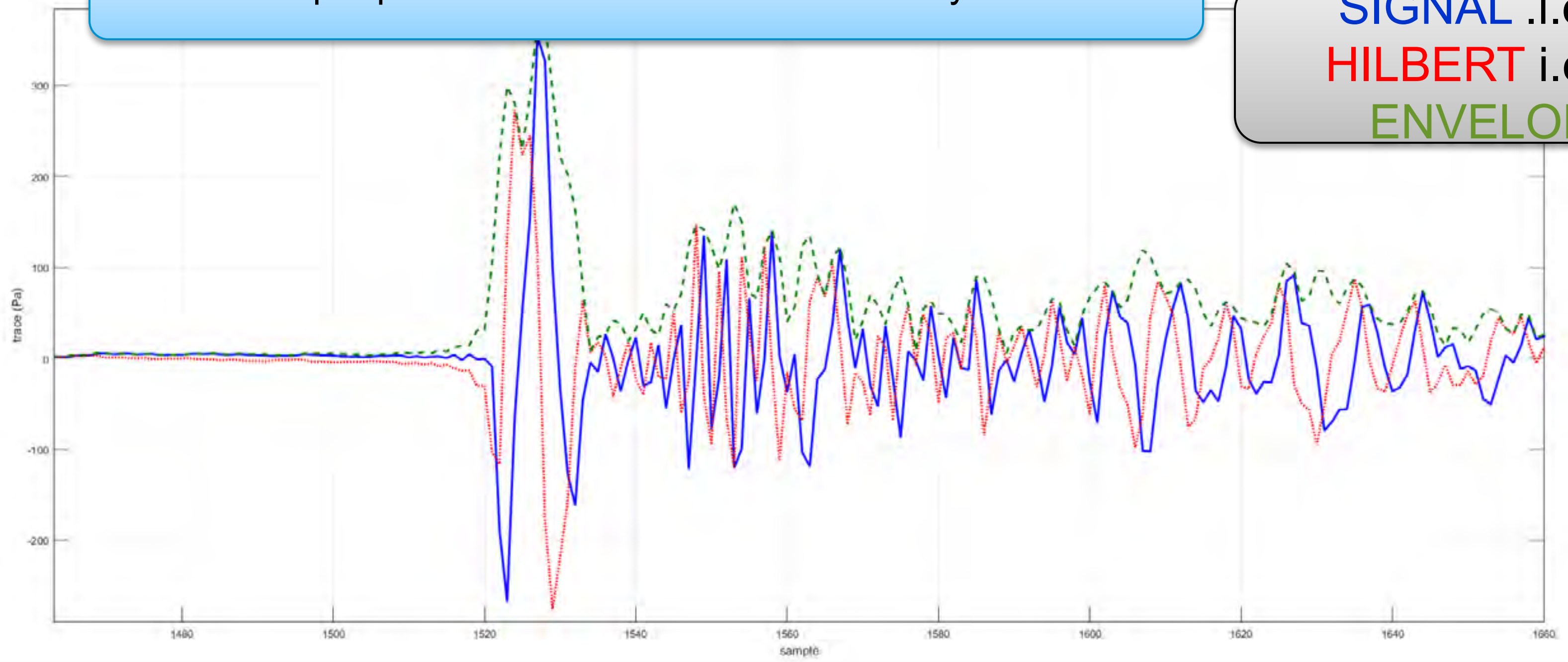
  A sinusoidal wave, or constant frequency sound has the same energy level; the envelope, derived through the Hilbert transform represents this energy.

- Use of this approach leads to a small increase in dB level (0.5 to 1.0) in SPL output and a 3dB boost to SEL values over conventional RMS approach. This is taken into account in our calculation of SEL values.

Application to a single seismic trace

The envelop represents the instantaneous intensity of the trace

SIGNAL .i.e x
HILBERT i.e. y
ENVELOP

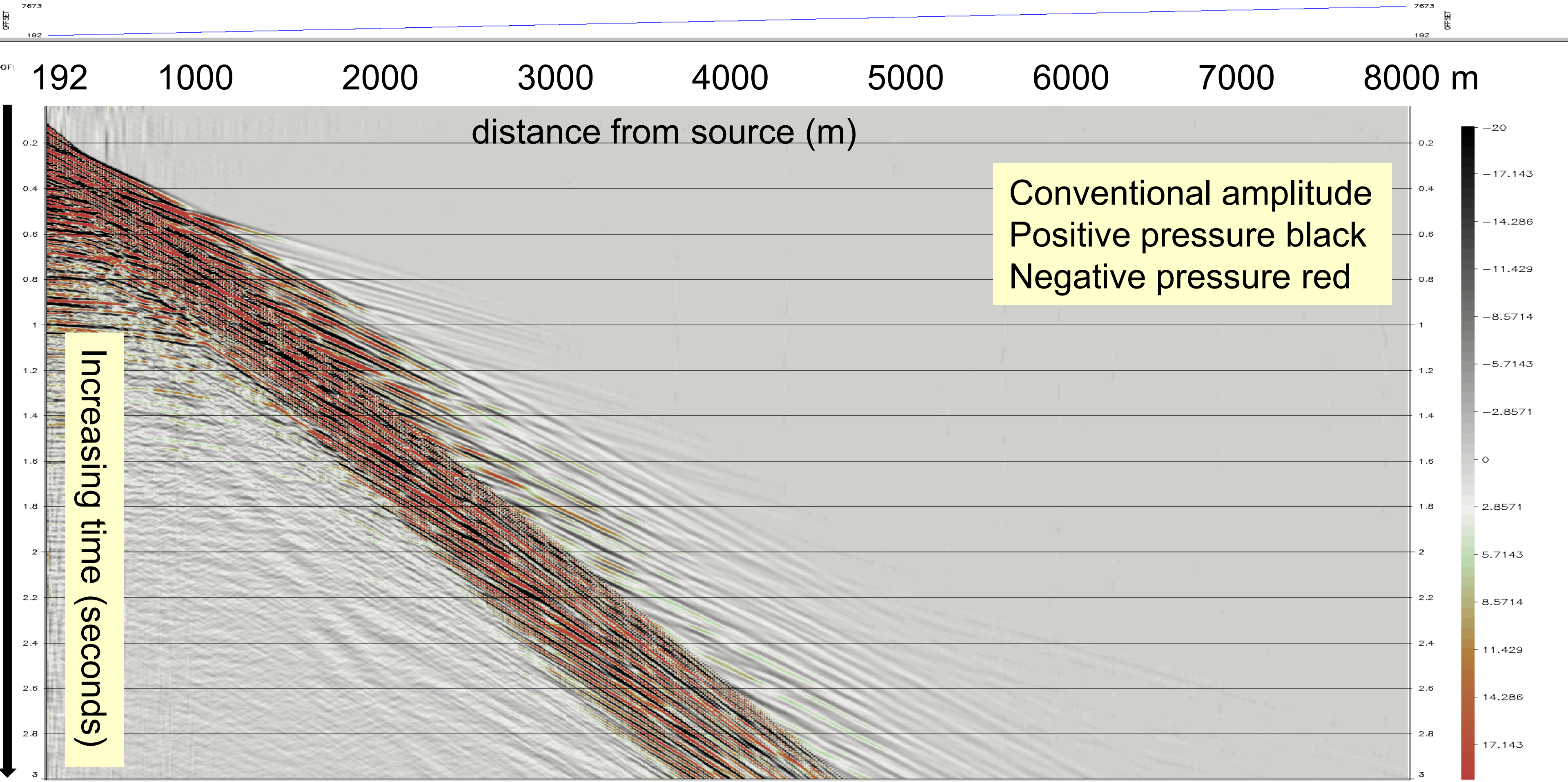


The envelop differs from signal by considering the imaginary part of the signal.
Using trace envelop in dB allows a continuous view of SPLpk.

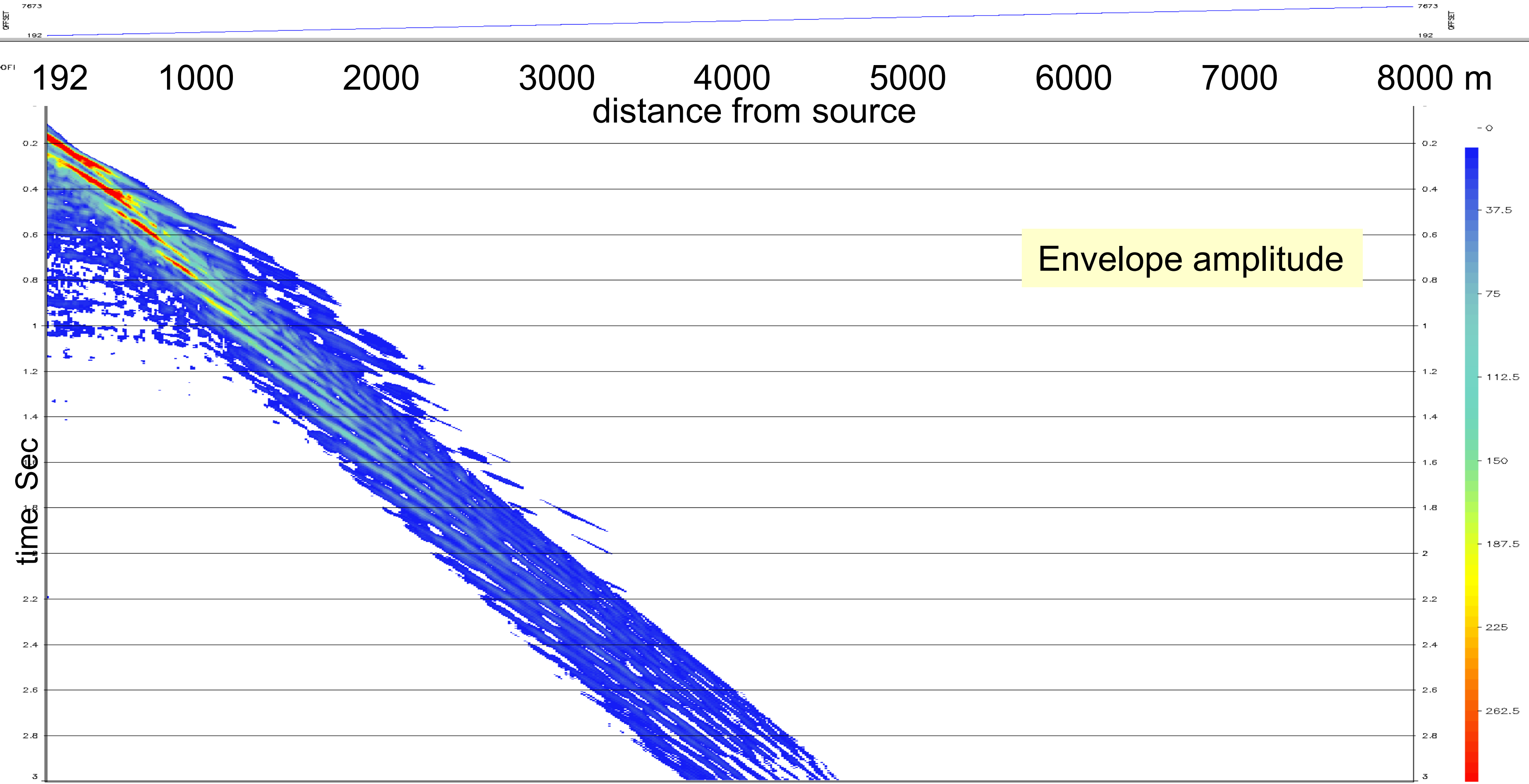
Methodology

1. Remove swell noise (low cut filtering)
2. Correct for array effects
3. Convert seismic recording to envelope amplitude (avoids zero values)
4. Convert from recorded amplitude on tape to Pa: value * 100 / sens_hydr
   - From mV to V: value / 1000
   - From V to bar using hydrophones sensitivity: value / sens_hydr
   - From bar to Pascal: value * 10^5
   - Simply: output in Pa = value * 100 / sens_hydr
   - All we need is the hydrophone sensitivity to convert seismic envelope amplitude to dB
5. Compute SEL from for each trace
6. Graph SPL and SEL for record

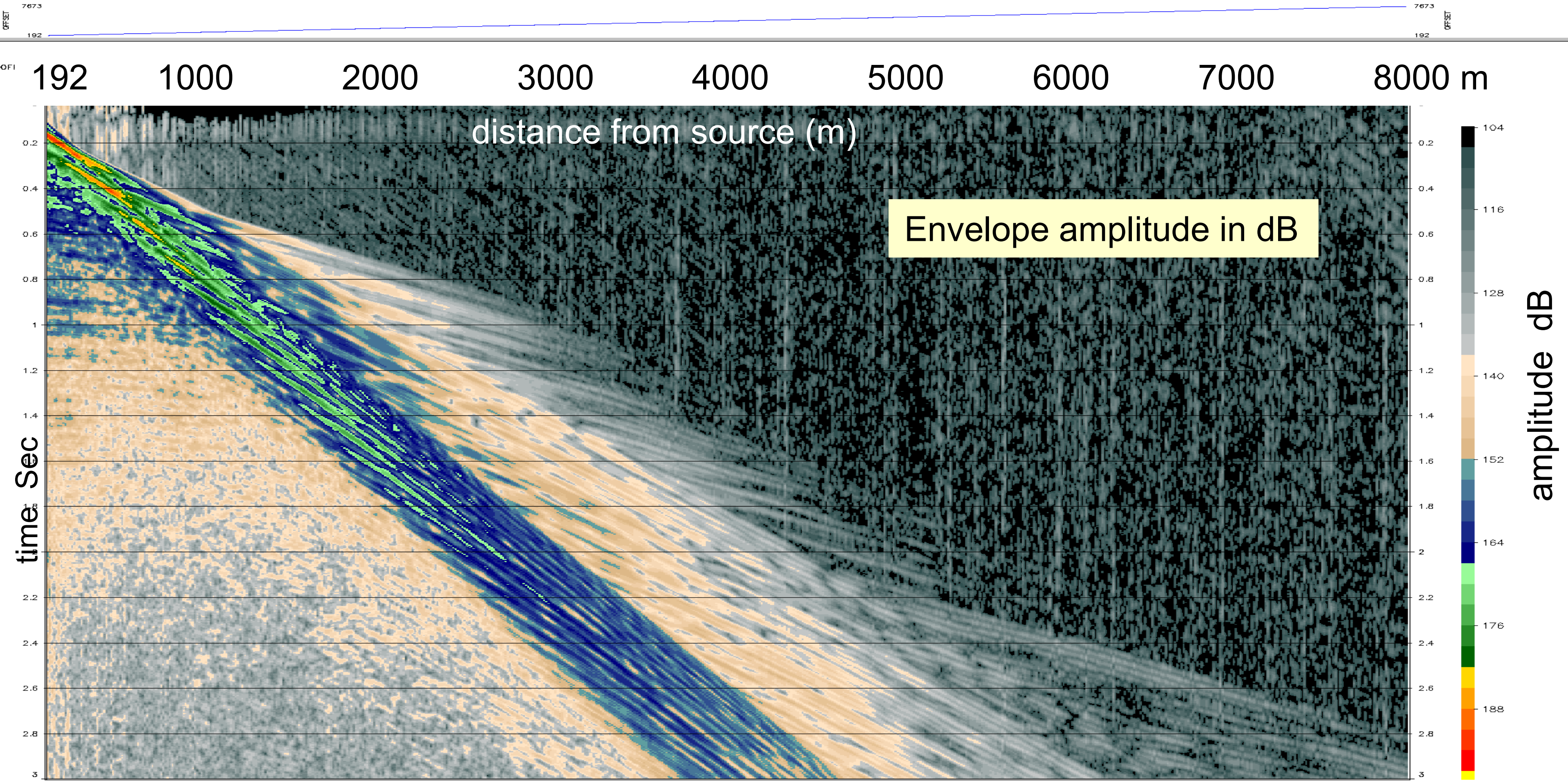
Conventional seismic shot record: 45 m water depth



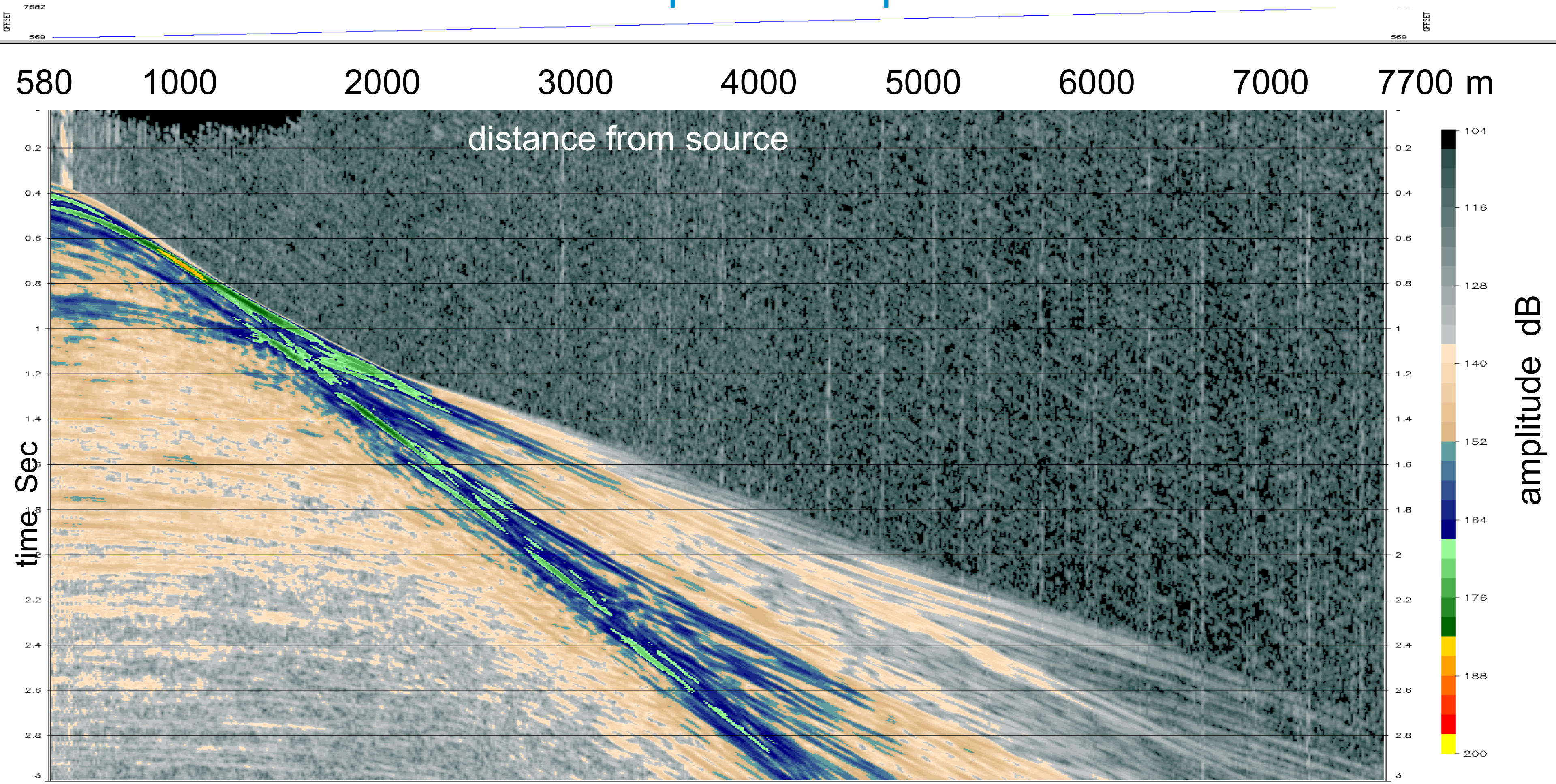
Amplitude envelope: 45 m water depth



SPL dB: 45 m water depth



SPL dB: 178 m water depth example



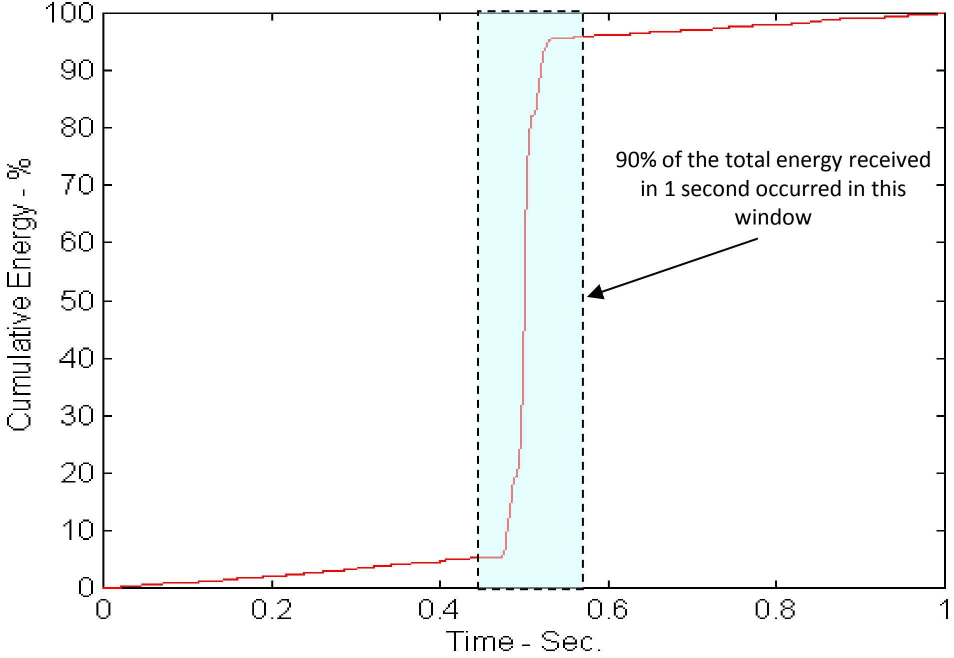
Methodology

1. Remove swell noise (low cut filtering)
2. Correct for array effects
3. Convert seismic recording to envelope amplitude (avoids zero values)
4. Convert from recorded amplitude on tape to Pa:
5. Compute SEL from for each trace

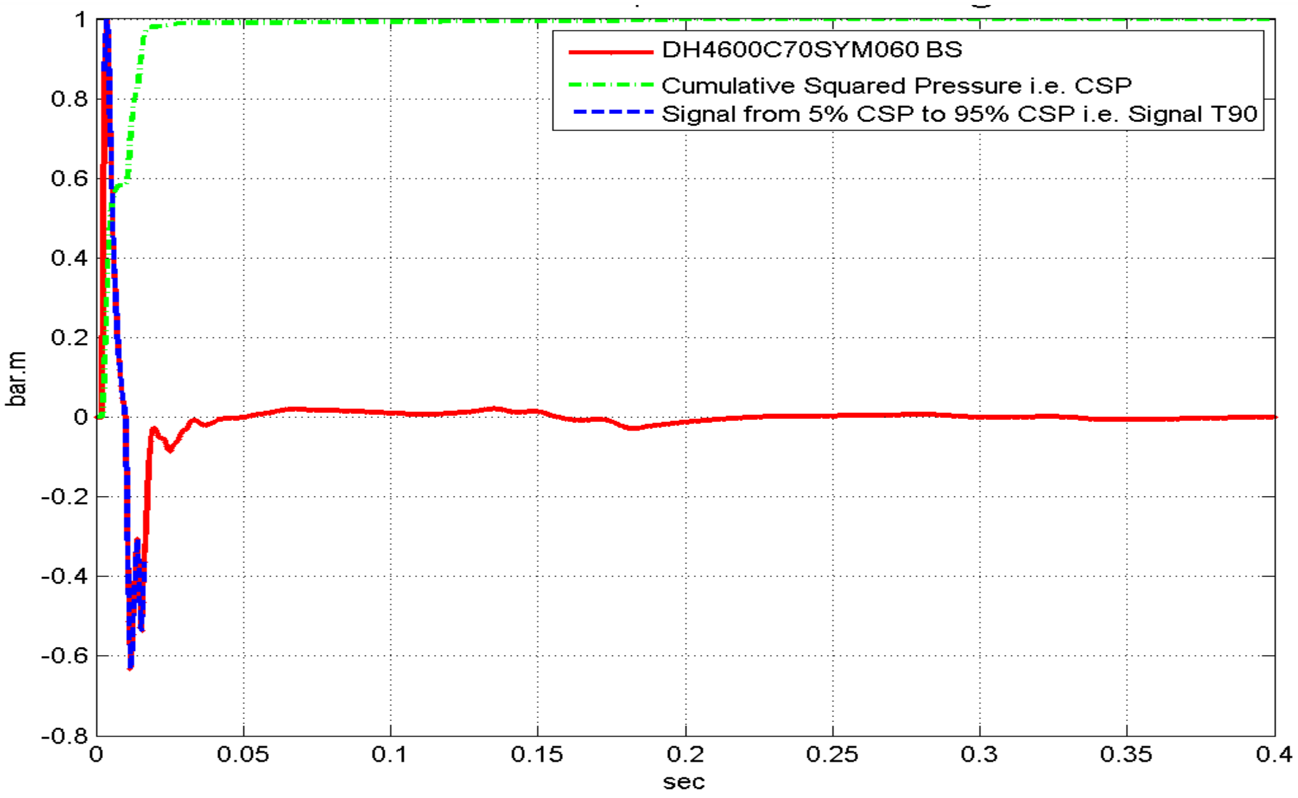
   The sound exposure level is derived by SEL = 10 * log10 (Σ ($P^2(t)$)) where t is the pulse length covering the time between the 5% and 95% points of the cumulative energy curve.

6. Graph SPL and SEL for record

Cumulative energy plot



Pulse length for SEL T90 computation



Methodology

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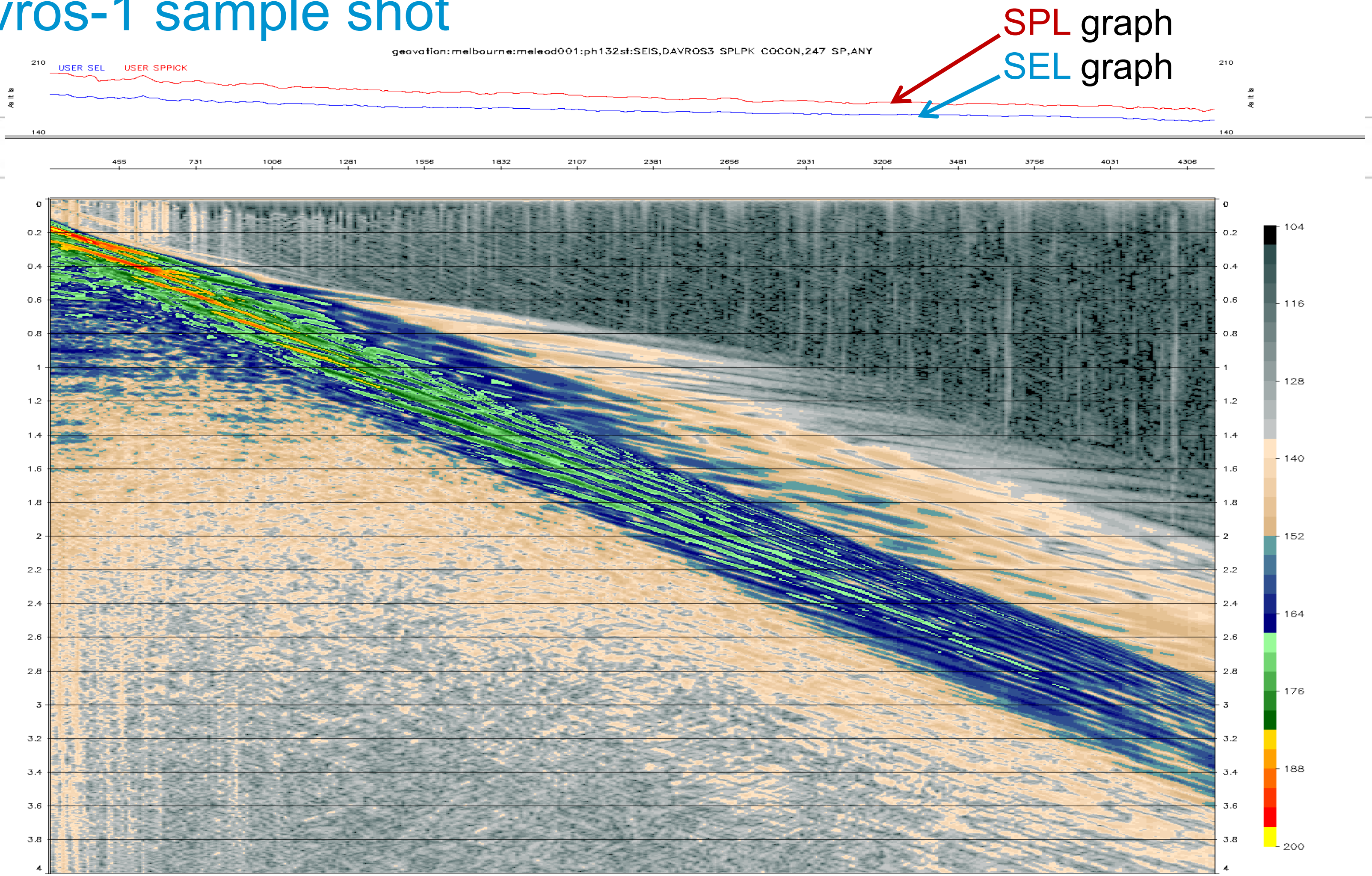
2. Correct for array effects
3. Convert seismic recording to envelope amplitude (avoids zero values)
4. Convert from recorded amplitude on tape to Pa:
5. Compute SEL from for each trace
6. Graph SPL and SEL for record

Davros-1 sample shot



Verification

The process outlined is verified against:

1. Nucleus model

   Direct arrival on both streamer record and ocean bottom records are compared with Nucleus modelling. This is found to be in very good agreement.

2. Ocean bottom record

   Streamer cable records at conventional (7 m depth) and BroadSeis (7-50 m depth) are compared against Ocean bottom recordings. There is little difference between the two cable depths and we see a small (~4dB) difference between ocean bottom recording and cable recording in a water depth range of 160-385 m for offsets ranging from 500 m to 7500 m.

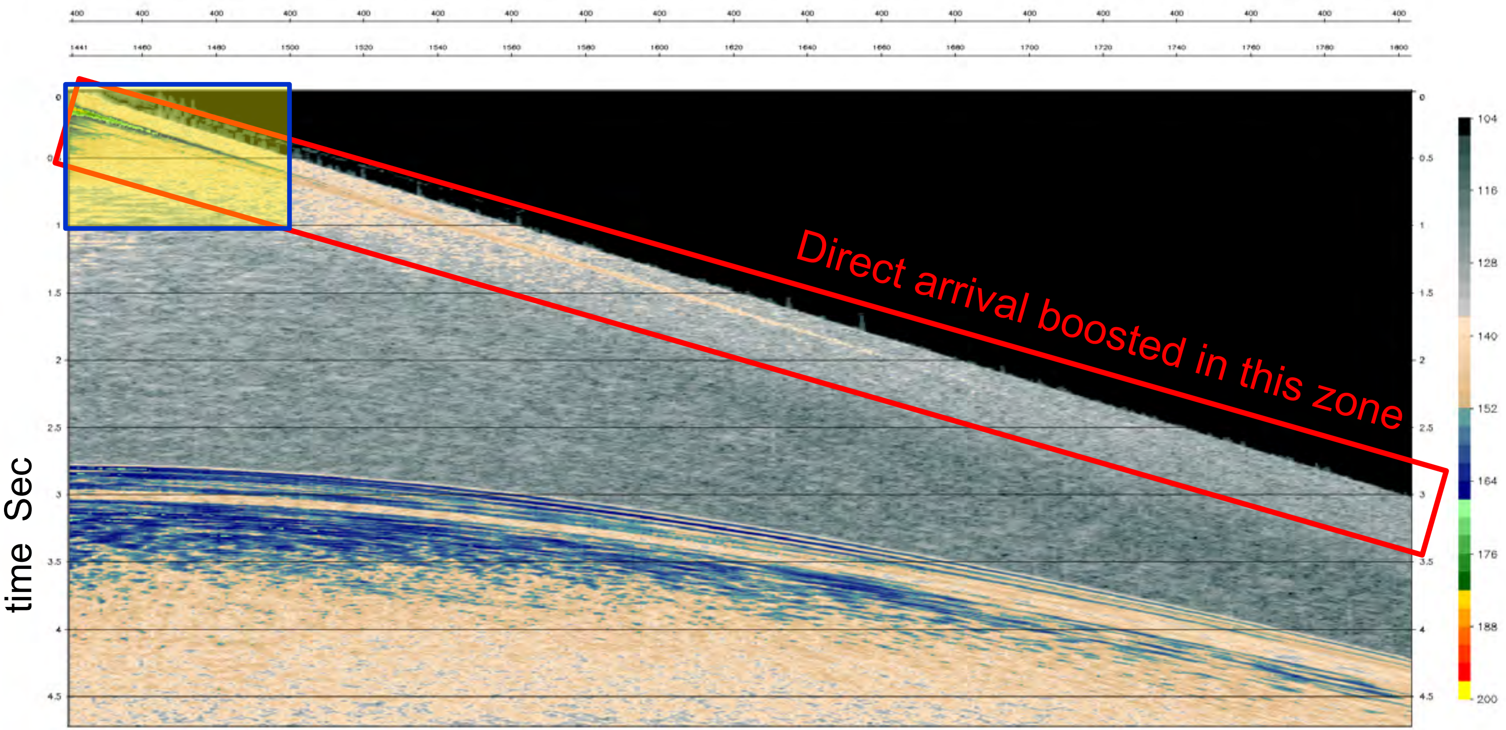
3. Ocean floor modelling

   More sophisticated modelling of sound waves predict an offset dependent increase in amplitude up to a critical angle that depends on grazing amplitude and sea floor substrate. On recorded data the same pattern is observed.

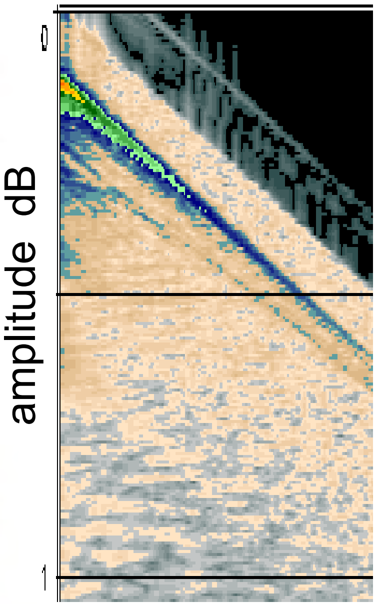
4. Field measurements from noise loggers (CMST data)

   The amplitudes produced by this method correspond closely to the measured levels for large source arrays by CMST ocean bottom loggers out to the maximum offset of our recording, 17 km.

Direct arrival boosted to reverse array effect.

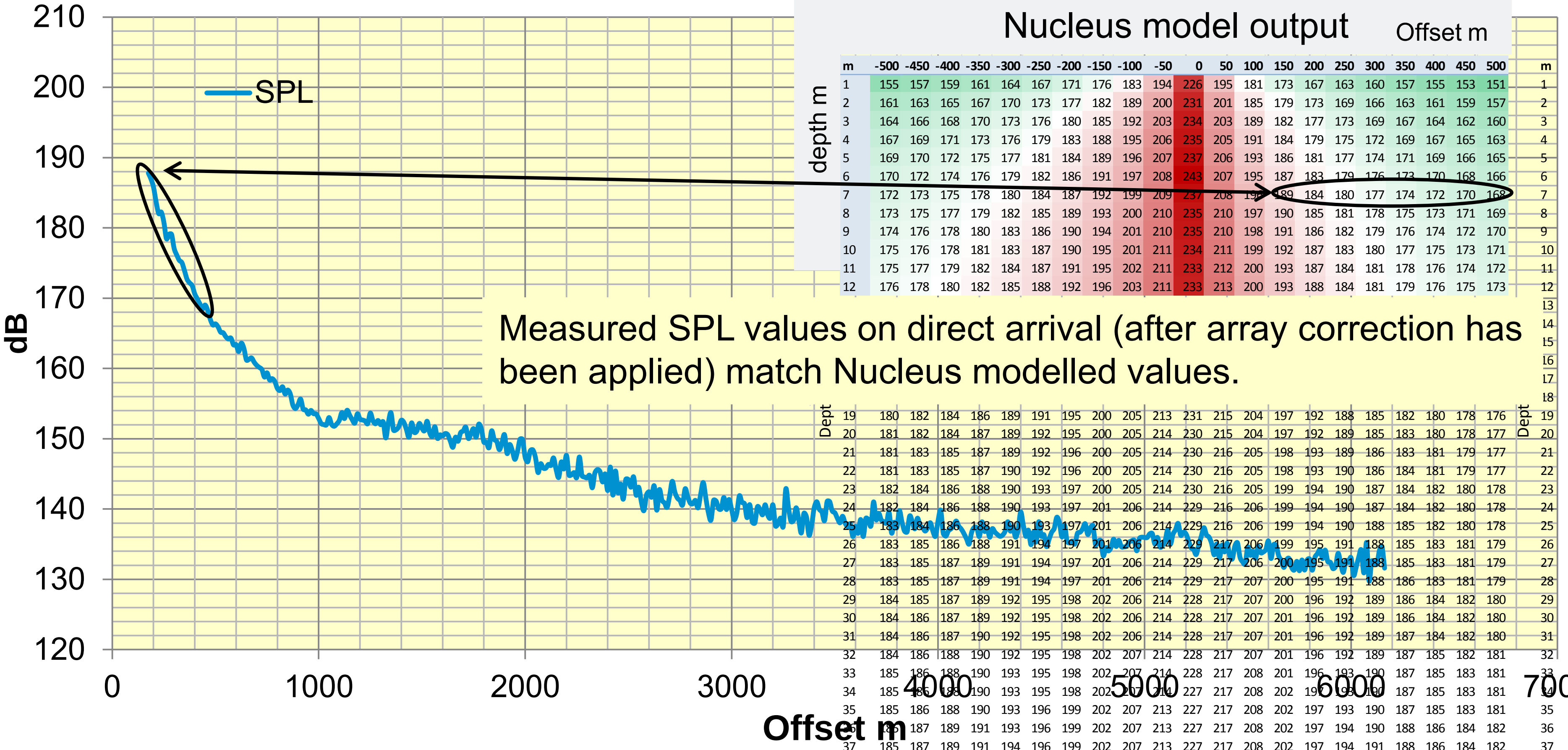


Close up direct arrival



Comparison to modelled data

Deep water: direct arrival zone



Measured SPL values on direct arrival (after array correction has been applied) match Nucleus modelled values.

Nucleus model output

Offset m

depth m

m	-500	-450	-400	-350	-300	-250	-200	-150	-100	-50	0	50	100	150	200	250	300	350	400	450	500
1	155	157	159	161	164	167	171	176	183	194	226	195	181	173	167	163	160	157	155	153	151
2	161	163	165	167	170	173	177	182	189	200	231	201	185	179	173	169	166	163	161	159	157
3	164	166	168	170	173	176	180	185	192	203	234	203	189	182	177	173	169	167	164	162	160
4	167	169	171	173	176	179	183	188	195	206	235	205	191	184	179	175	172	169	167	165	163
5	169	170	172	175	177	181	184	189	196	207	237	206	193	186	181	177	174	171	169	166	165
6	170	172	174	176	179	182	186	191	197	208	243	207	195	187	183	179	176	173	170	168	166
7	172	173	175	178	180	184	187	192	199	209	237	208	196	189	184	180	177	174	172	170	168
8	173	175	177	179	182	185	189	193	200	210	235	210	197	190	185	181	178	175	173	171	169
9	174	176	178	180	183	186	190	194	201	210	235	210	198	191	186	182	179	176	174	172	170
10	175	176	178	181	183	187	190	195	201	211	234	211	199	192	187	183	180	177	175	173	171
11	175	177	179	182	184	187	191	195	202	211	233	212	200	193	187	184	181	178	176	174	172
12	176	178	180	182	185	188	192	196	203	211	233	213	200	193	188	184	181	179	176	175	173
19	180	182	184	186	189	191	195	200	205	213	231	215	204	197	192	188	185	182	180	178	176
20	181	182	184	187	189	192	195	200	205	214	230	215	204	197	192	189	185	183	180	178	177
21	181	183	185	187	189	192	196	200	205	214	230	216	205	198	193	189	186	183	181	179	177
22	181	183	185	187	190	192	196	200	205	214	230	216	205	198	193	190	186	184	181	179	177
23	182	184	186	188	190	193	197	200	205	214	230	216	205	199	194	190	187	184	182	180	178
24	182	184	186	188	190	193	197	201	206	214	229	216	206	199	194	190	187	184	182	180	178
25	183	184	186	188	190	193	197	201	206	214	229	216	206	199	194	190	188	185	182	180	178
26	183	185	186	188	191	194	197	201	206	214	229	217	206	199	195	191	188	185	183	181	179
27	183	185	187	189	191	194	197	201	206	214	229	217	206	200	195	191	188	185	183	181	179
28	183	185	187	189	191	194	197	201	206	214	229	217	207	200	195	191	188	186	183	181	179
29	184	185	187	189	192	195	198	202	206	214	228	217	207	200	196	192	189	186	184	182	180
30	184	186	187	189	192	195	198	202	206	214	228	217	207	201	196	192	189	186	184	182	180
31	184	186	187	190	192	195	198	202	206	214	228	217	207	201	196	192	189	187	184	182	180
32	184	186	188	190	192	195	198	202	207	214	228	217	207	201	196	192	189	187	185	182	181
33	185	186	188	190	193	195	198	202	207	214	228	217	208	201	196	193	190	187	185	183	181
34	185	186	188	190	193	195	198	202	207	214	227	217	208	202	197	193	190	187	185	183	181
35	185	186	188	190	193	196	199	202	207	213	227	217	208	202	197	193	190	187	185	183	181
36	[illegible]	187	189	191	193	196	199	202	207	213	227	217	208	202	197	194	190	188	186	184	182
37	185	187	189	191	194	196	199	202	207	213	227	217	208	202	197	194	191	188	186	184	182

Depth

m	-500
1	127
2	133
3	136
4	139
5	141
6	142
7	144
8	145
9	146
10	147
11	148
12	148
13	149
14	150
15	150
16	151
17	151
18	152
19	152
20	153
21	153
22	153
23	154
24	154
25	155
26	155
27	155
28	155
29	156
30	156
31	156
32	157
33	157
34	157
35	157
36	157
37	158

Verification

The process outlined is verified against:

1. Nucleus model

   Direct arrival on both streamer record and ocean bottom records are compared with Nucleus modelling. This is found to be in very good agreement.

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   Streamer cable records at conventional (7 m depth) and BroadSeis (7-50 m depth) are compared against Ocean bottom recordings. There is little difference between the two cable depths and we see a small (~4dB) difference between ocean bottom recording and cable recording in a water depth range of 160-385 m for offsets ranging from 500 m to 7500 m.

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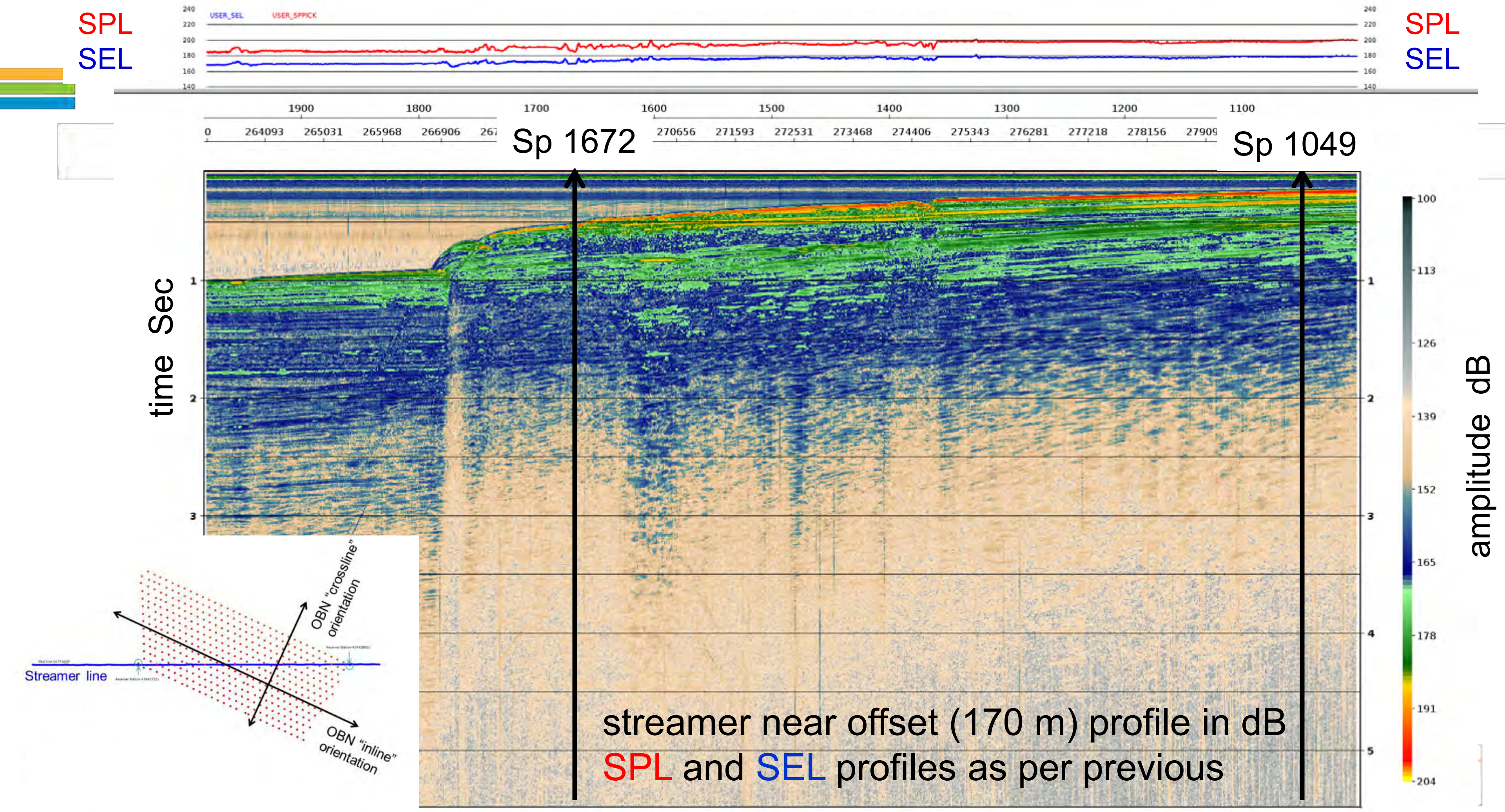
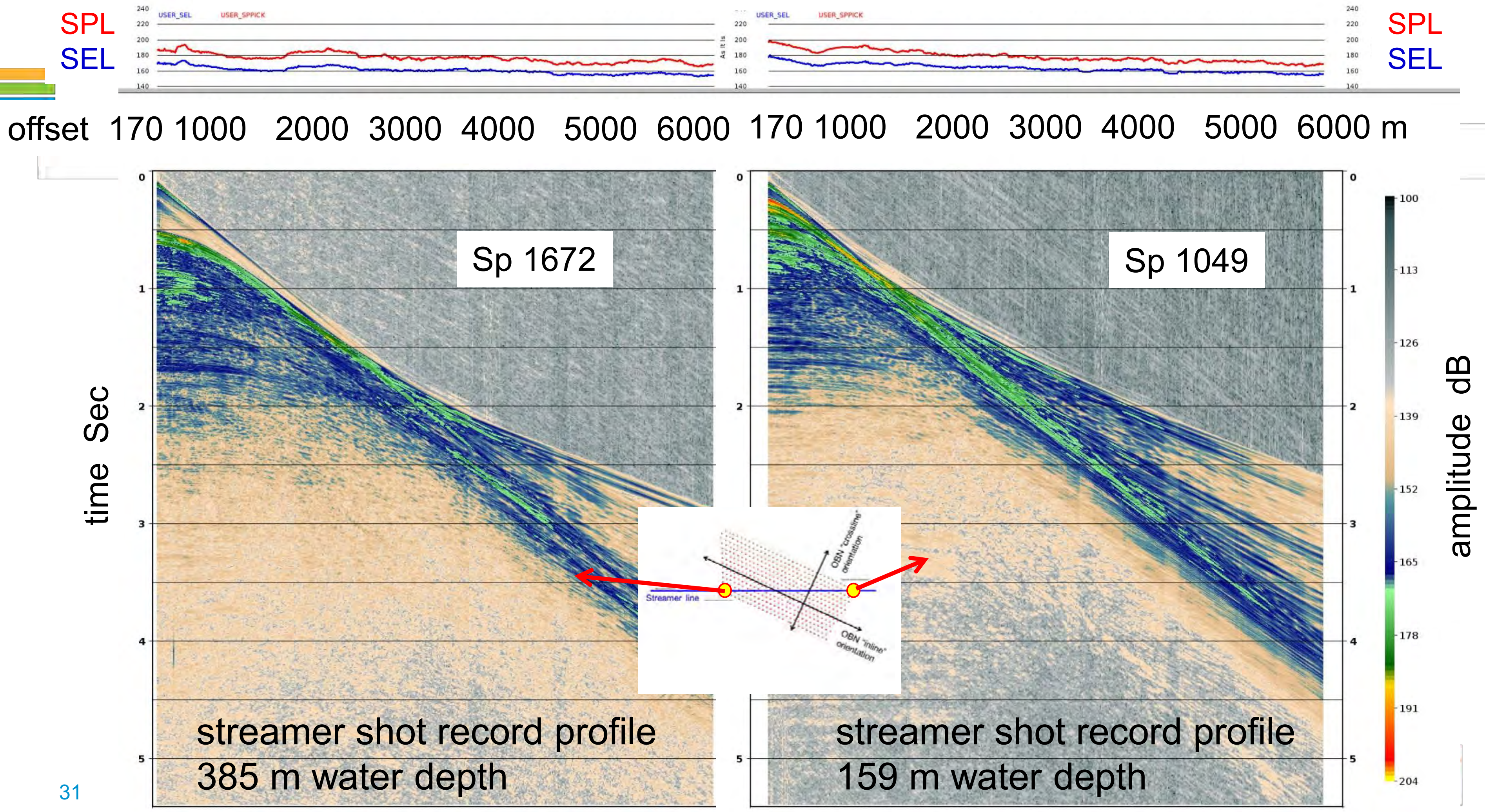
   More sophisticated modelling of sound waves predict an offset dependent increase in amplitude up to a critical angle that depends on grazing amplitude and sea floor substrate. On recorded data the same pattern is observed.

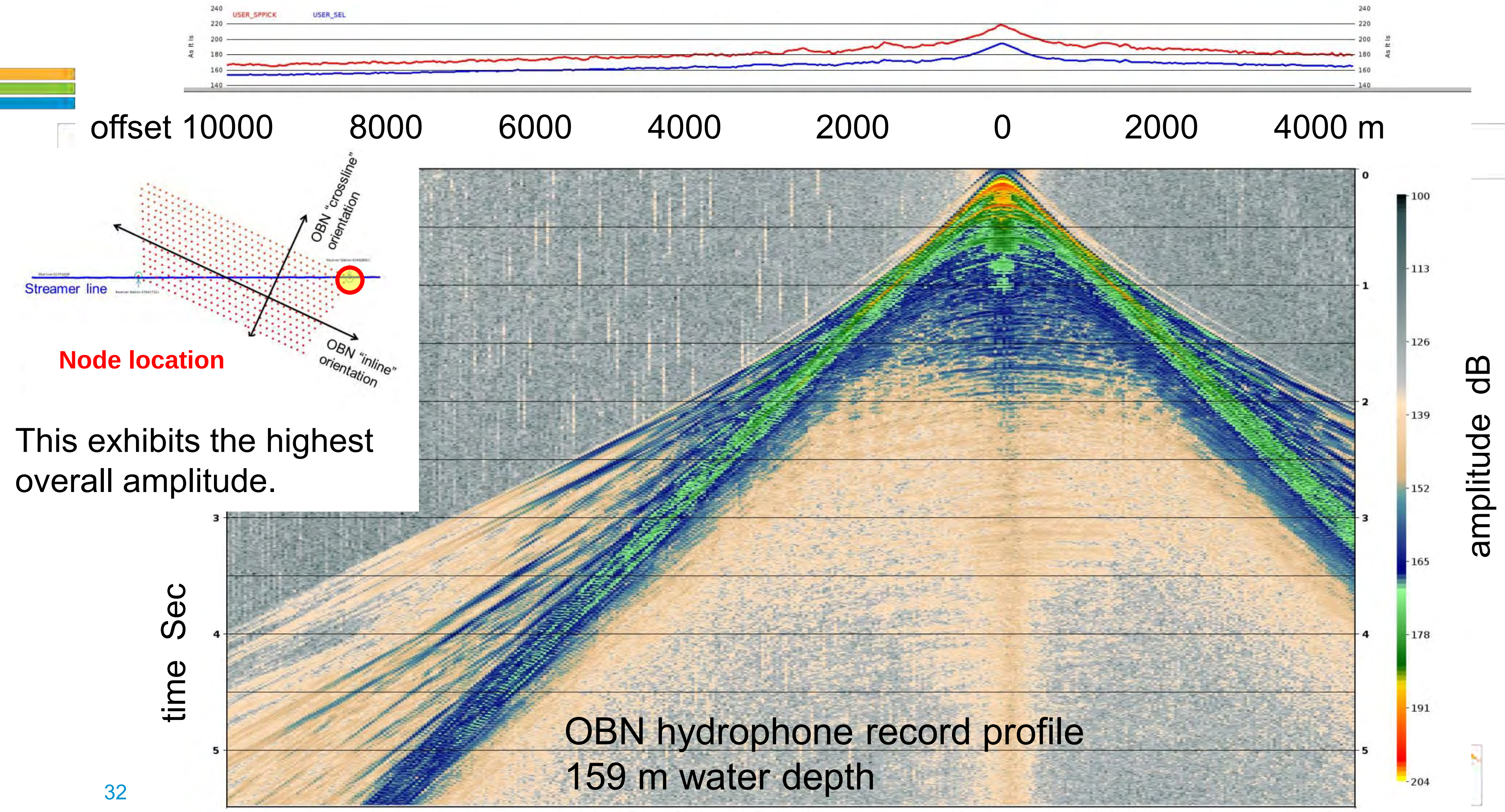
4. Field measurements from noise loggers (CMST data)

   The amplitudes produced by this method correspond closely to the measured levels for large source arrays by CMST ocean bottom loggers out to the maximum offset of our recording, 17 km.



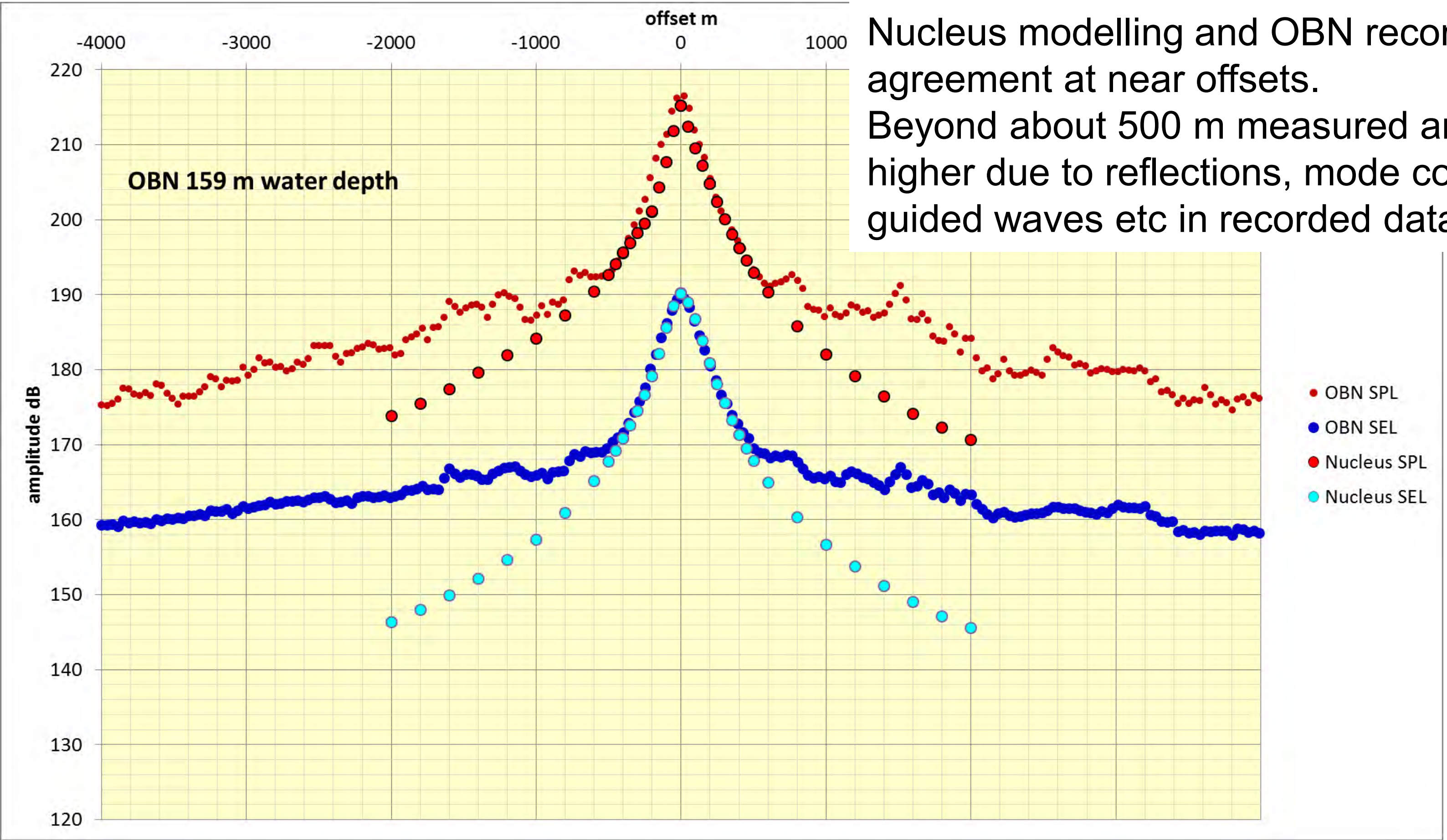
SPL
SEL
USER_SEL
USER_SPPICK
Sp 1672
Sp 1049
time Sec
amplitude dB
OBN "crossline" orientation
OBN "inline" orientation
Streamer line
streamer near offset (170 m) profile in dB
SPL and SEL profiles as per previous


SPL
SEL
USER_SEL
USER_SPPICK
offset 170 1000 2000 3000 4000 5000 6000 170 1000 2000 3000 4000 5000 6000 m
time Sec
Sp 1672
Sp 1049
Streamer line
OBN "crossline" orientation
OBN "inline" orientation
amplitude dB
streamer shot record profile
385 m water depth
streamer shot record profile
159 m water depth



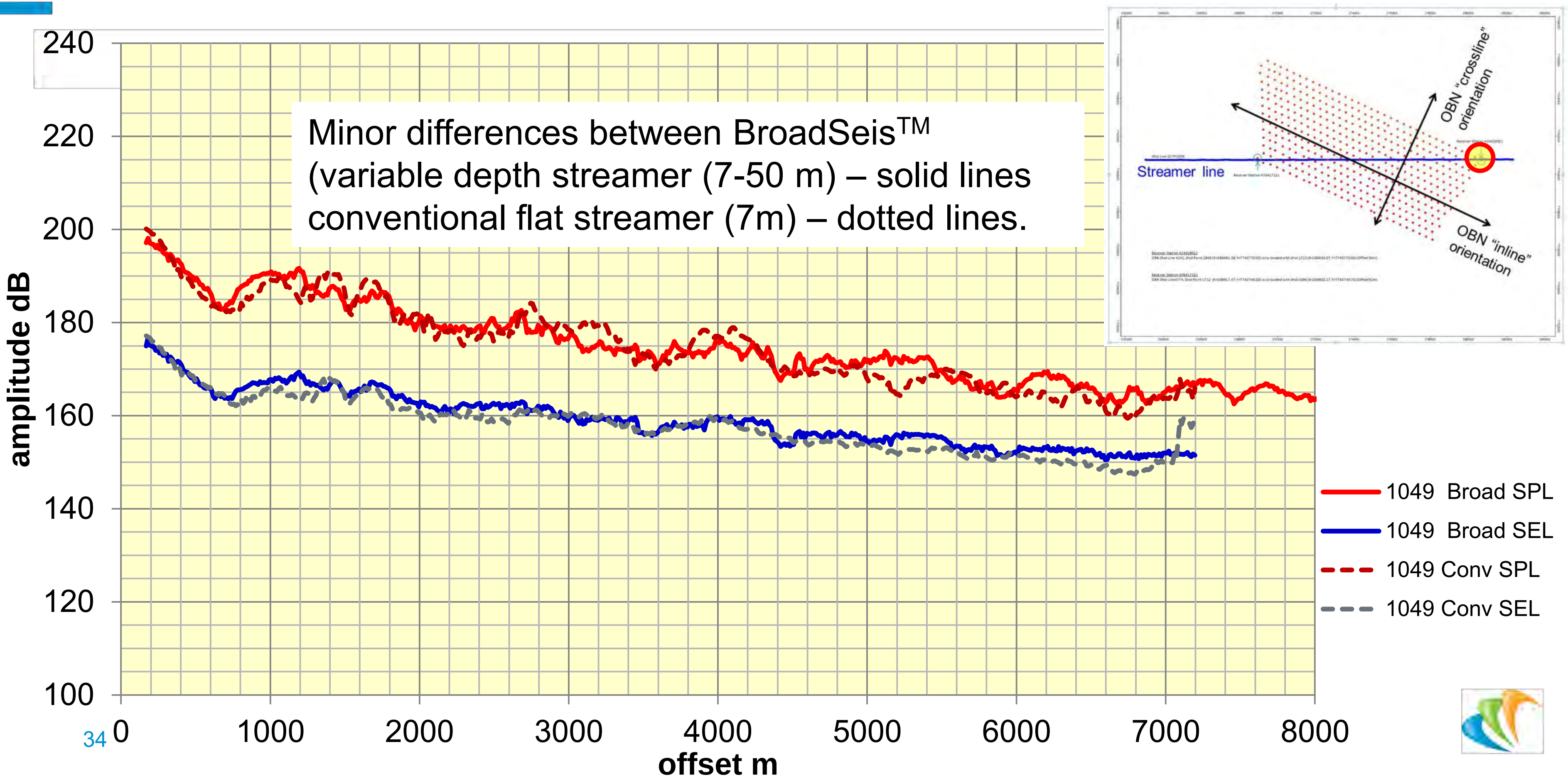
This exhibits the highest overall amplitude.

OBN at 159 m compared to Nucleus modelling at 160 m

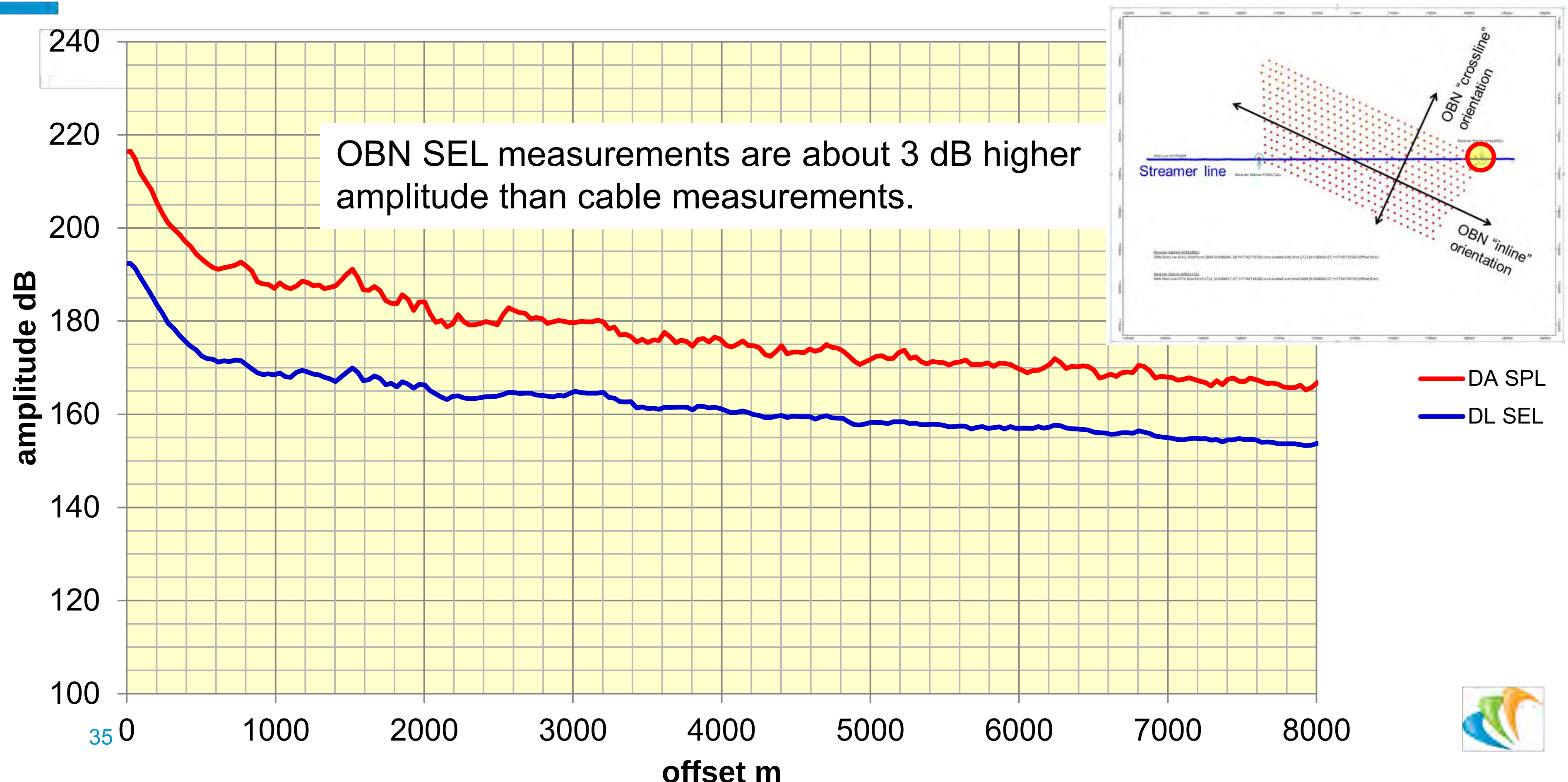


Nucleus modelling and OBN records are in good agreement at near offsets.
Beyond about 500 m measured amplitudes are higher due to reflections, mode conversions, guided waves etc in recorded data.

SPL and SEL measurements from cables in 159 m water depth



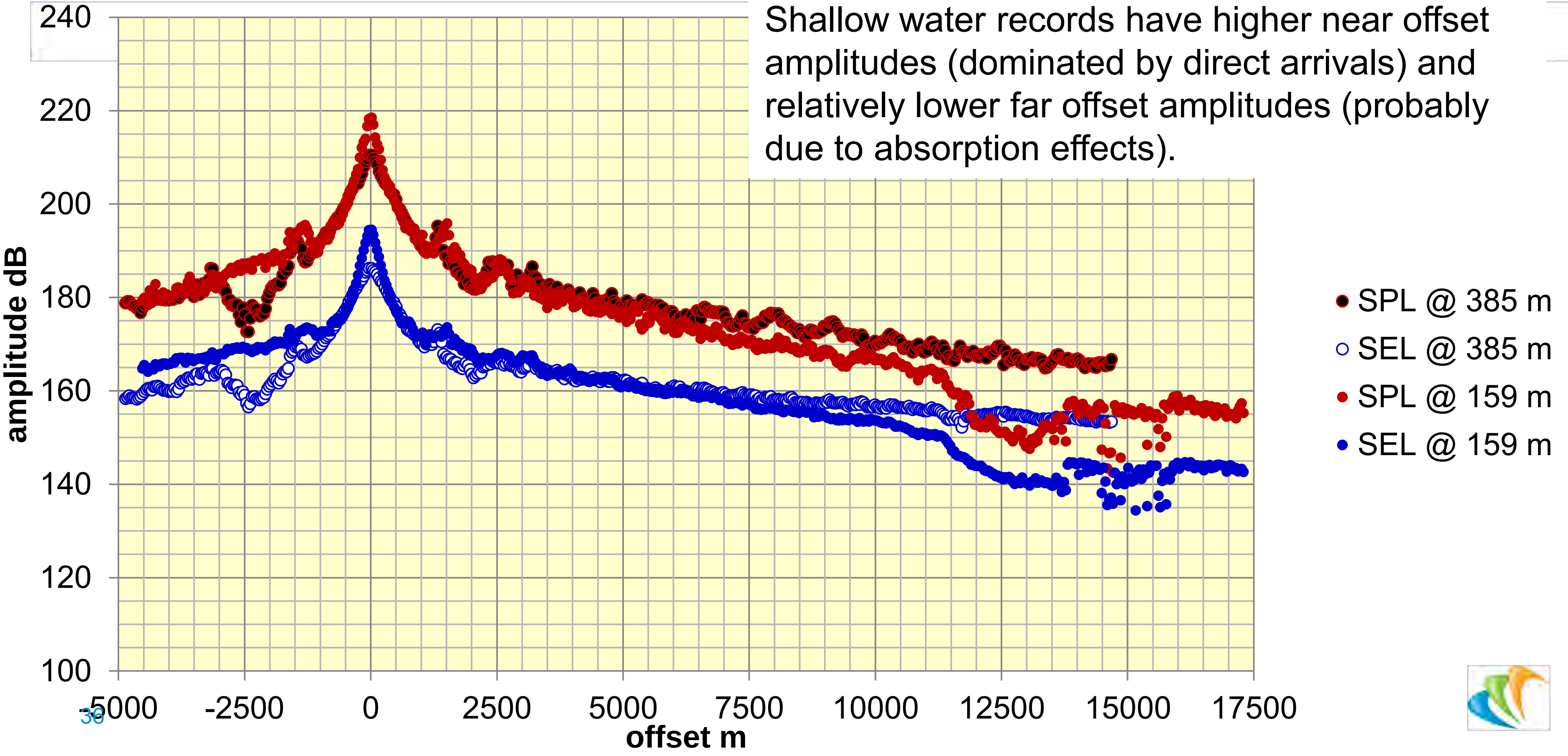
SPL and SEL measurements from OBN at 159 m



OBN SEL measurements are about 3 dB higher amplitude than cable measurements.

Effect of water depth on OBN values

Shallow water records have higher near offset amplitudes (dominated by direct arrivals) and relatively lower far offset amplitudes (probably due to absorption effects).



Observations

- Nucleus modelling and OBN records are in good agreement at near offsets. Beyond about 500 m measured amplitudes are higher due to reflections, mode conversions, guided waves etc in recorded data.
- OBN measurements are a few dB higher than cable measurements due to
  - array effects suppressing the cable measurements
  - extra pass through water layer
- In deeper water, OBN records will be higher amplitude due to longer travel time – cable records see two-way travel time through the water layer, OBN only one. This can be calculated and applied to field measurements.
- These observations are valid in the water depths we have observed here – 159 to 385 m

Verification

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   More sophisticated modelling of sound waves predict an offset dependent increase in amplitude up to a critical angle that depends on grazing amplitude and sea floor substrate. On recorded data the same pattern is observed.

4. Field measurements from noise loggers (CMST data)

   The amplitudes produced by this method correspond closely to the measured levels for large source arrays by CMST ocean bottom loggers out to the maximum offset of our recording, 17 km.

Maximum reflection energy depends on substrate and grazing angle

Material	Calcarenite	Sand
Density (kg.m^{-3})	2400	1800
Compressional wave speed (m.s^{-1})	2800	1700
Compressional wave attenuation (dB/wavelength)	0.1	0.8
Shear wave speed (m.s^{-1})	1400	-
Shear wave attenuation (dB/wavelength)	0.2	-

Table 1: Geo-acoustic parameters used for reflection coefficient calculation.

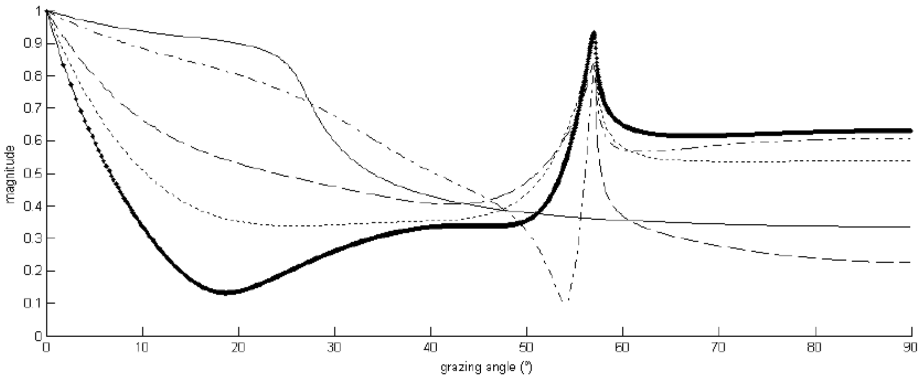
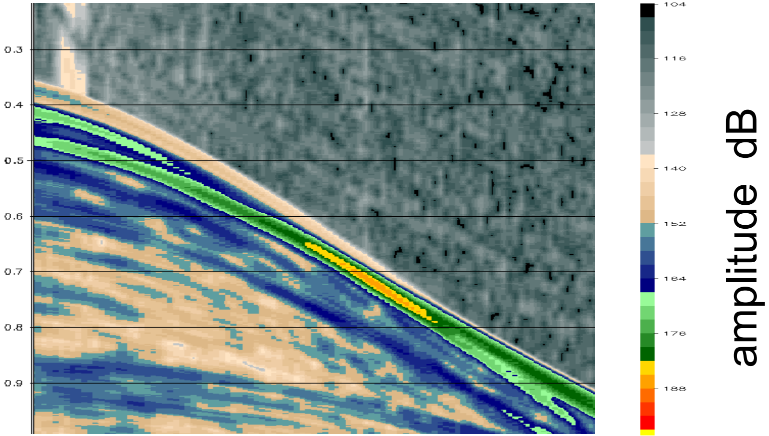


Fig. 1. Magnitude of plane wave reflection coefficient vs. grazing angle for seabeds comprising a calcarenite halfspace covered by sand of thickness 0λ (thick line), 0.1λ (dotted line), 0.2λ (broken line), 0.5λ (dash-dot line), and ∞ (thin solid line). λ is compressional wave wavelength in the sand layer, geoacoustic parameters are given in Table 1.

From Fan, Duncan & Gavrilov: Illustrating that a maximum amplitude occurs at some distance from the source depending on seafloor conditions. We also see maximum reflection on the field data at some distance from the source.

580 1000 m



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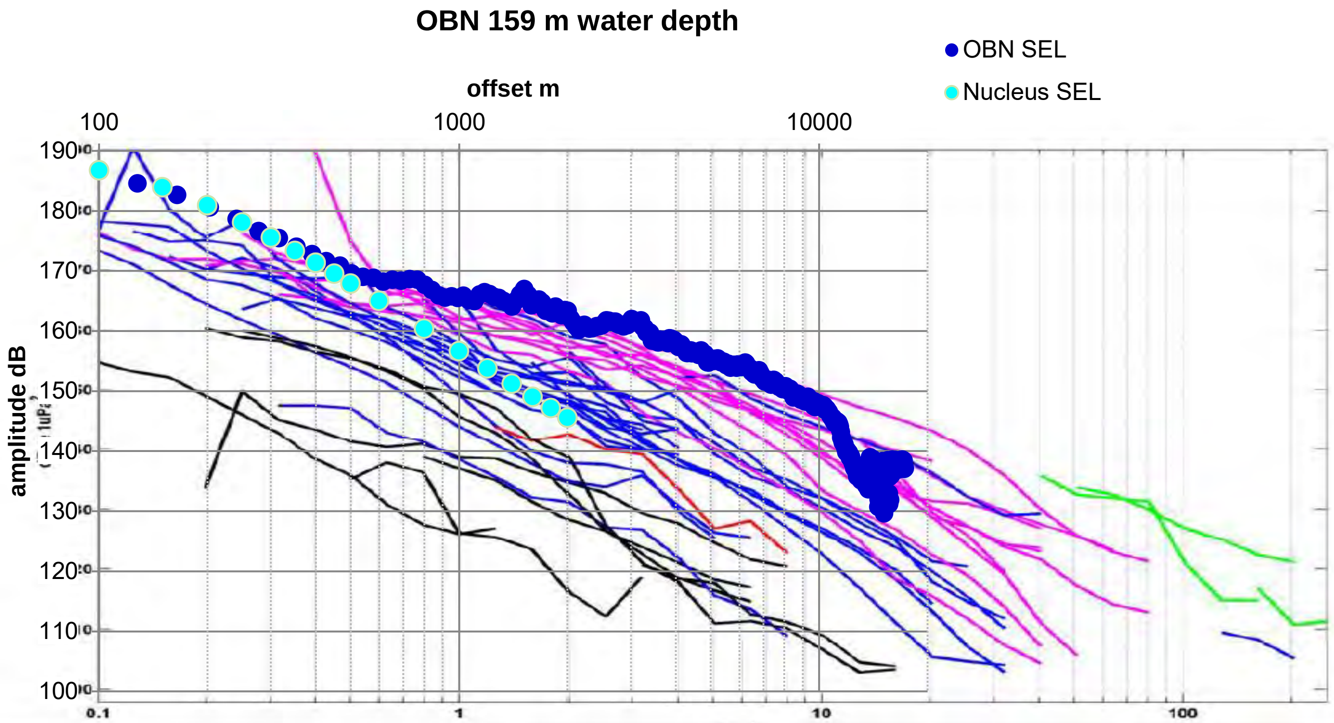
   The amplitudes produced by this method correspond closely to the measured levels for large source arrays by CMST ocean bottom loggers out to the maximum offset of our recording, 17 km.

OBN & Nucleus SEL vs CMST logger data



Good agreement between OBN and CMST data out to 10 Km

All air gun measures where received levels for a given survey have been averaged in log spaced range bins and presented as the mean value/bin +95% confidence limit. The black curves are arrays or single components of <1,000 cui capacity; the red curve is array of 1,000-2,000 cui; the blue curves 2,000-3,000 cui and the magenta curves 3,000-4,000 cui. Source: CMST Curtin University, CMST (2013) report

Figure 2-2: Sound exposure level (SEL) decay curves for a number of different seismic sources in western and southern Australian waters

Appendix 1
Review of method by CMST

Passion for Geoscience

Curtin University

Centre for Marine Science and Technology

Review of Measurement Approach to Evaluate Seismic Signal Amplitudes

Prepared for CGG

Prepared by: Alexander Gavrilov

PROJECT: CMST-1479

REPORT: 2016 – 22

August 2016

Overview

CGG are proposing a new approach to evaluate the underwater sound intensity, peak pressure and sound exposure levels in particular, from an offshore seismic survey using an airgun array, which is needed to assess the potential impact of airgun noise on marine fauna. The approach is based on measurements of the sound signals received at individual receiving elements of a seismic streamer (or a number of streamers in the case of 3D surveys). It is claimed by the proponent that this new approach is more accurate than the traditional ones based purely on airgun sound emission models, as it takes into account the sound energy reflected or scattered back from the interface and substrate of the seabed into the water column, in contrast to the modelling approach. This is true for the commercial modelling software currently available on market, such as Nucleus; however, there are some other software means developed by research groups, such as EnviroSeis from the Centre for Marine Science and Technology of Curtin University, which take into account both sea surface and bottom reflections of the sound waves emitted by an airgun array. On the other hand, such models and software means require some prior knowledge of seabed geoacoustic properties which are not always available, while measurement results include the effect of in-situ seabed conditions.

The proposed measurement procedure consists of the following steps:

1. Sound signals from each receiving element of the streamer, which is a line array of 12 to 15 m length, are high-pass filtered at a cut-off frequency of 2.5 Hz to suppress swell-induced low-frequency noise;
2. Signal waveforms are transformed into their envelopes using Hilbert transform, which facilitates visualisation of the sound intensity versus time and receiver's offset in the streamer;
3. Signal amplitude in millivolts is converted to the sound pressure in Pa using hydrophone sensitivity data;
4. Sound pressure amplitude is corrected for the directionality of the receiving element, which is frequency dependent and referred to as an array effect.
5. Peak pressure (SPL_{peak}) and sound exposure (SEL) levels are calculated for each airgun signal (commonly referred to as a trace) as a function of time and receiver's offset, i.e. distance from the airgun array.

All these operations are rational and will provide reasonably accurate measurements of the two sound intensity measures, SPL_{peak} and SEL used for assessing noise impacts. The only minor drawback of using the waveform envelope rather than the waveform itself for calculating the sound levels is that the SPL_{peak} values obtained from the waveform envelope after Hilbert transform tend to be slightly overestimated, by less than 0.5 dB on average. At larger offsets, the bottom reflected signal arrivals will dominate in the received signal; hence proper correction should be applied based on the incidence angle estimated for the bottom reflected arrivals.

Measurements of SPL_{peak} and SEL values were made using a BroadSeis streamer towed at 7-30 m below the sea surface in water depths of 45 m and 178 m, and also for a conventional streamer towed at 7 m and a BroadSeis™ streamer with the cable depth varying from 7 to 50 m in water depths of 159 m and 385 m. The latter were also compared against data recorded on a 2D array of ocean bottom seismographs over the same area of the seafloor. The measurements of SPL_{peak} were consistent with modelling predictions by Nucleus at offsets less than 500 m. The SEL measurements using the streamer data revealed generally higher levels than the modelling predictions, especially at larger offsets where the bottom reflected signal arrivals dominate in the received signals. This takes place because the multiple bottom and sea surface reflections are not taken into account in Nucleus.

The measurements also demonstrated that the levels measured by the streamers towed at different depths and by the ocean bottom seismographs were similar, within a few dB, at the same offsets relative to the airgun array. Based on this observation, the authors make a conclusion that the sound levels measured via a seismic streamer and the procedure summarized above, can be extrapolated into the entire water column without significant errors.

Conclusions

The measurement approach proposed by the authors to evaluate underwater sound levels from an airgun array has obvious advantages over the traditional approach based purely on modelling. Firstly, it allows for the actual characteristics of the airgun array, such as its directionality, and the environment, such as the surface sound duct in the ocean and its effect on sound propagation. Moreover, the measurements allow for multiple reflections from the seafloor and its substrate and from the sea surface, which contribute significantly to the total acoustic energy of the sound field in the water column and consequently to the sound exposure level. The traditional/commercial models of sound emission from airgun arrays do not take this into account.

There are issues in the proposed approach that need to be clarified before this measurement method is widely applied. Firstly, it is supposed that the sound levels measured at receiver elements of a towed seismic streamer can be extrapolated into any depth below the sea surface. Although the authors notice that that the actual sound levels in the middle of the water column and at the seafloor can be higher by a few dB than those measured from the streamer data, the maximum prediction error to be expected for both SPL_{peak} and *SEL* is uncertain from the presented material.

Secondly, the authors make their conclusion based on streamer data obtained in a frequency band of 220 Hz. According to the literature and personal knowledge of the reviewer, such a recording bandwidth is sufficient to represent more than 90% of the sound energy emitted by various airgun arrays. However, some seismic recording systems have a narrower frequency band (e.g. 120 Hz), so would be useful to assess how the narrowing of the recording bandwidth may affect the measurements of SPL_{peak} and *SEL*. It is expected that the low-pass filtering implemented in seismic streamers will affect (reduce) primarily the peak pressure in the received signals.

Recommendations

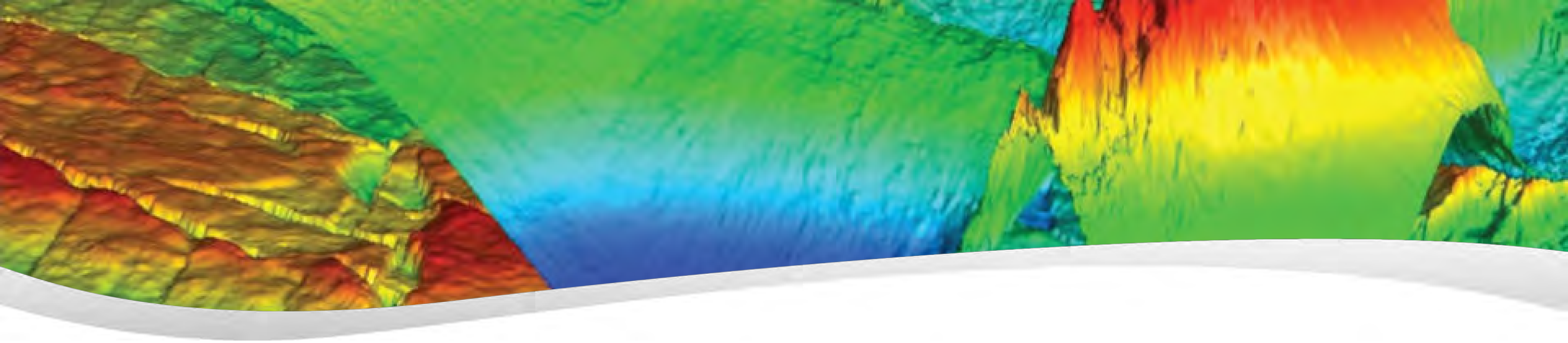
Based on literature (for example see DeRuiter at al., 2006 and Madsen et al., 2006), the sound level received in the water column from an airgun array is expected to be depth dependent at certain distances from the array, e.g. at very short offsets, in certain environments depending on water depth and sound velocity profile. Hence the authors are recommended to assess likely (or maximum) errors in the sound level predictions from the measurements. As it would be impractical to perform such verification by multiple measurements in various environments using sound receivers at different depths, the authors are recommended to carry out modelling tests using a more comprehensive model of sound emission from airgun arrays and transmission in the ocean sound channel, such as the EnviroSeis from Curtin, which takes into account all effects of wave refraction and boundary reflections.

The authors are also recommended to consider correction for the receiver array effect applied separately to the bottom reflected signal arrivals dominating at larger offsets, if it is not already implemented in their methodology.

References

DeRuiter, S.L., Tyack, P.L., Lin, Y-T., Newhall, A.E., Lynch, J.F. and Miller, P. (2006). “Modeling acoustic propagation of airgun array pulses recorded on tagged sperm whales (*Physeter macrocephalus*)”, *J. Acoust. Soc. Am.* 120(6), pp. 4100-4114.

Madsen, P.T., Johnson, M., Miller, P., Aguilar Soto, N., Lynch, J. and Tyack, P. (2006). “Quantitative measures of air-gun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments”, *J. Acoust. Soc. Am.* 120(4), pp. 2366-2379.



Gippsland Seismic Amplitudes
5 to 20 m water depth

G01a (Northern fields)
Tuskfish
Elver
Sue
Bazzard
Oscar
HGP

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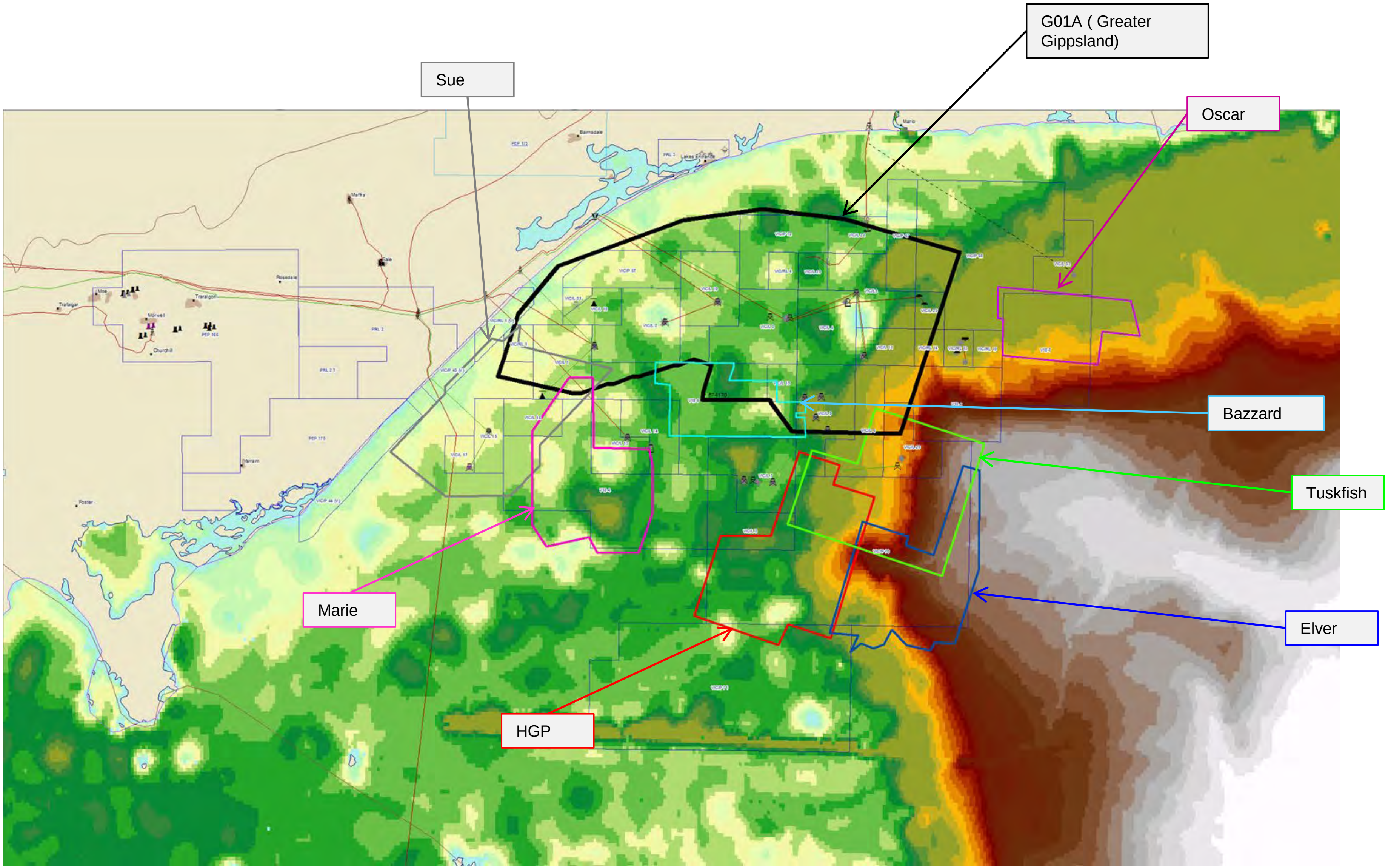
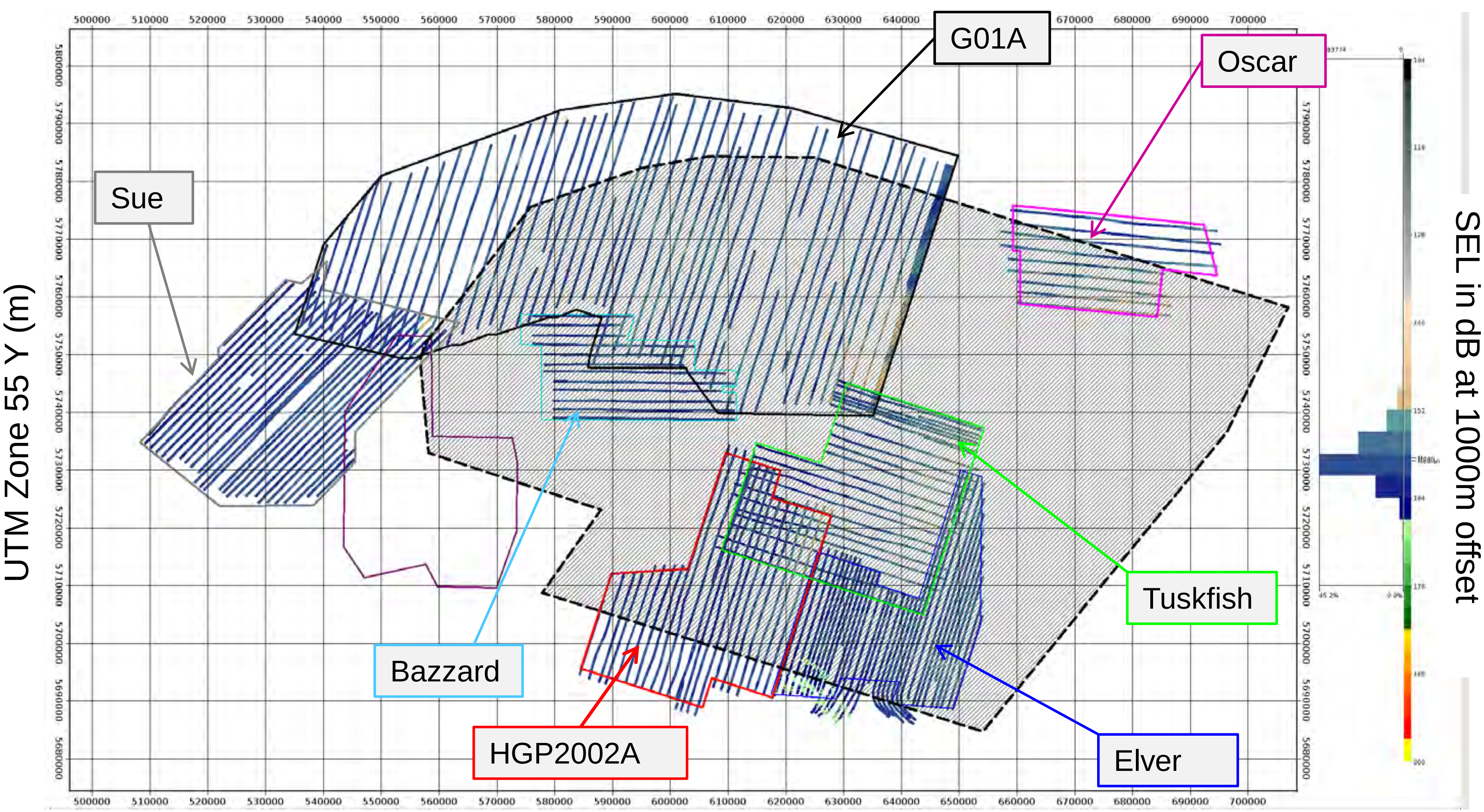
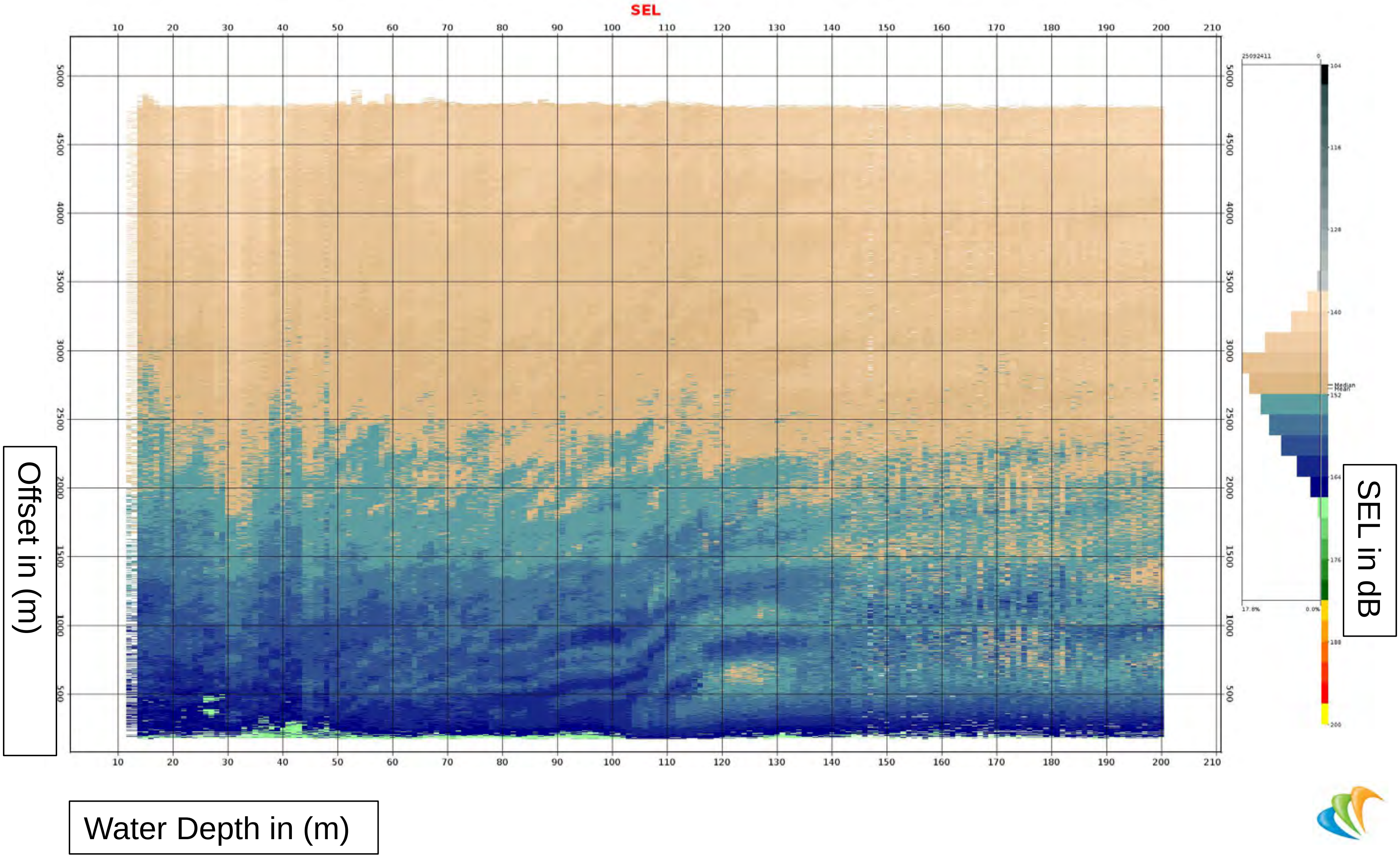

G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Elver
Marie
HGP

Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay

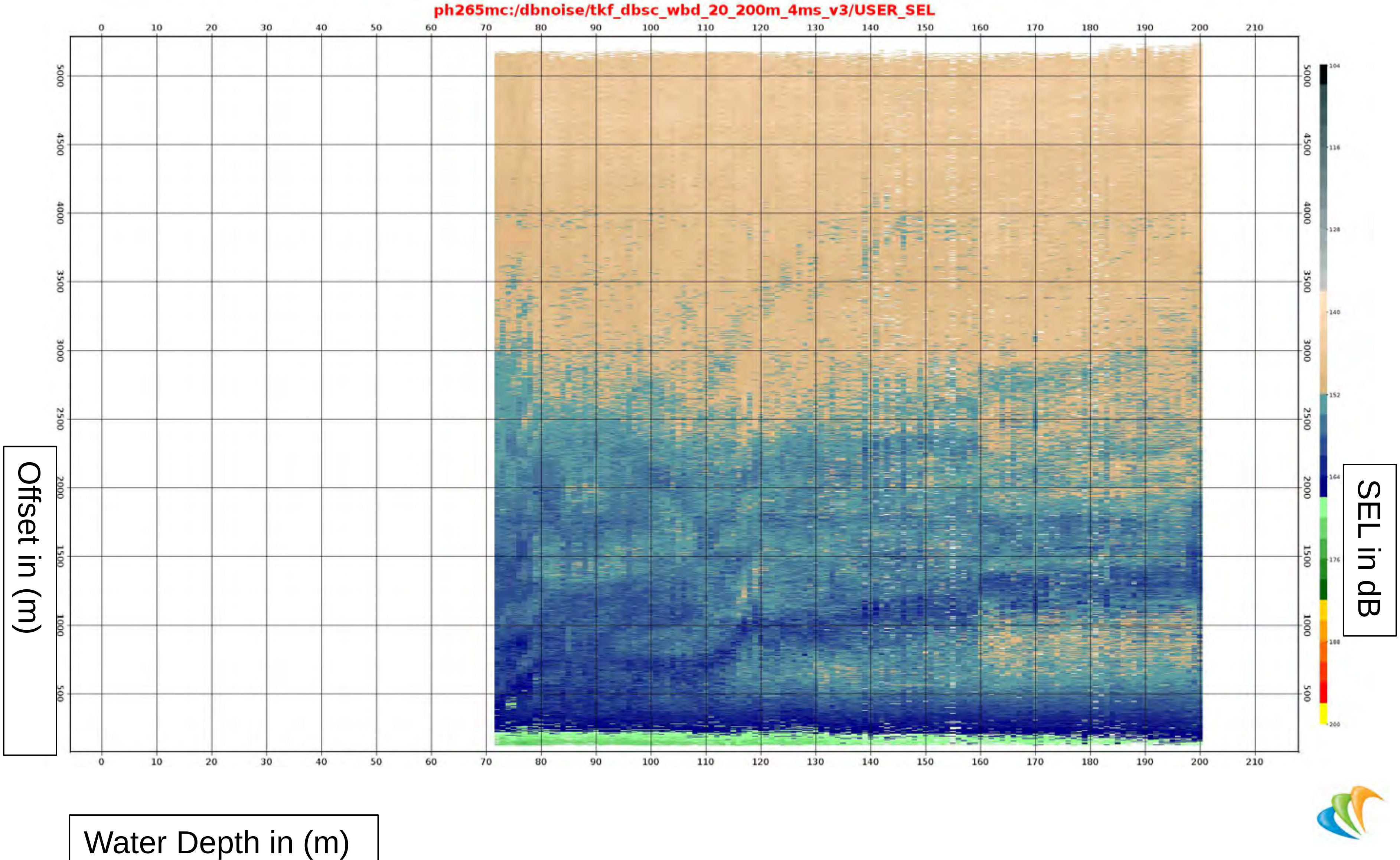


SEL
Water Depth
5m to 200m

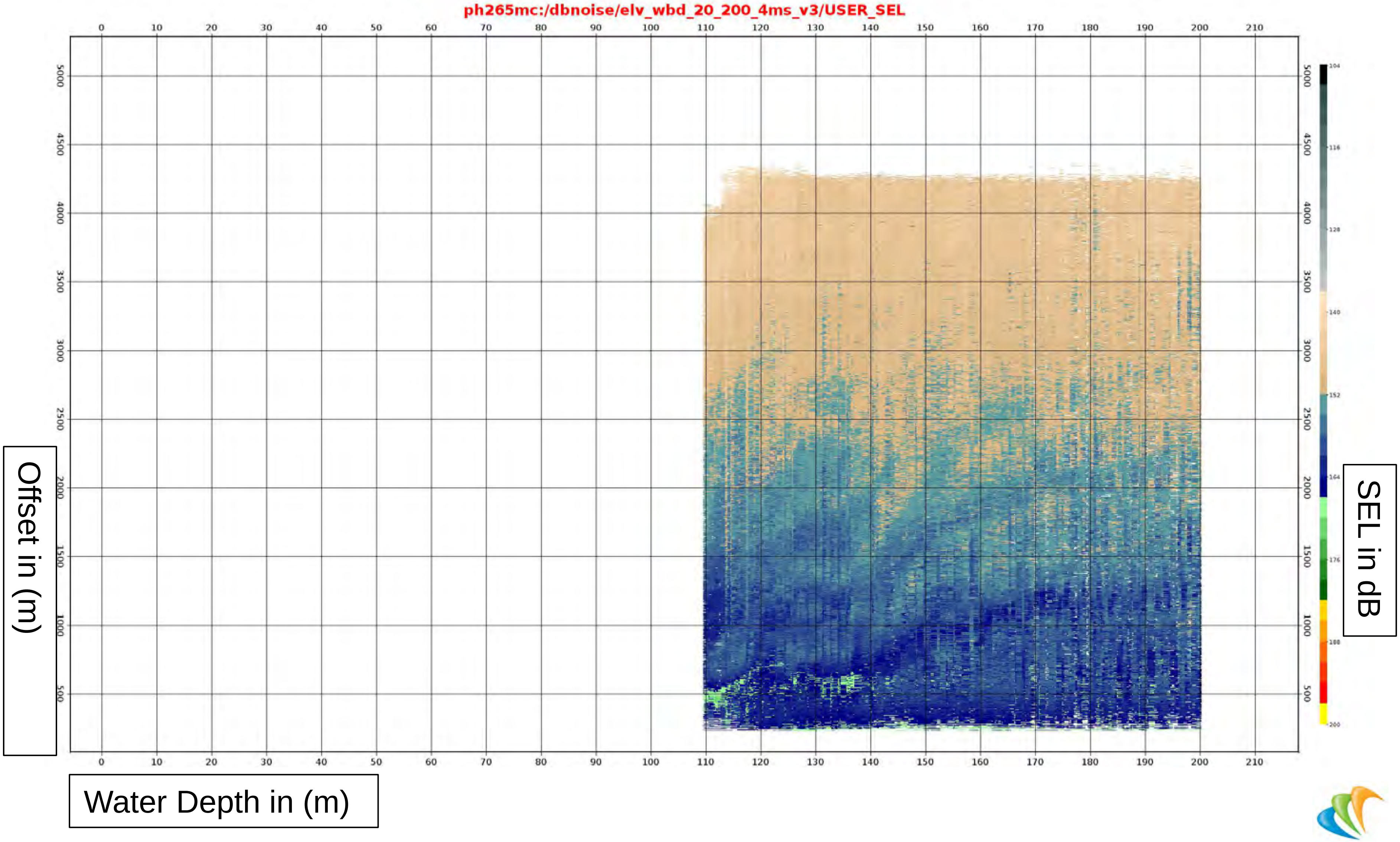
Survey: G01A (Northern Fields)
Shot water depth: 5 m to 200m



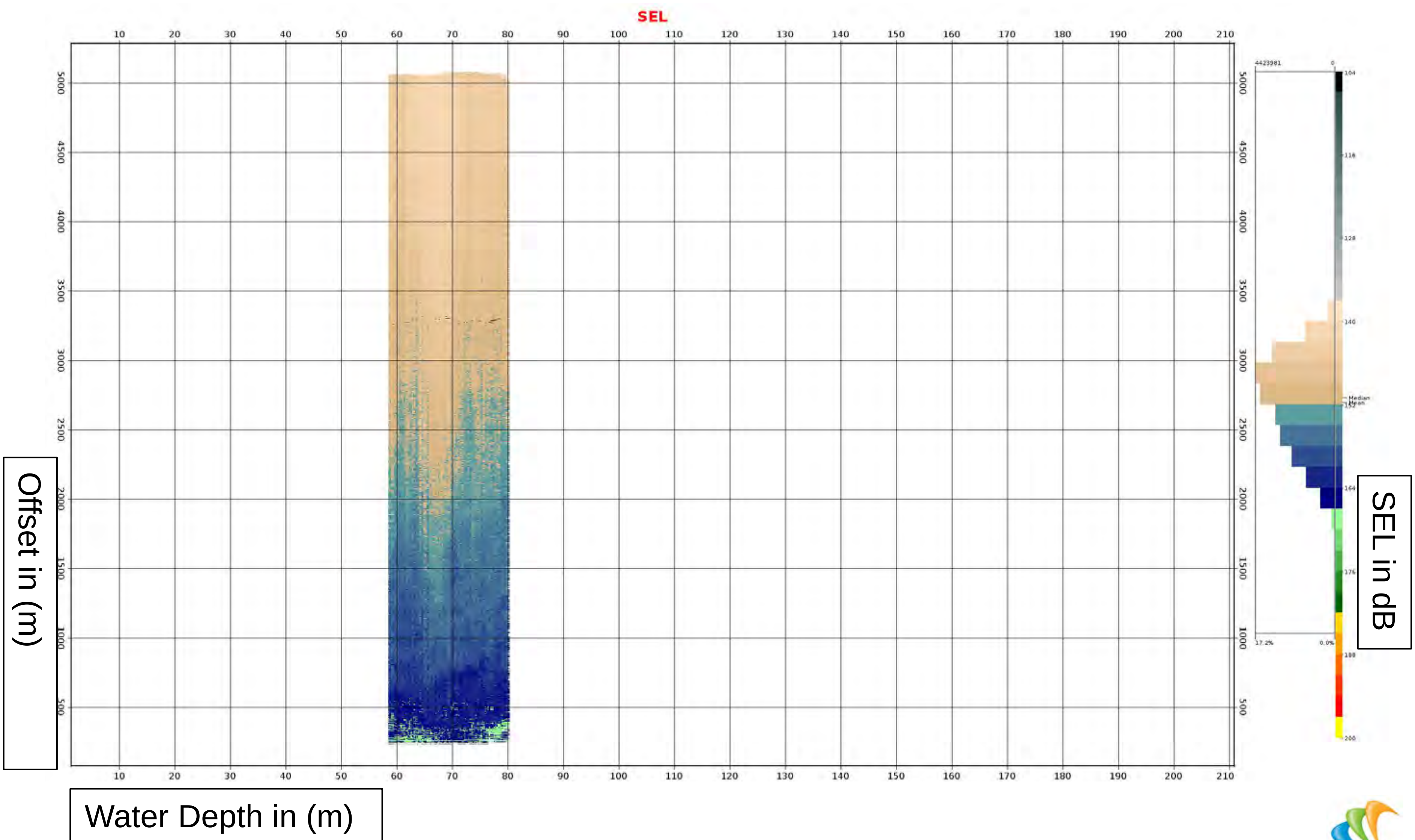
Survey: Tuskfish
Shot water depth: 5 m to 200m



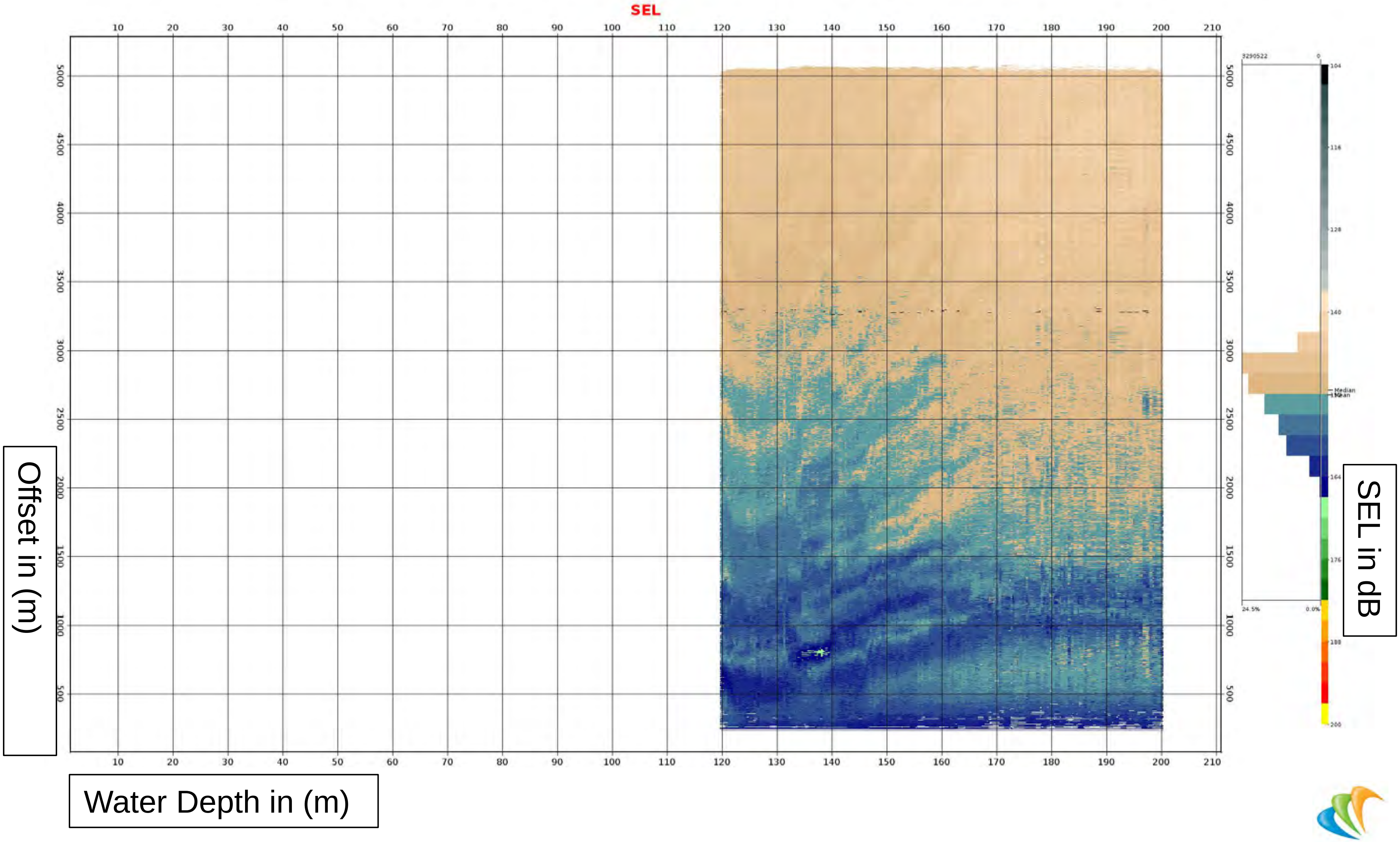
Survey: Elver
Shot water depth: 5 m to 200m



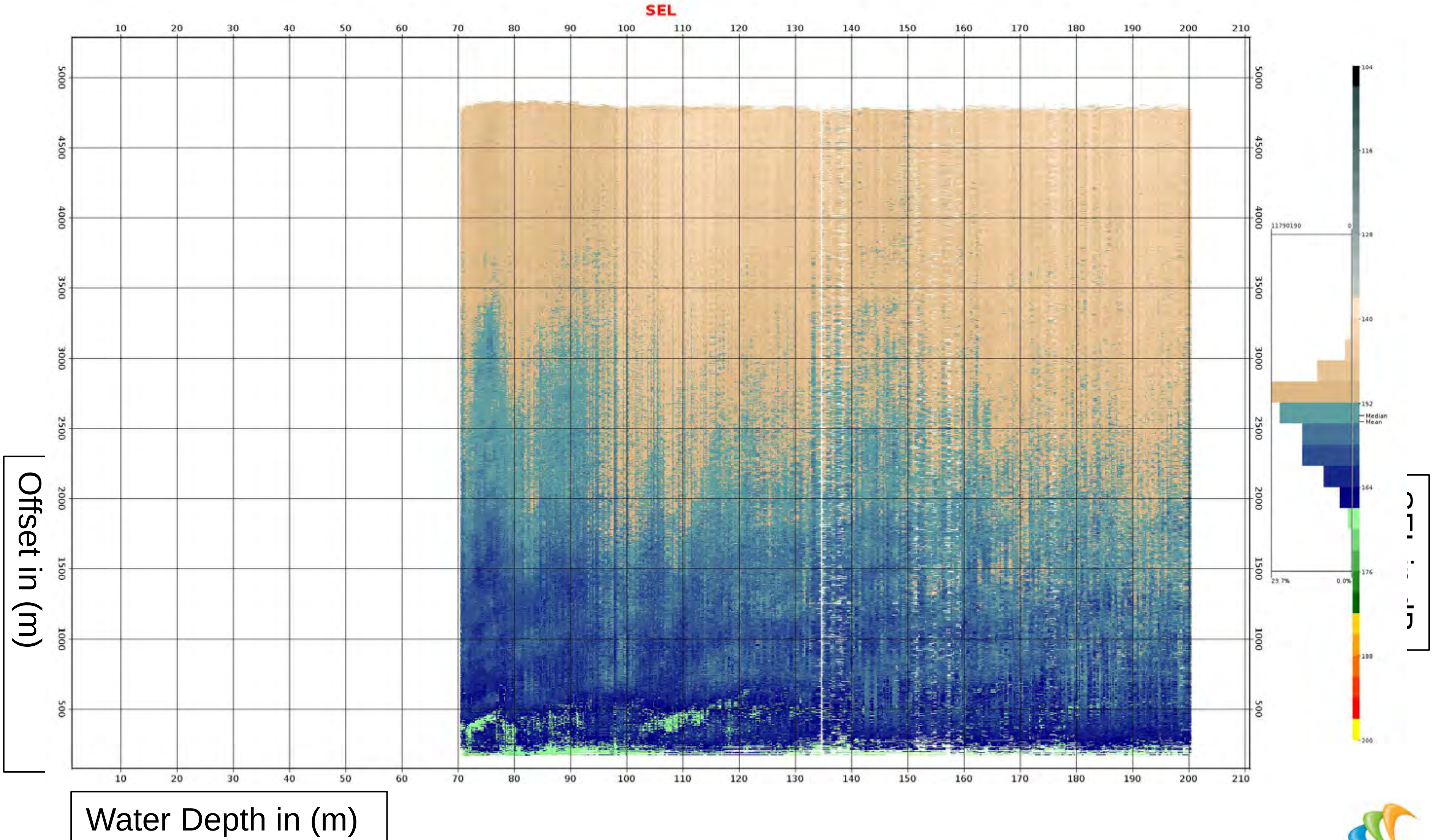
Survey: Bazzard
Shot water depth: 5 m to 200m



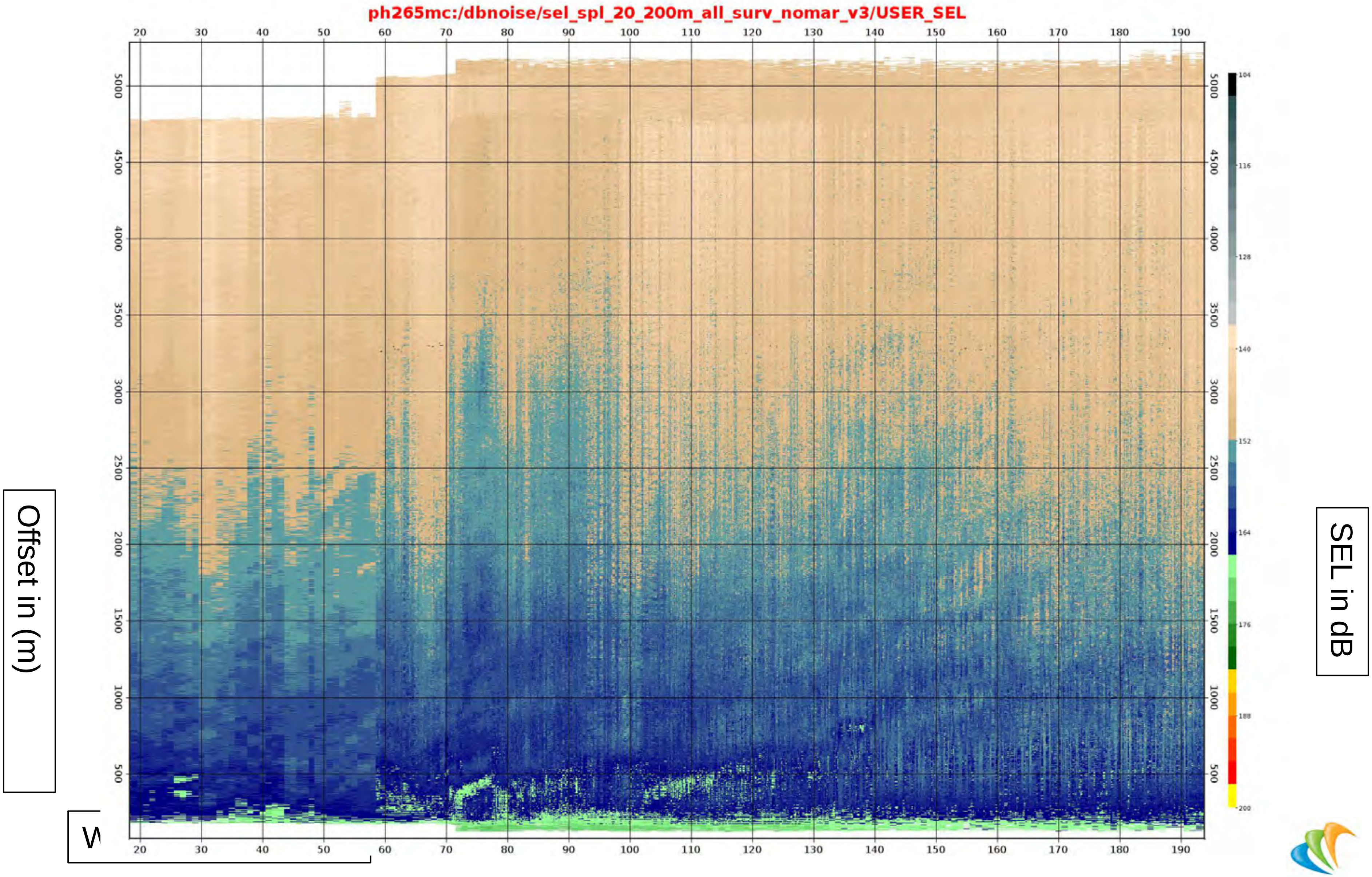
Survey: Oscar
Shot water depth: 5 m to 200m



Survey: HGP
Shot water depth: 5 m to 200m

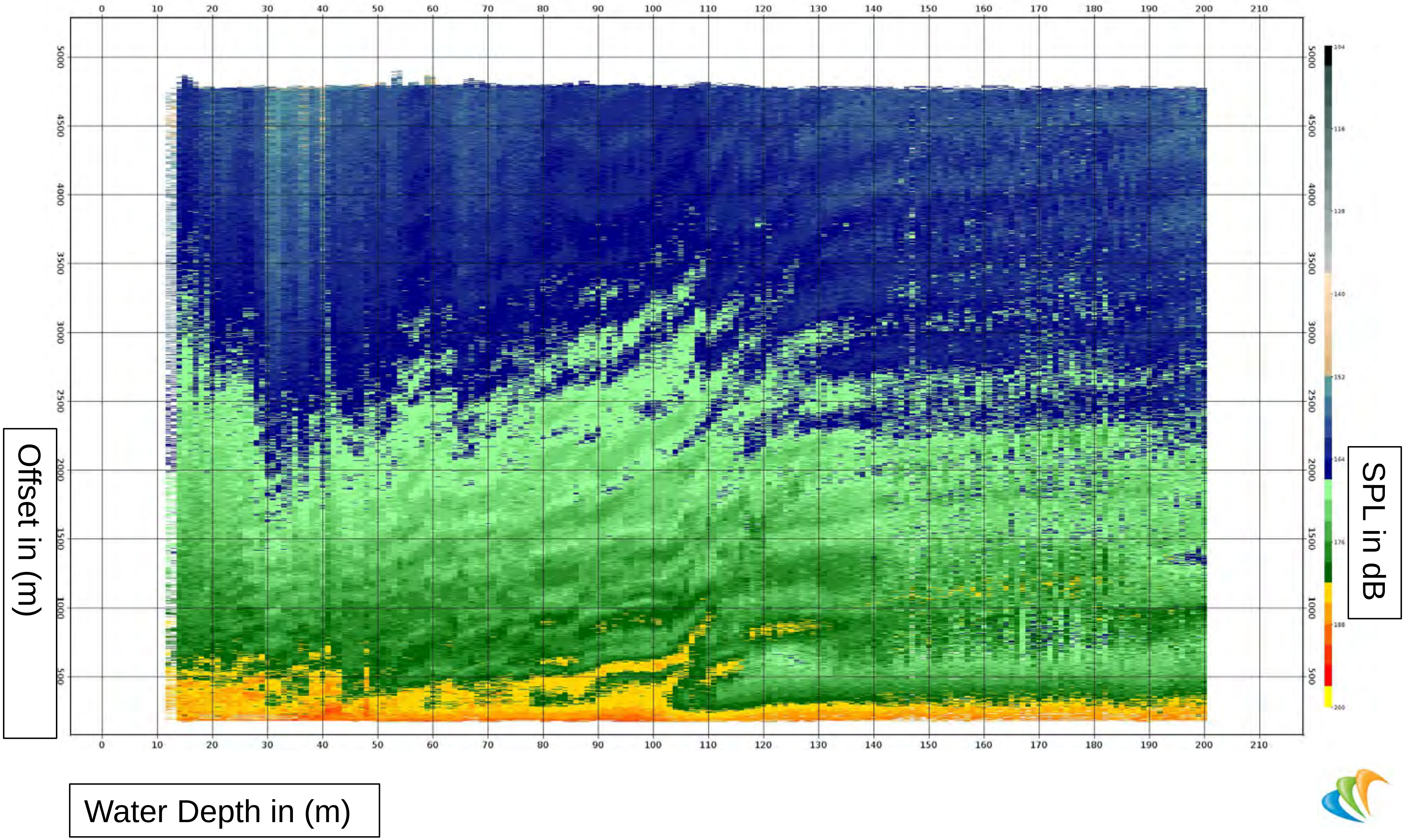


Survey: All surveys
Shot water depth: 5 m to 200m

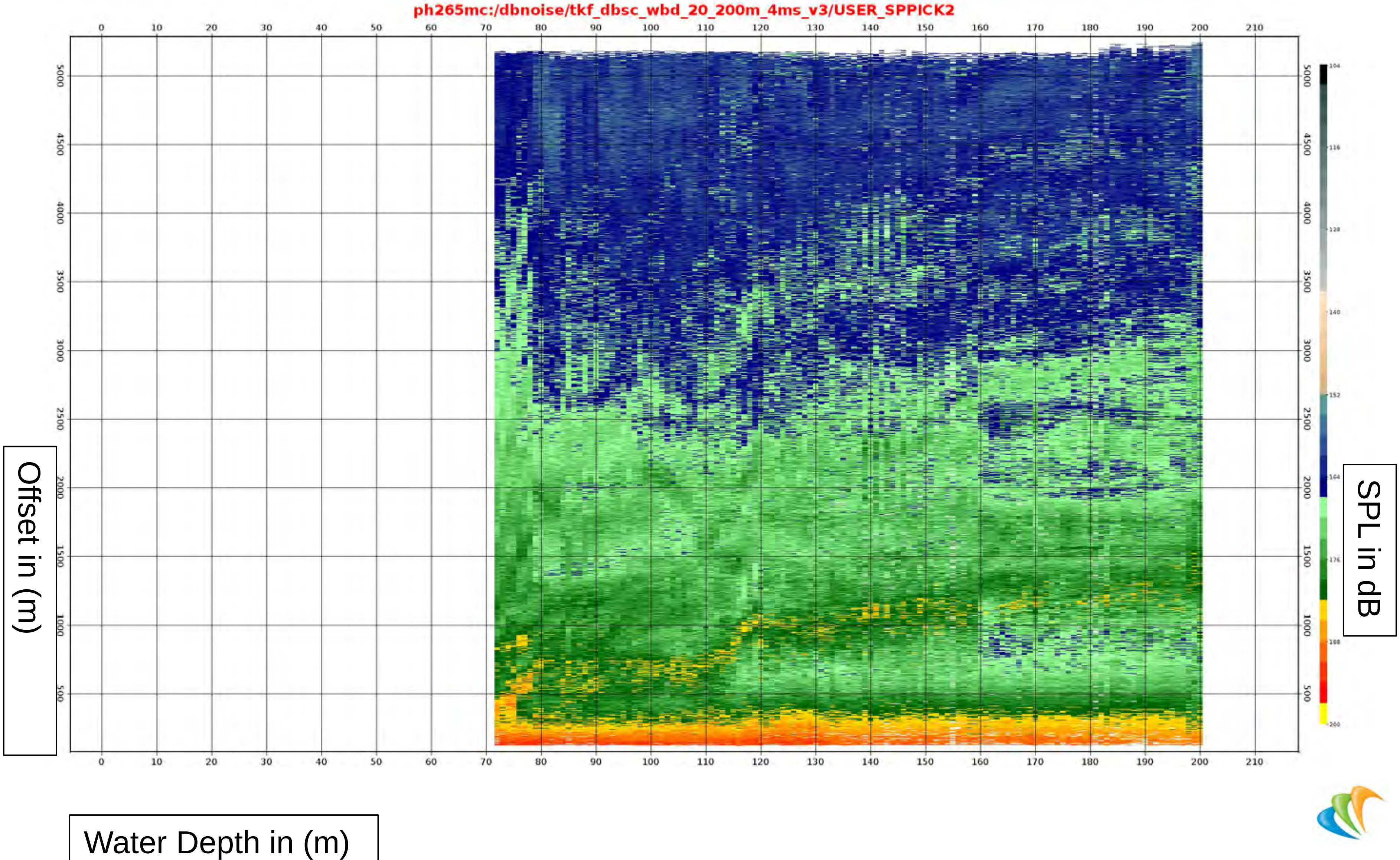


SPL
Water Depth
5m to 200m

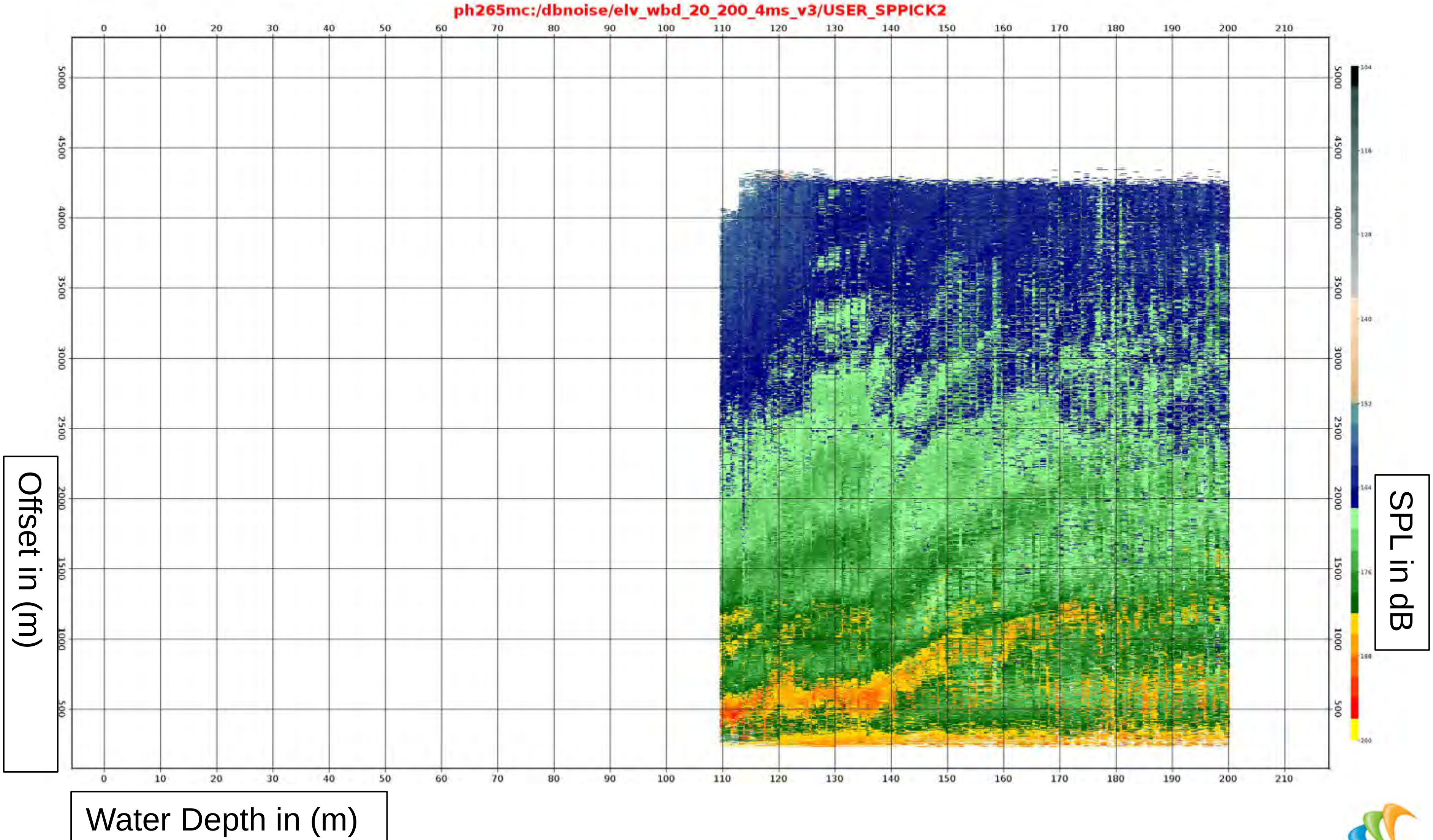
Survey: G01A (Northern Fields)
Shot water depth: 5 m to 200m



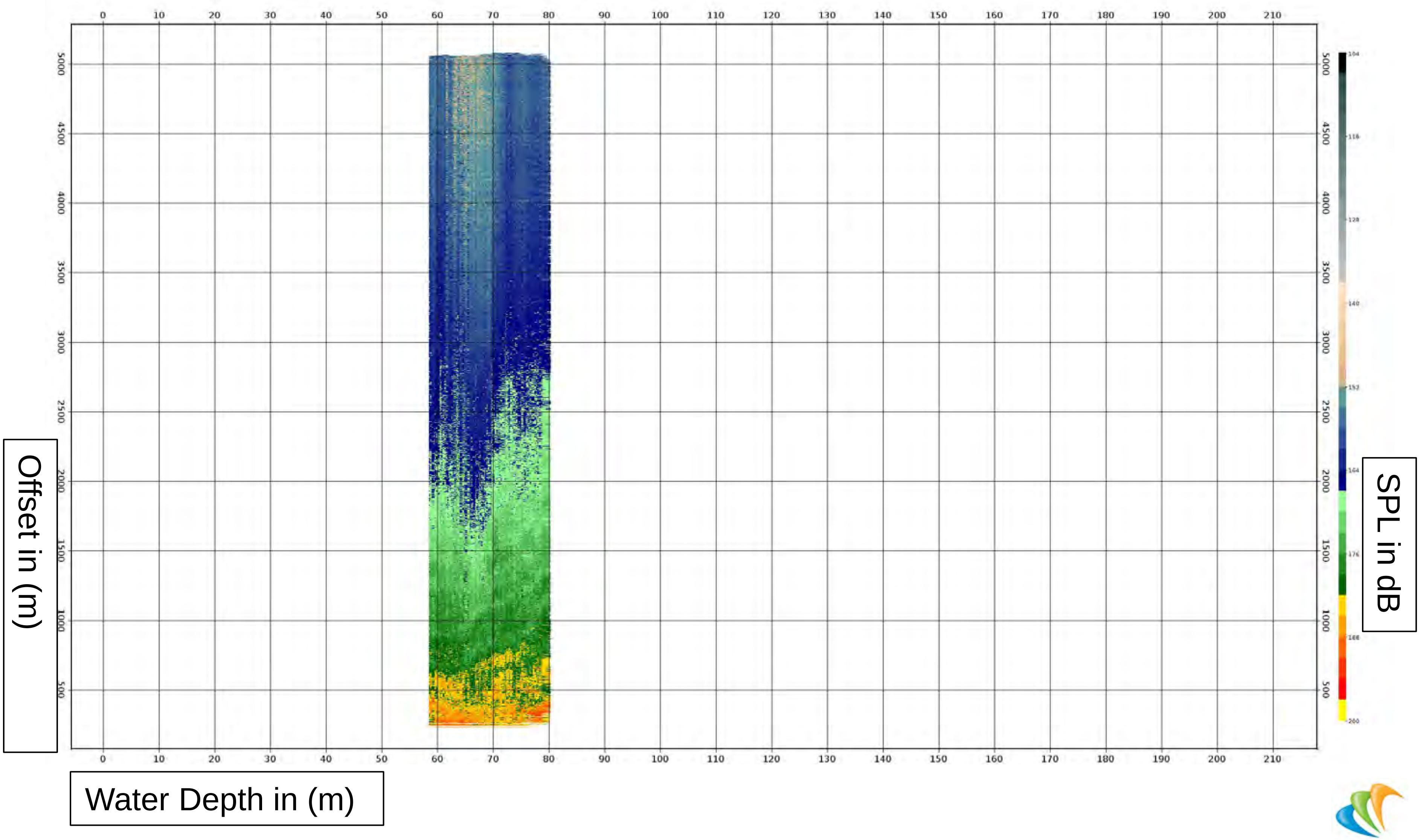
Survey: Tuskfish
Shot water depth: 5 m to 200m



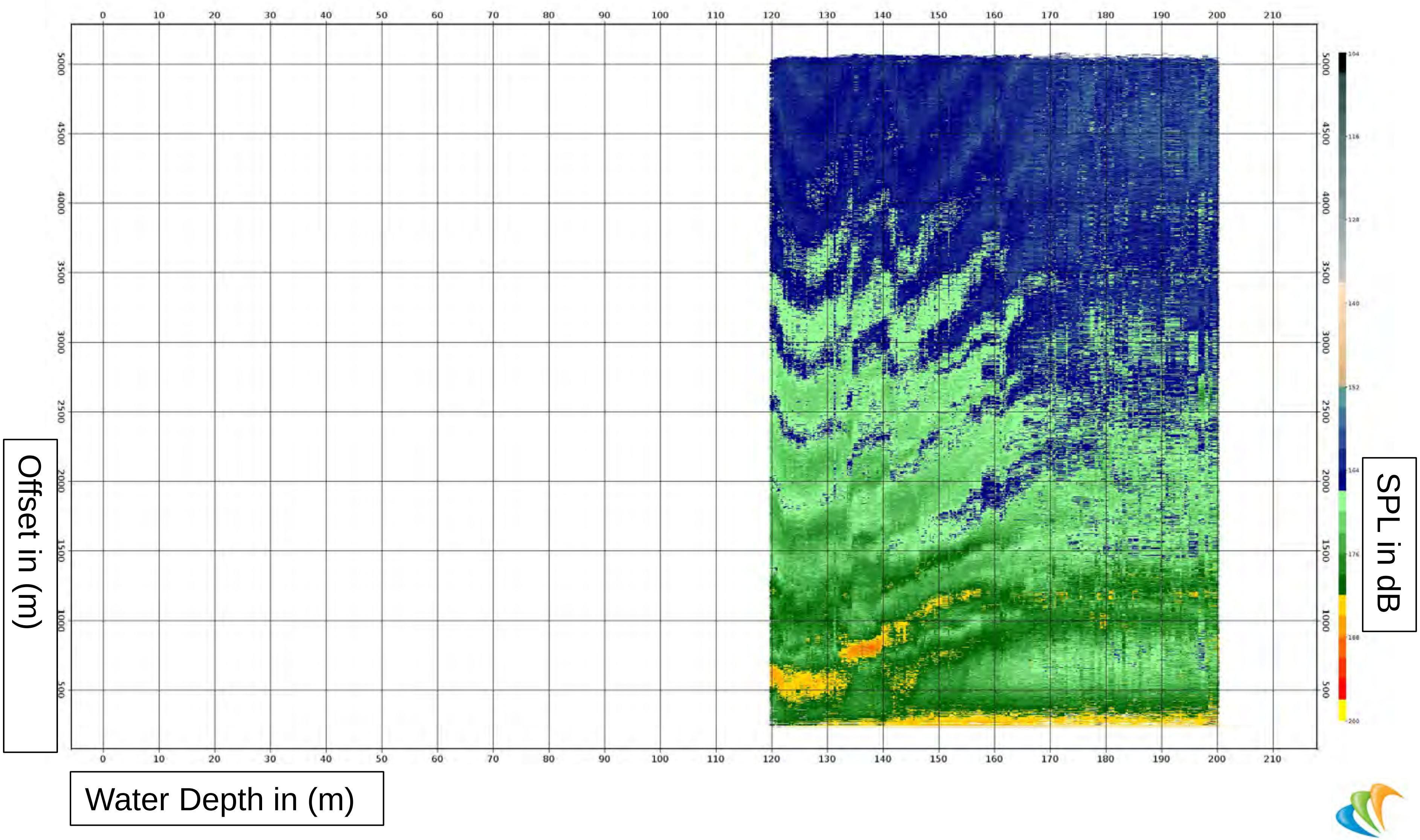
Survey: Elver
Shot water depth: 5 m to 200m



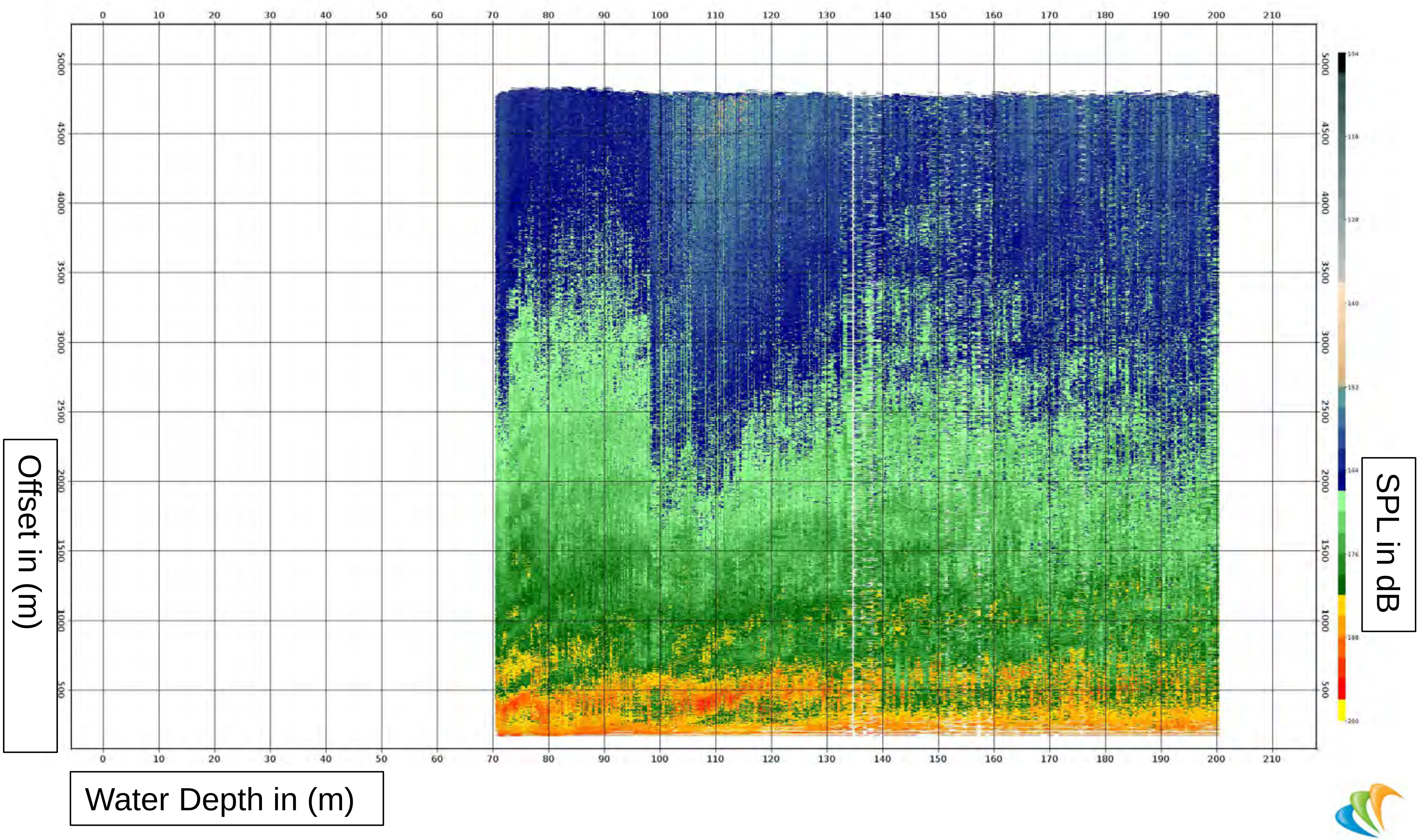
Survey: Bazzard
Shot water depth: 5 m to 200m



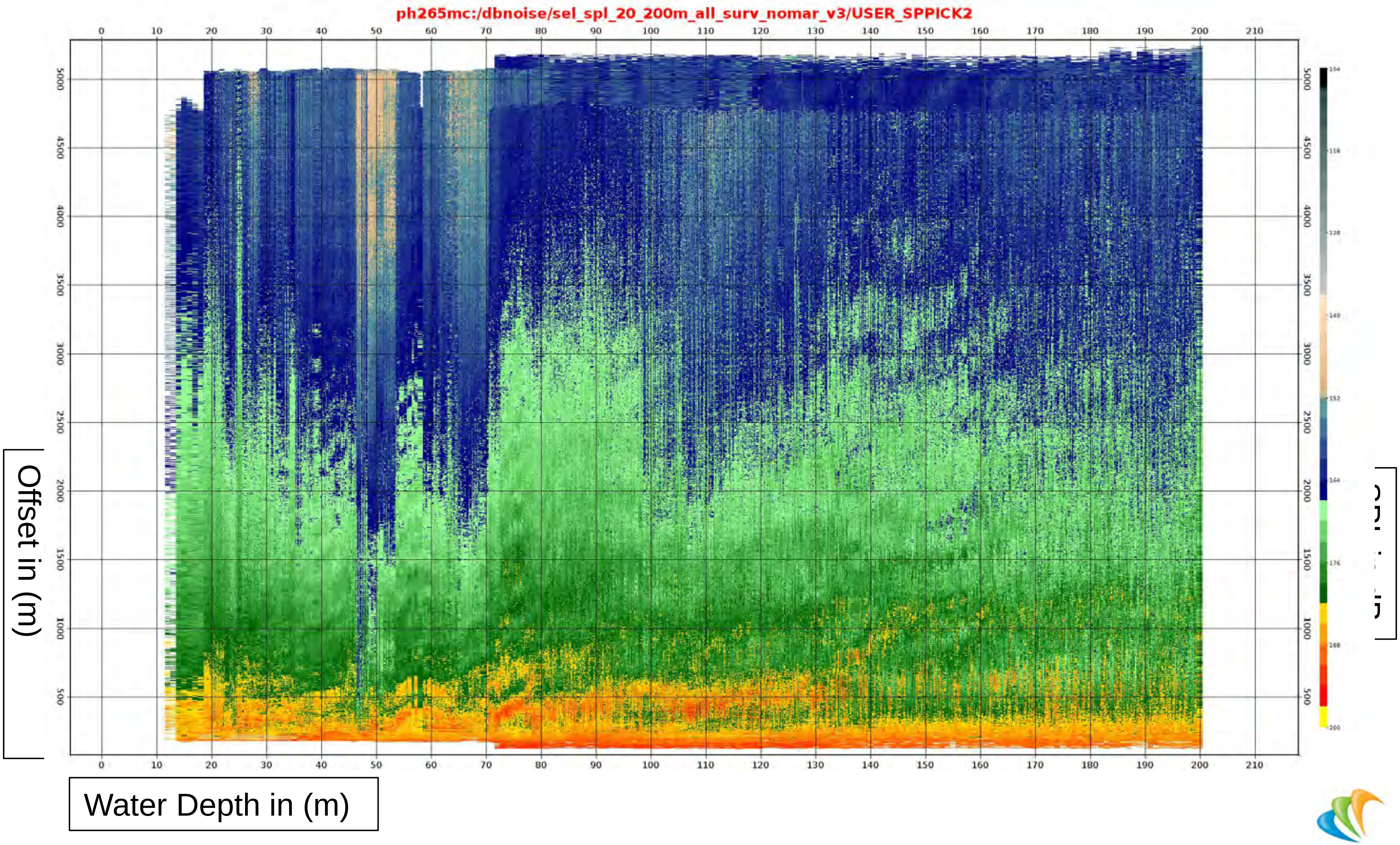
Survey: Oscar
Shot water depth: 5 m to 200m



Survey: HGP
Shot water depth: 5 m to 200m



Survey: All surveys
Shot water depth: 5 m to 200m

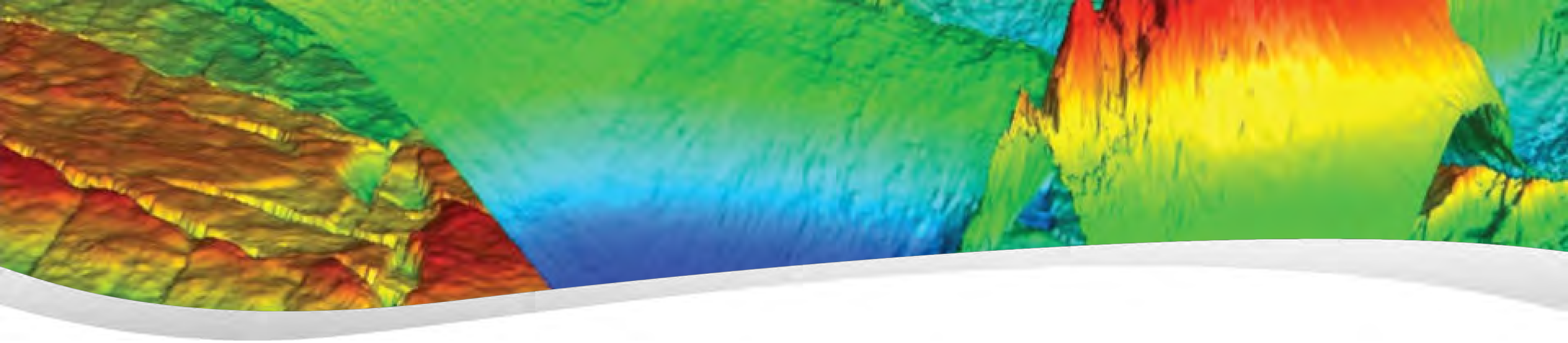


Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
G01A Northern Fields	Geco Beta	3900	85/265	6144	3/18	180/72	2	50	18.75	6	2000	3542	6	20 V/Bar	T^2	Scale 0.001	0
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

Survey	Offset		Water depth		Number of samples	For Water bottom Range 20 to 200 m									
						SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572	140908652	3.5	180.3	150.6	151.2	6.702	124.6	205.8	165.9	166.6	9.013
Tuskfish	127	5247	72	2579	9424066	23.2	174.5	152.6	153.2	5.149	58.9	195.5	169.1	170.1	6.679
Elver	234	4358	110	2592	4695040	110	175.9	152.9	153.6	6.281	118.9	197.5	171.2	171.2	7.941
Bazzard	237	5082	59	79.9	25666220	100.748	182.9	150.1	151.7	6.697	105.162	209.86	164.5	165.8	9.268
Oscar	236	5104	120	607	134275479	100.522	181	151.3	152	4.854	108.137	207.9	168.094	169.2	6.29
HGP	168	4842	70.9	785.4	49834206	128.9	174.9	153.8	154.6	5.266	144.5	197.1	170.3	171.4	7.158
All surveys	127	5247	12	2592	243955760	3.5	182.9	151.6	152.1	6.428	58.9	209.86	167.3	167.9	8.718



Gippsland Seismic Amplitudes
200 to 1,000 m water depth

G01a (Northern fields)
Tuskfish
Elver
Bazzard
Oscar
HGP

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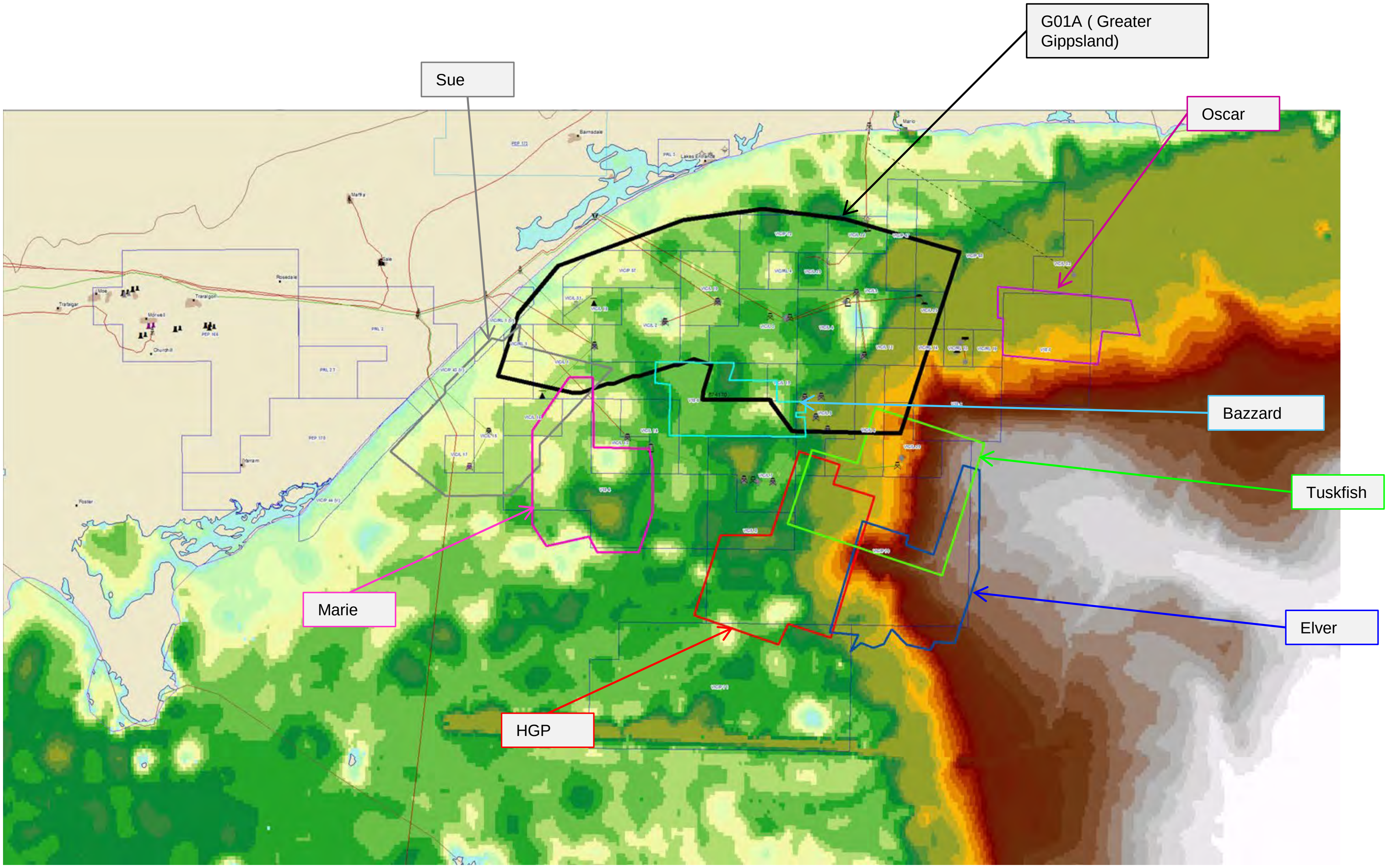
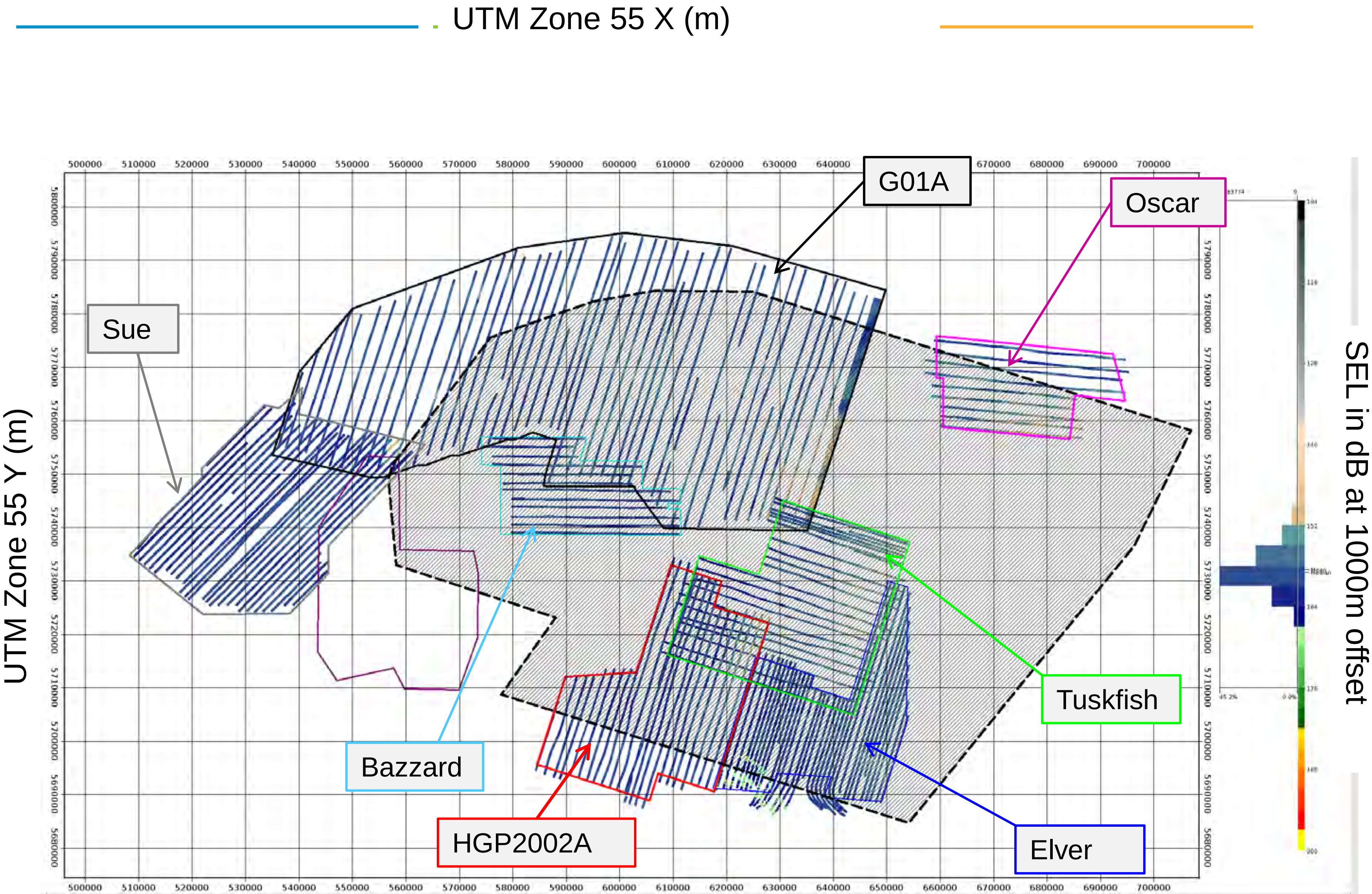

G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Elver
Marie
HGP

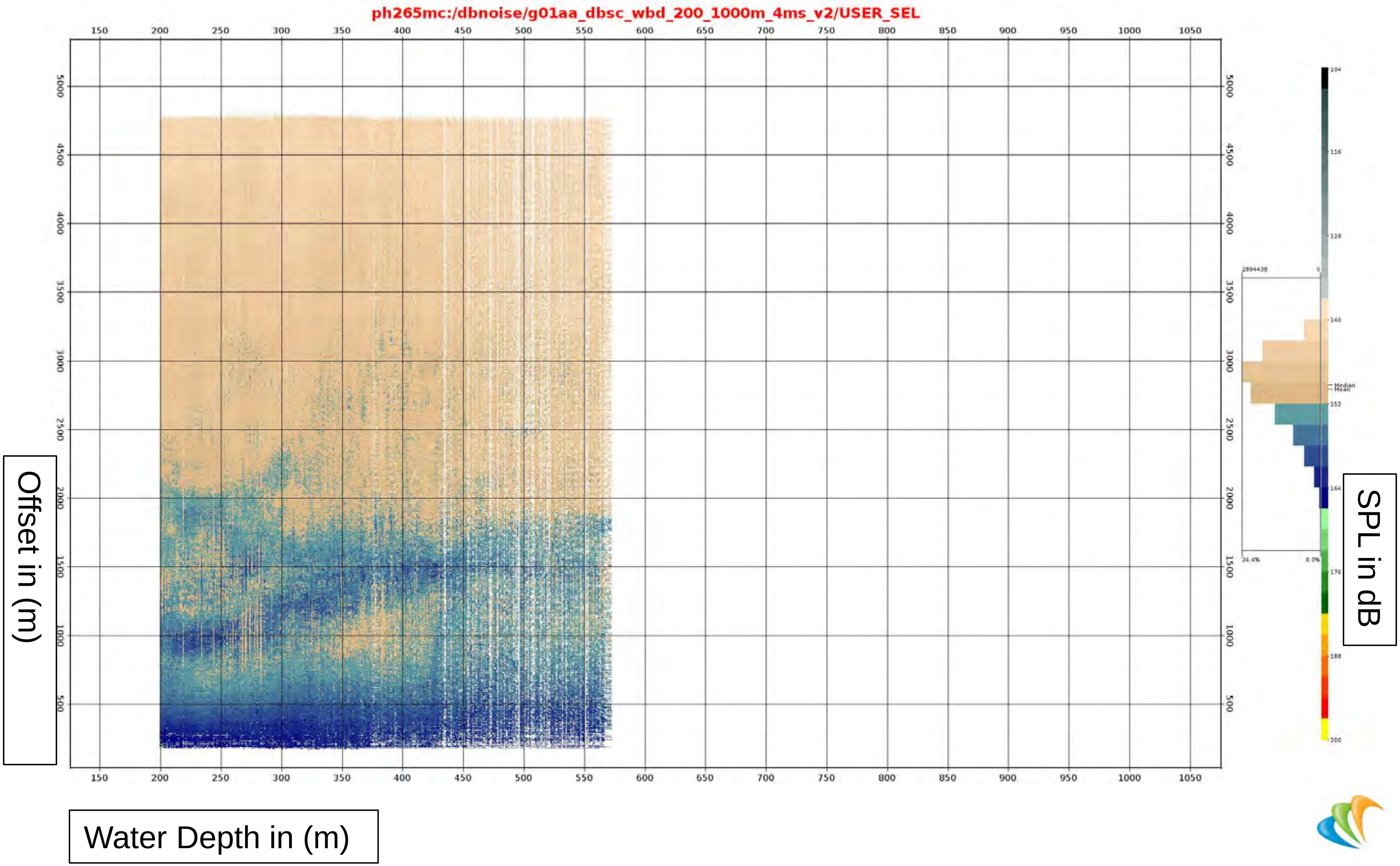
Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay



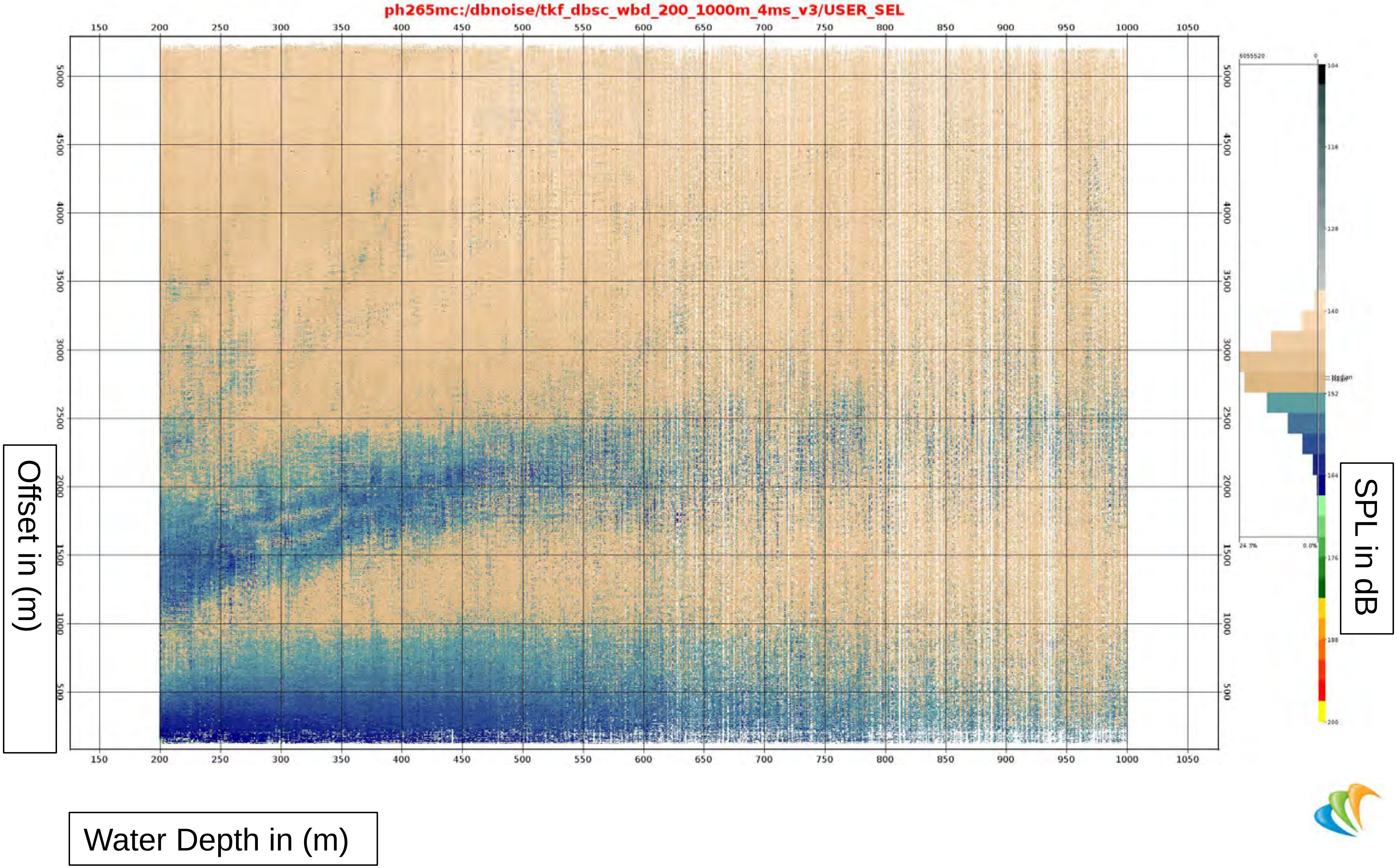
SEL
Water Depth
200m to 1000m

Survey: G01A (Northern Fields)

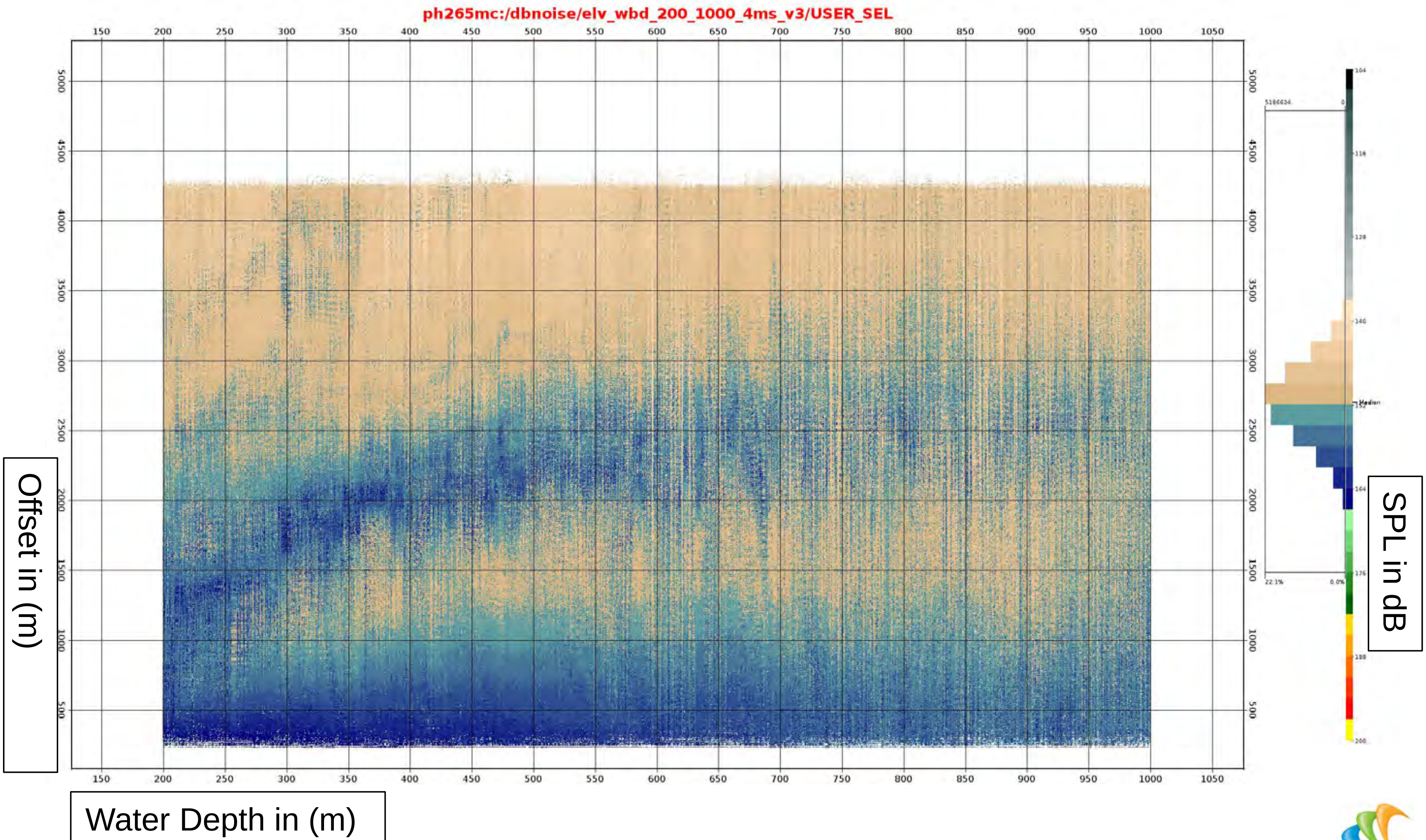
Shot water depth: 200 m to 1000 m



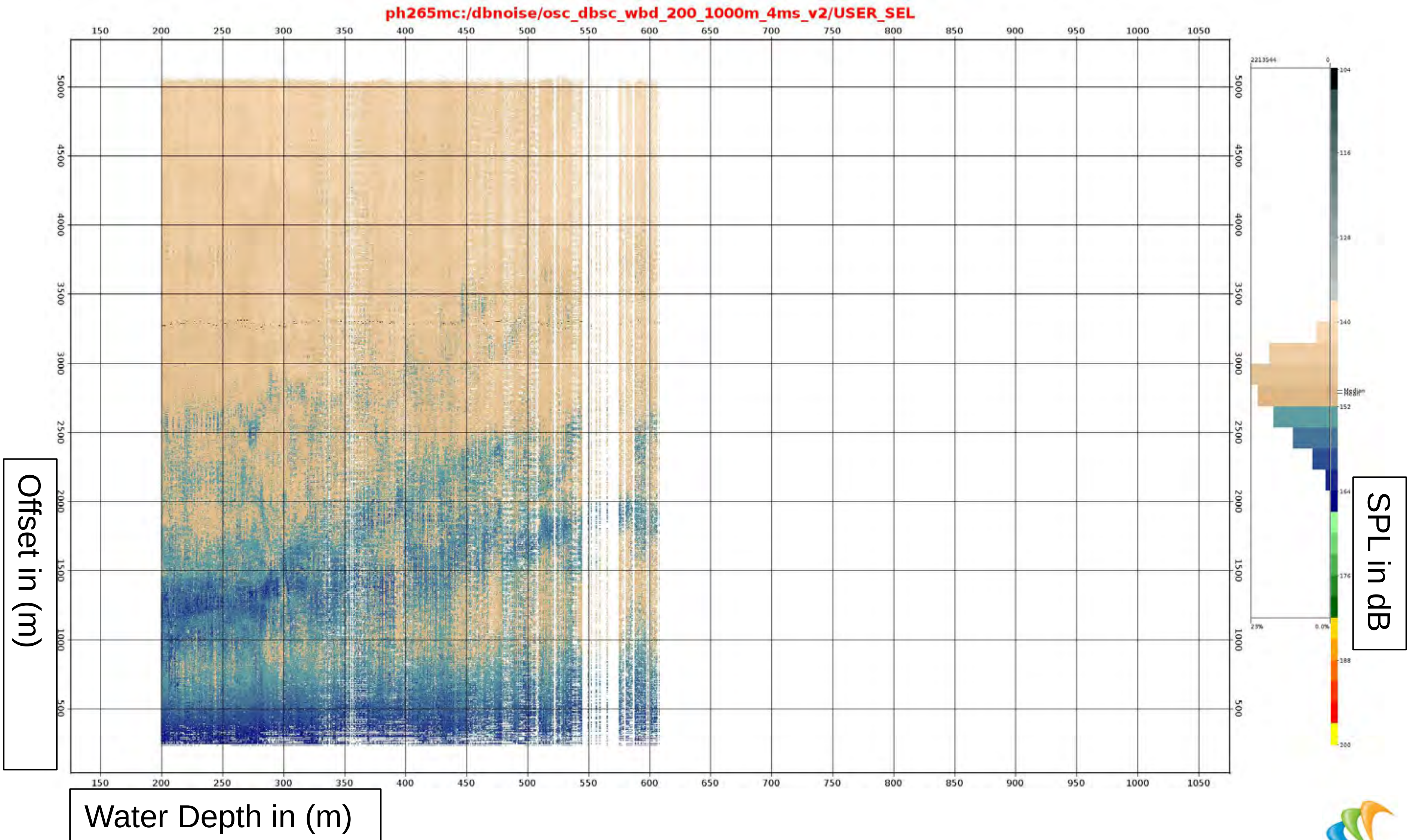
Survey: Tuskfish
Shot water depth: 200 m to 1000 m



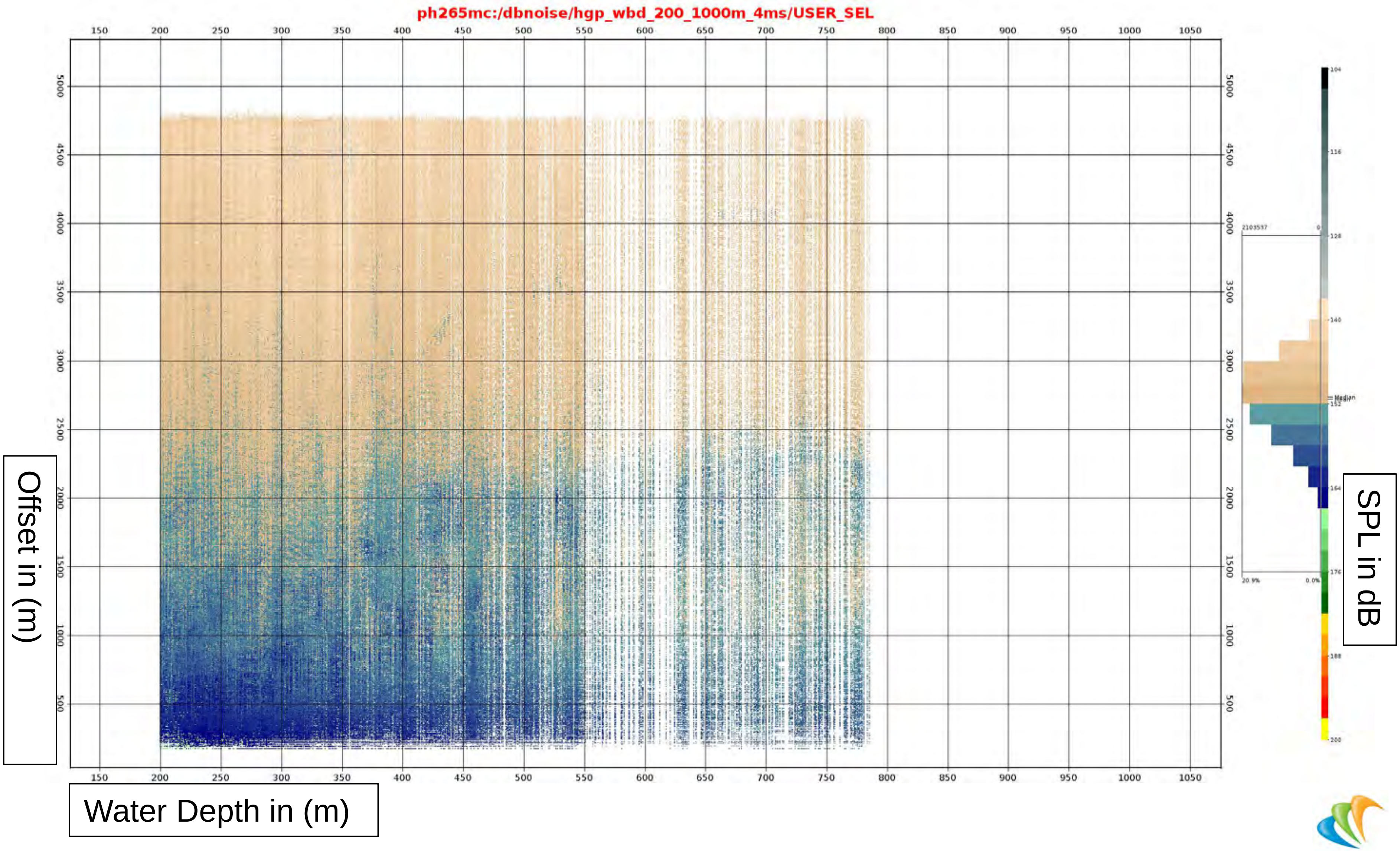
Survey: Elver
Shot water depth: 200 m to 1000 m



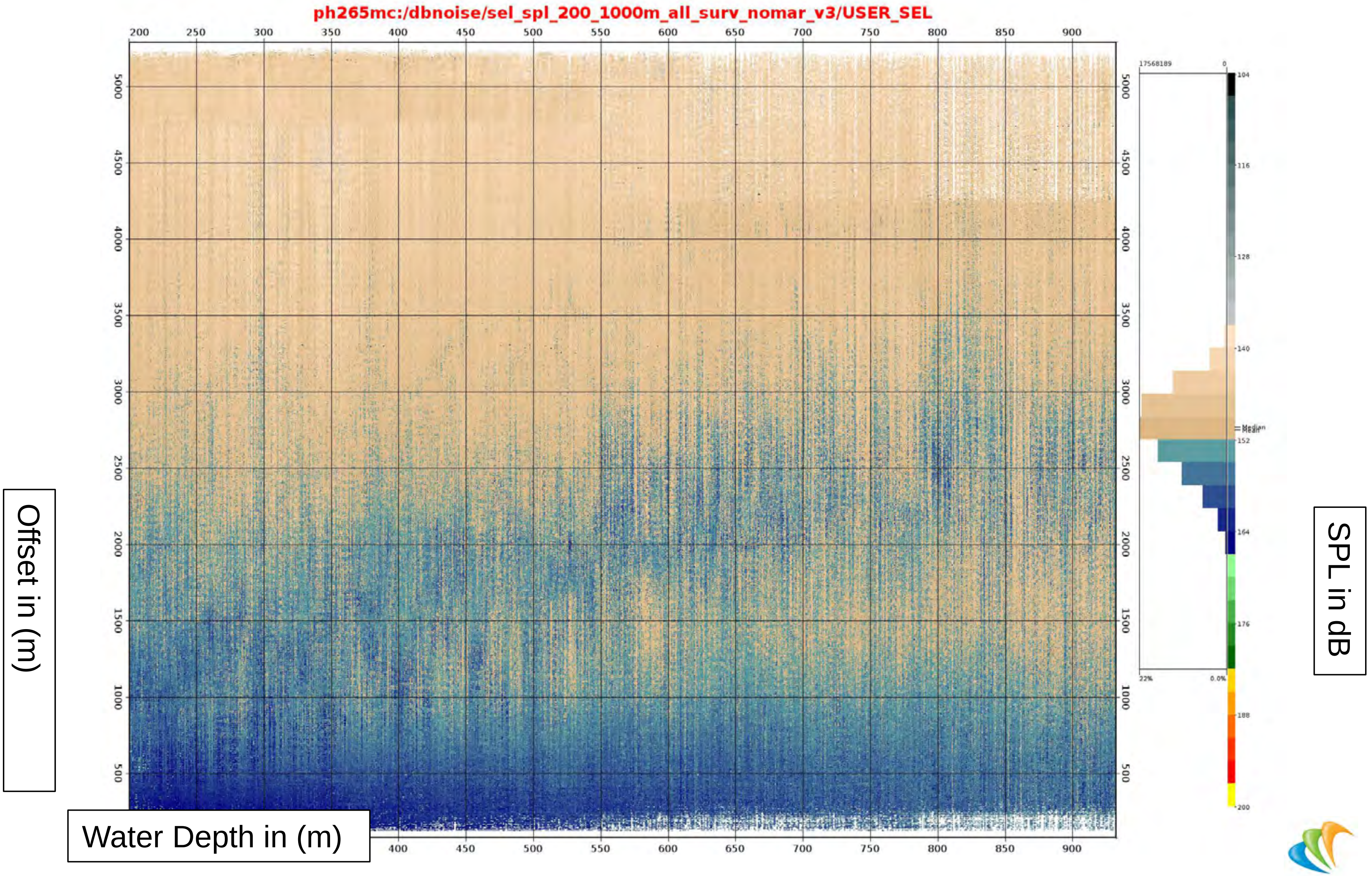
Survey: Oscar
Shot water depth: 200 m to 1000 m



Survey: HGP
Shot water depth: 200 m to 1000 m

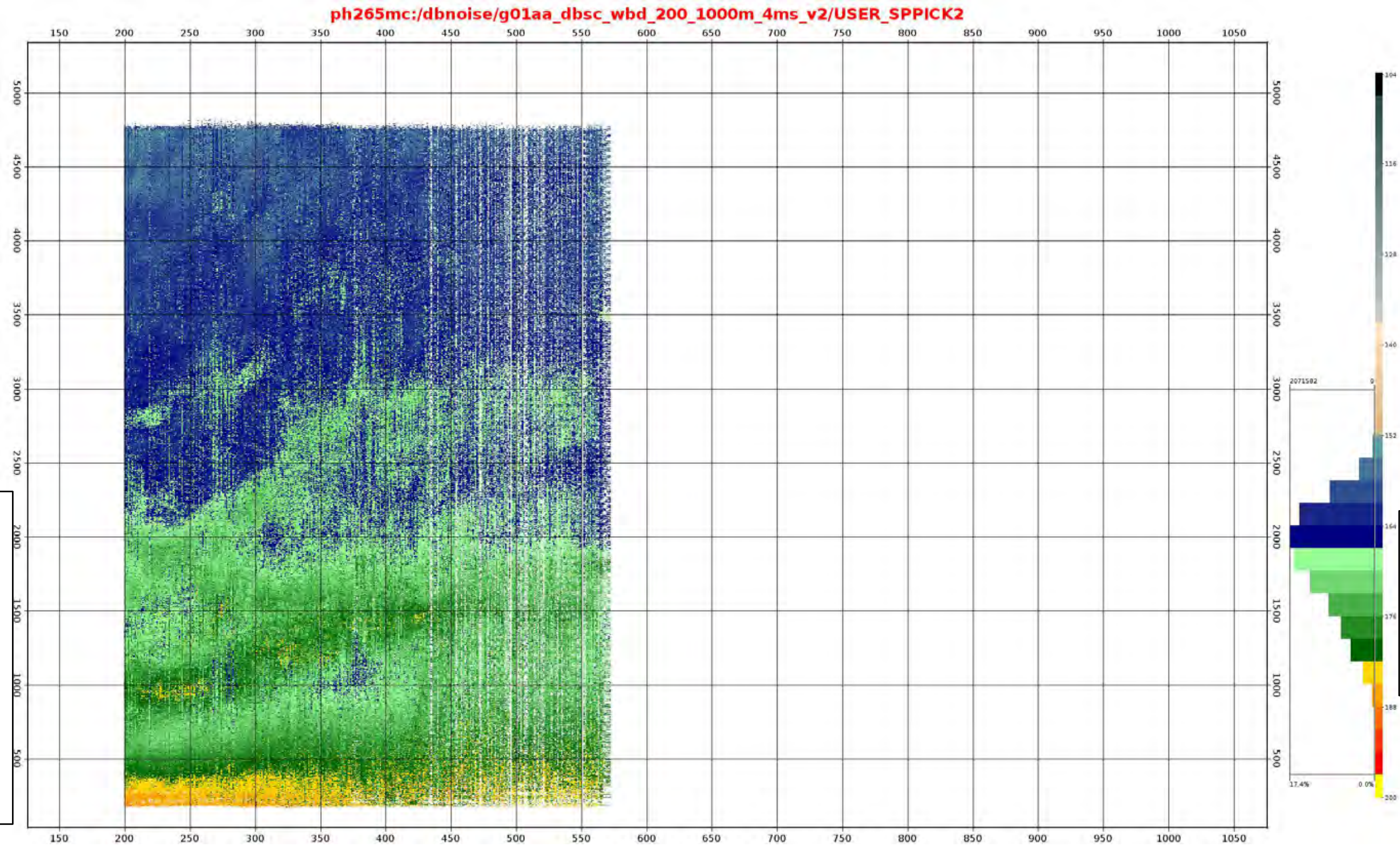


Survey: All surveys
Shot water depth: 200 m to 1000 m



SPL
Water Depth
200m to 1000m

Survey: G01A (Northern Fields)
Shot water depth: 200 m to 1000 m

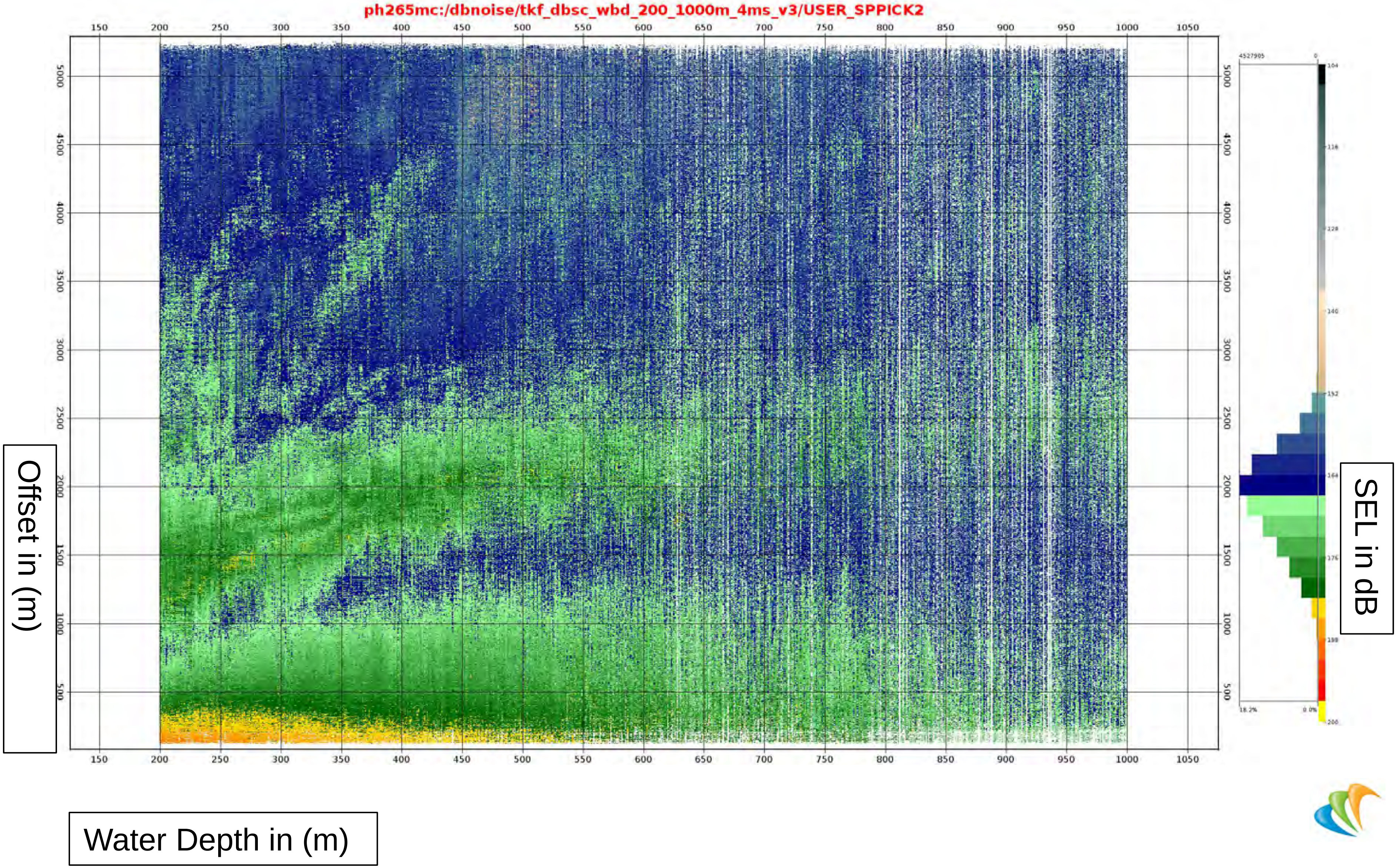


Offset in (m)

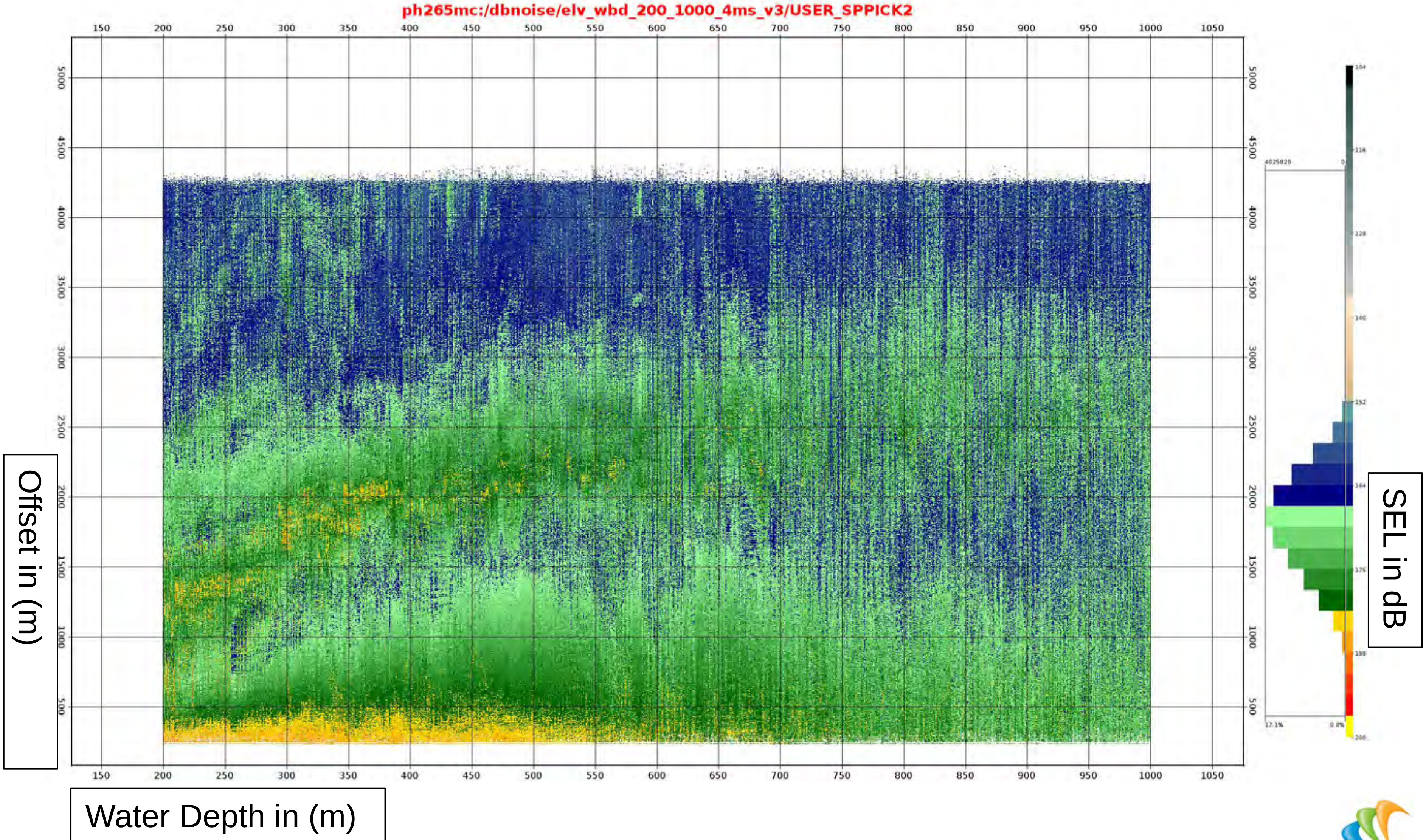
SEL in dB

Water Depth in (m)

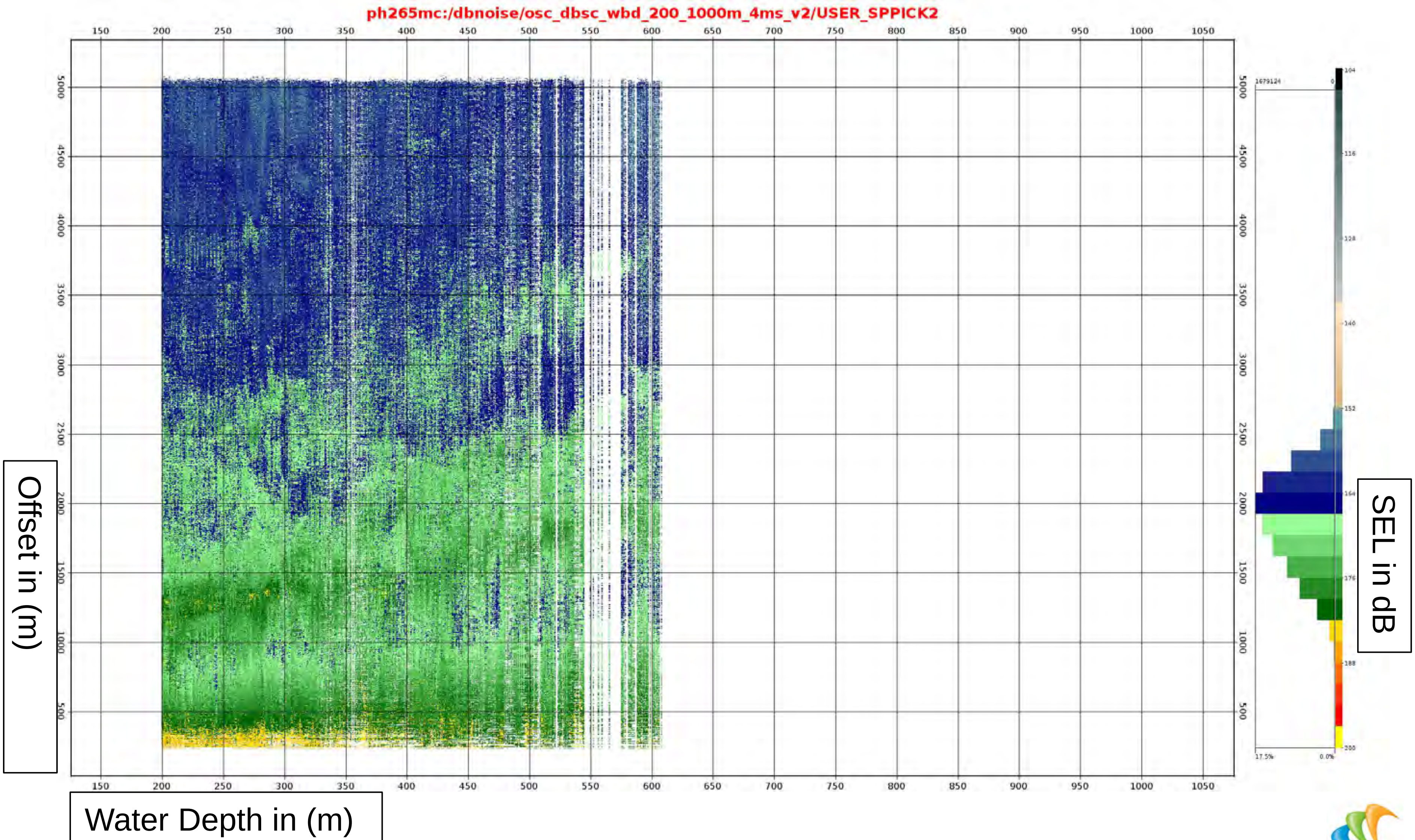
Survey: Tuskfish
Shot water depth: 200 m to 1000 m



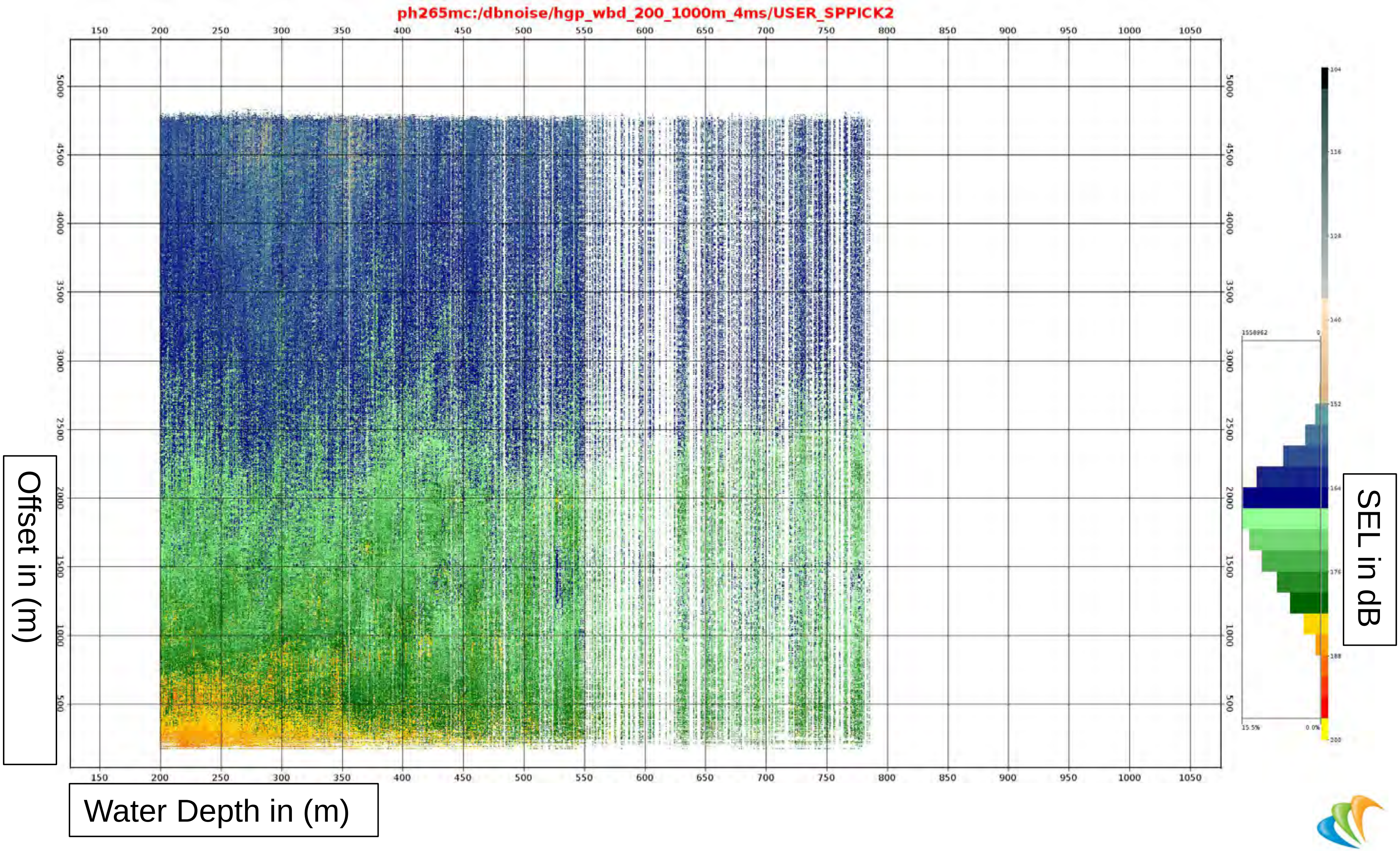
Survey: Elver
Shot water depth: 200 m to 1000 m



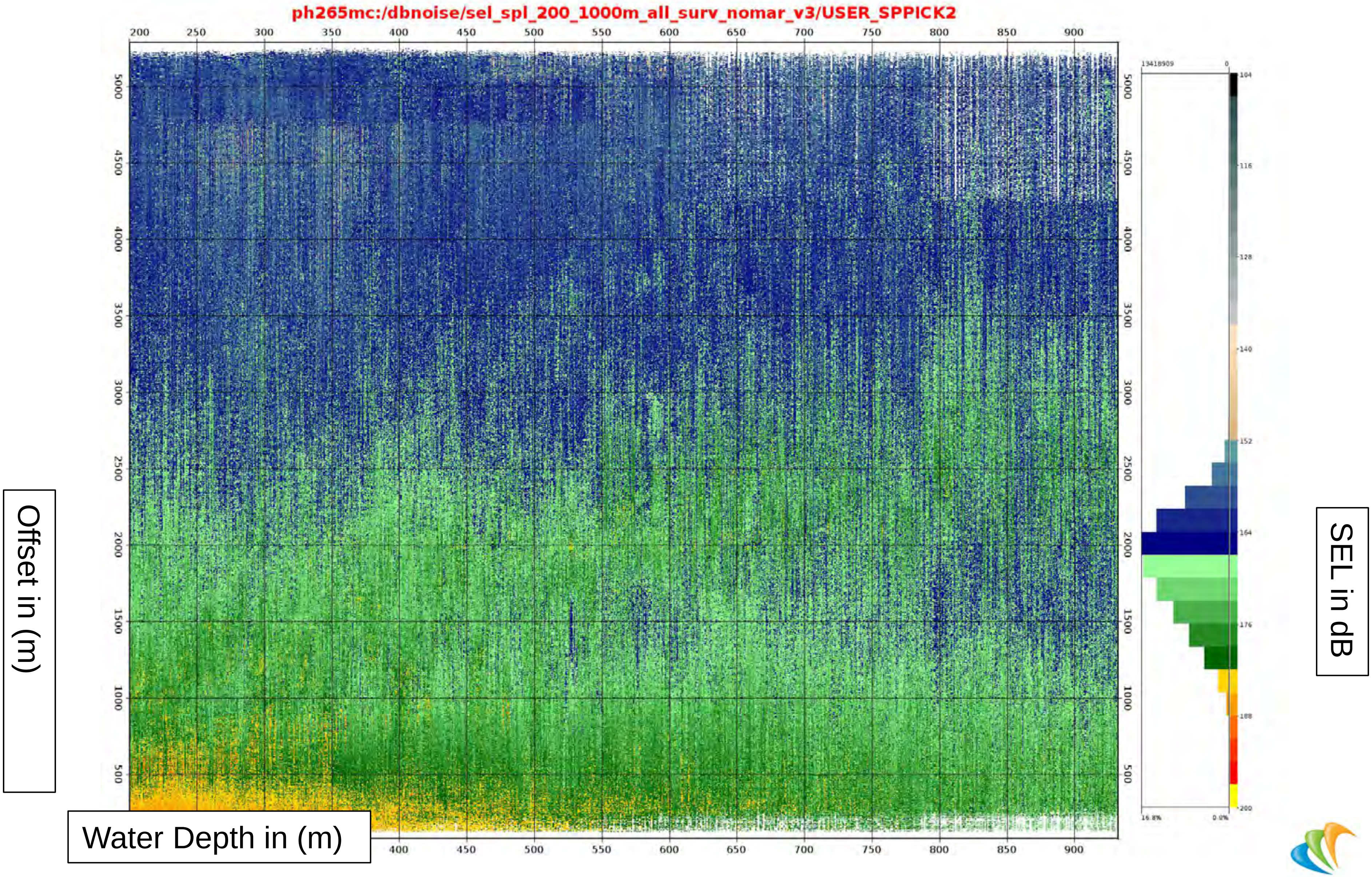
Survey: Oscar
Shot water depth: 200 m to 1000 m



Survey: HGP
Shot water depth: 200 m to 1000 m



Survey: All surveys
Shot water depth: 200 m to 1000 m



Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
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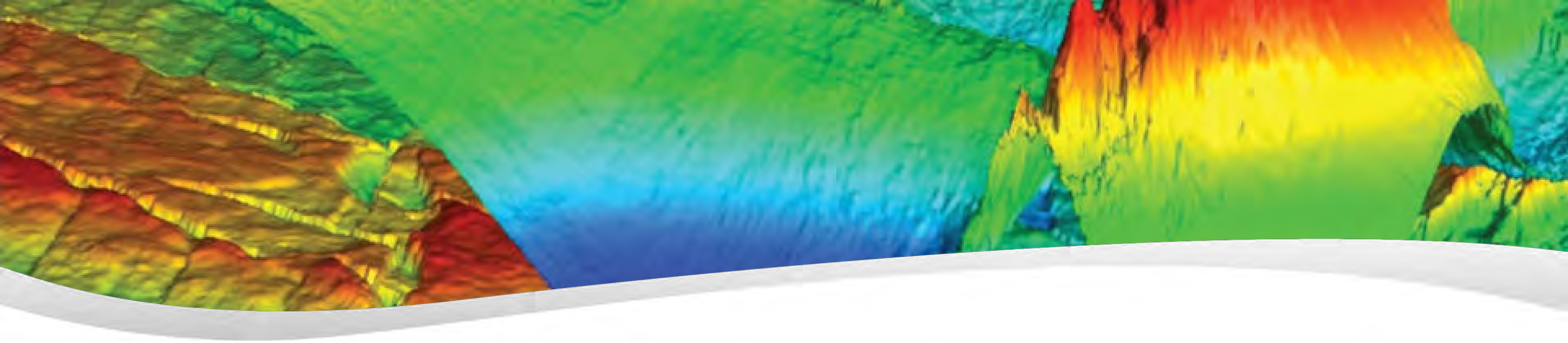
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

Survey	Offset		Water depth		Number of samples	For Water bottom Range 200 to 1000 m									
						SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572	11884854	135.7	172.4	149.3	149.9	4.995	147.8	195.3	167.7	168.4	6.677
Tuskfish	127	5247	72	2579	24899918	23.8	172.7	149.6	149.9	5.034	58.9	207.7	168.1	168.6	6.748
Elver	234	4358	110	2592	23503360	111.2	173.755	151.597	151.7	5.254	119.5	195.6	169.2	169.5	6.702
Sue	236	5084	19.1	57.6											
Bazzard	237	5082	59	79.9											
Oscar	236	5104	120	607	9608978	100.1	180.1	149.7	150.2	4.861	107.7	207.7	167.6	168.1	6.386
HGP	168	4842	70.9	785.4	10062592	129.5	174.3	151.1	151.4	5.216	145.1	196.1	168.9	169.3	7.097
All surveys	127	5247	12	2592	79959702	23.8	180.7	150.3	150.66	5.151	58.9	207.7	168.1	168.6	6.748



Gippsland Seismic Amplitudes
>1,000 m water depth

G01a (Northern fields)
Tuskfish
Elver
Bazzard
Oscar
HGP

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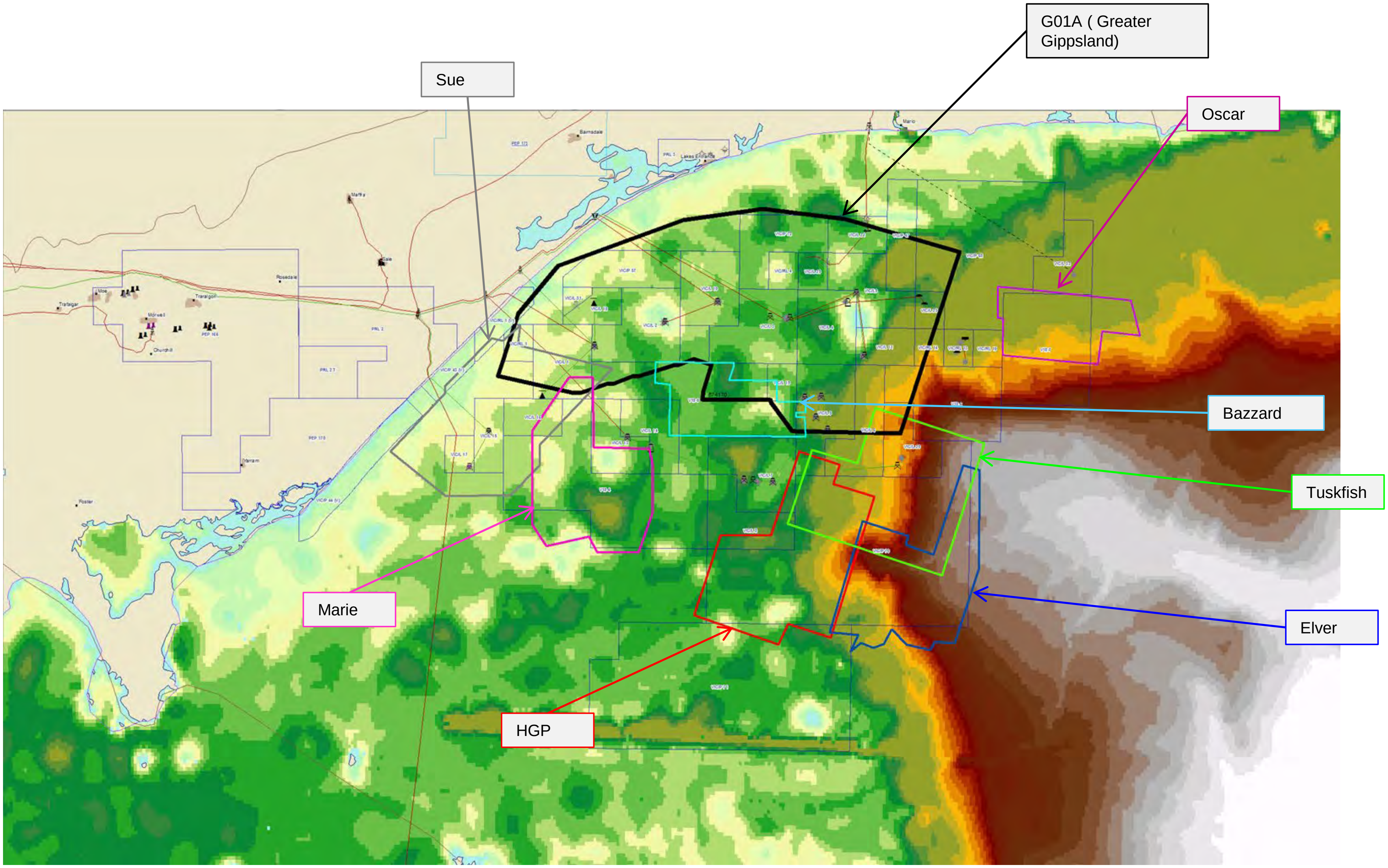
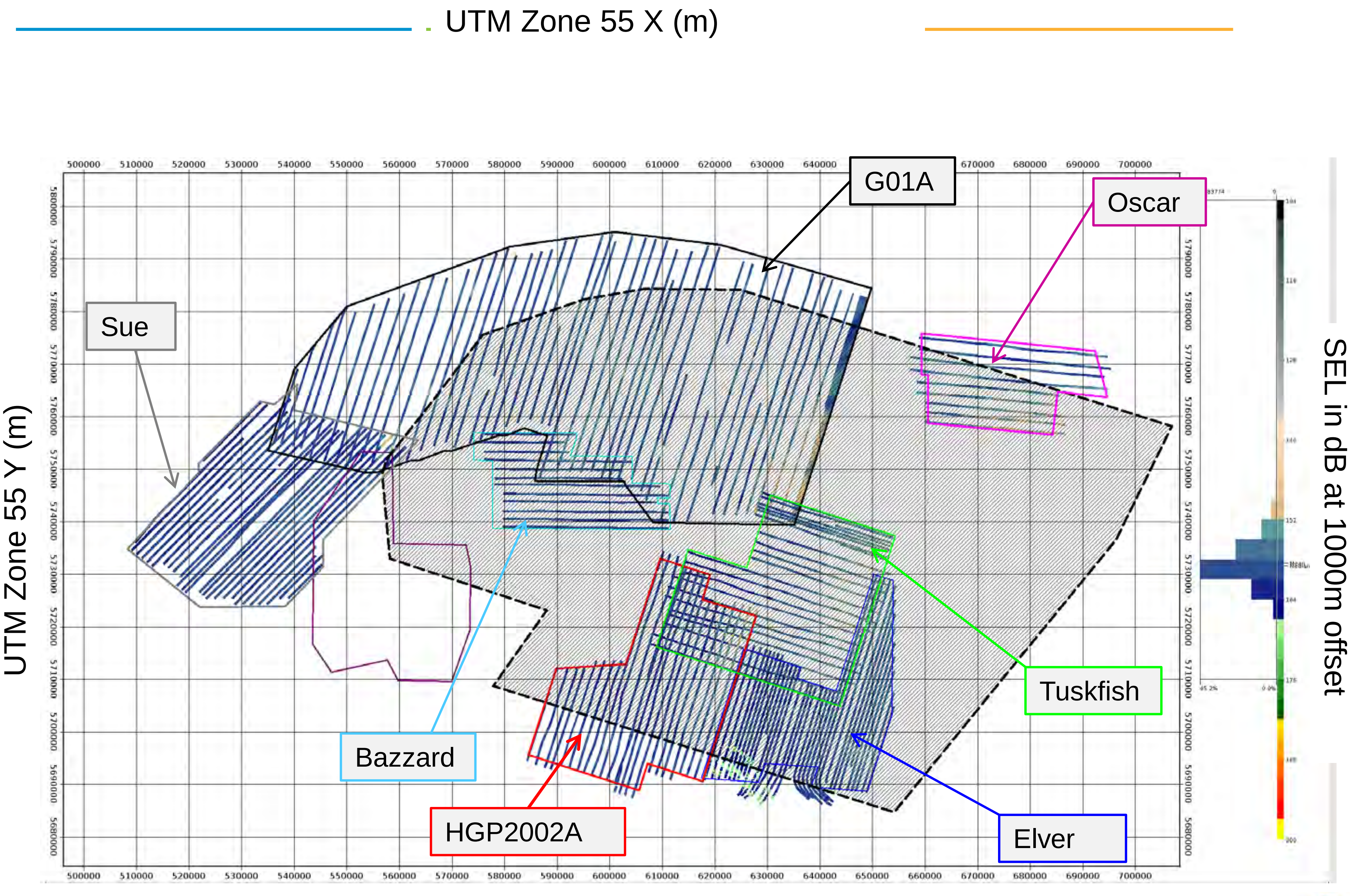


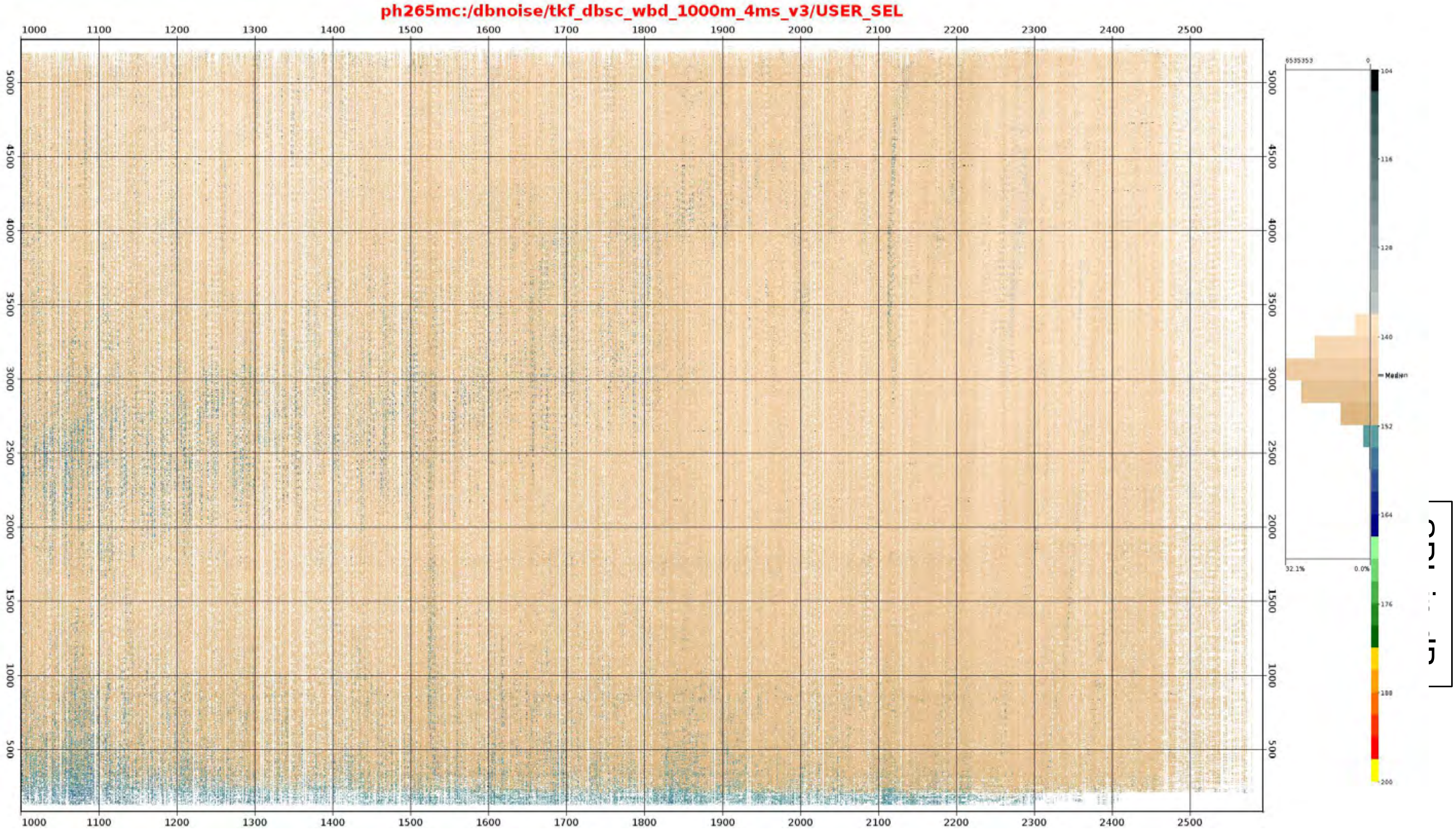
G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Elver
Marie
HGP

Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay



SEL
Water Depth
1000 m

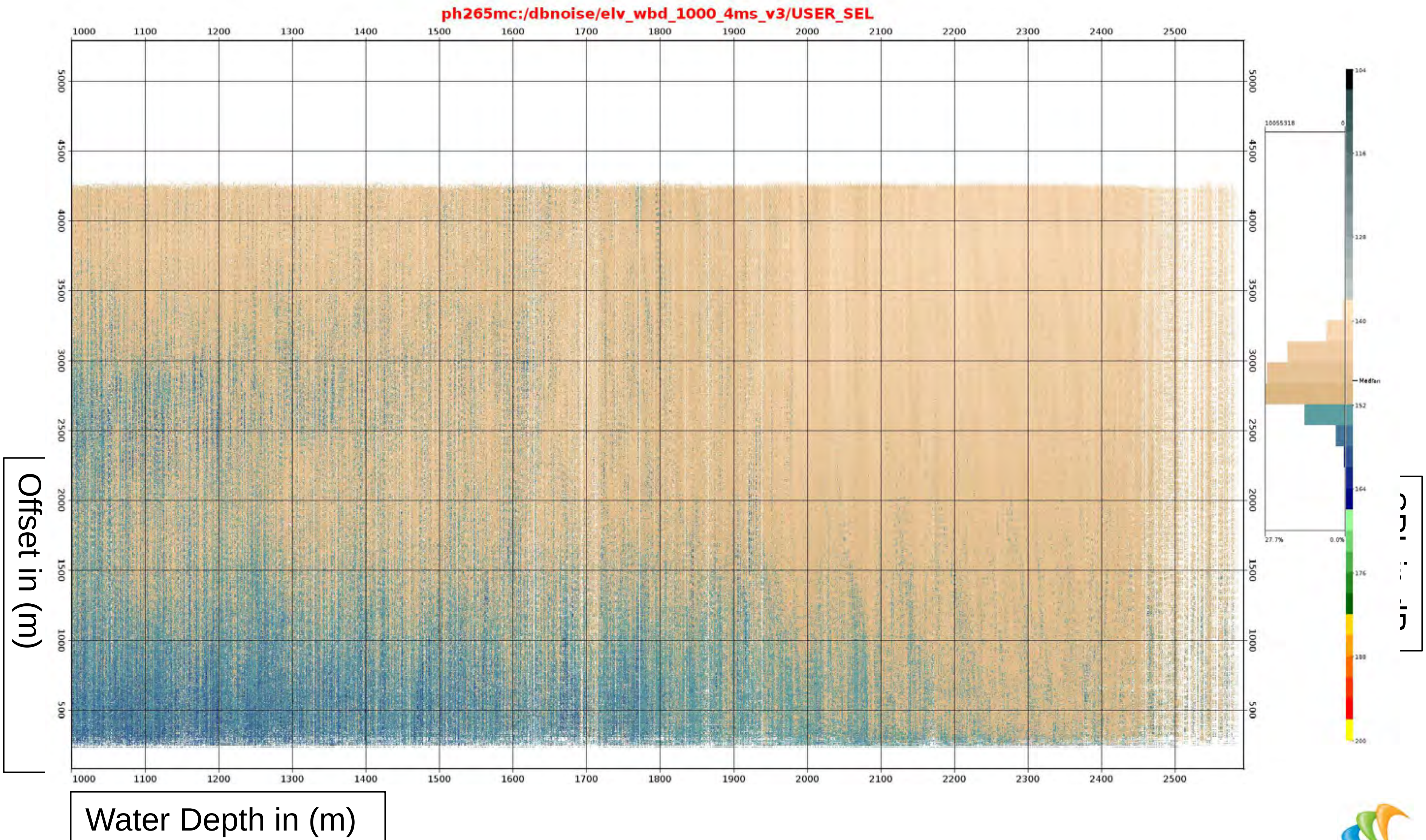
Survey: Tuskfish
Shot water depth: 1000 m



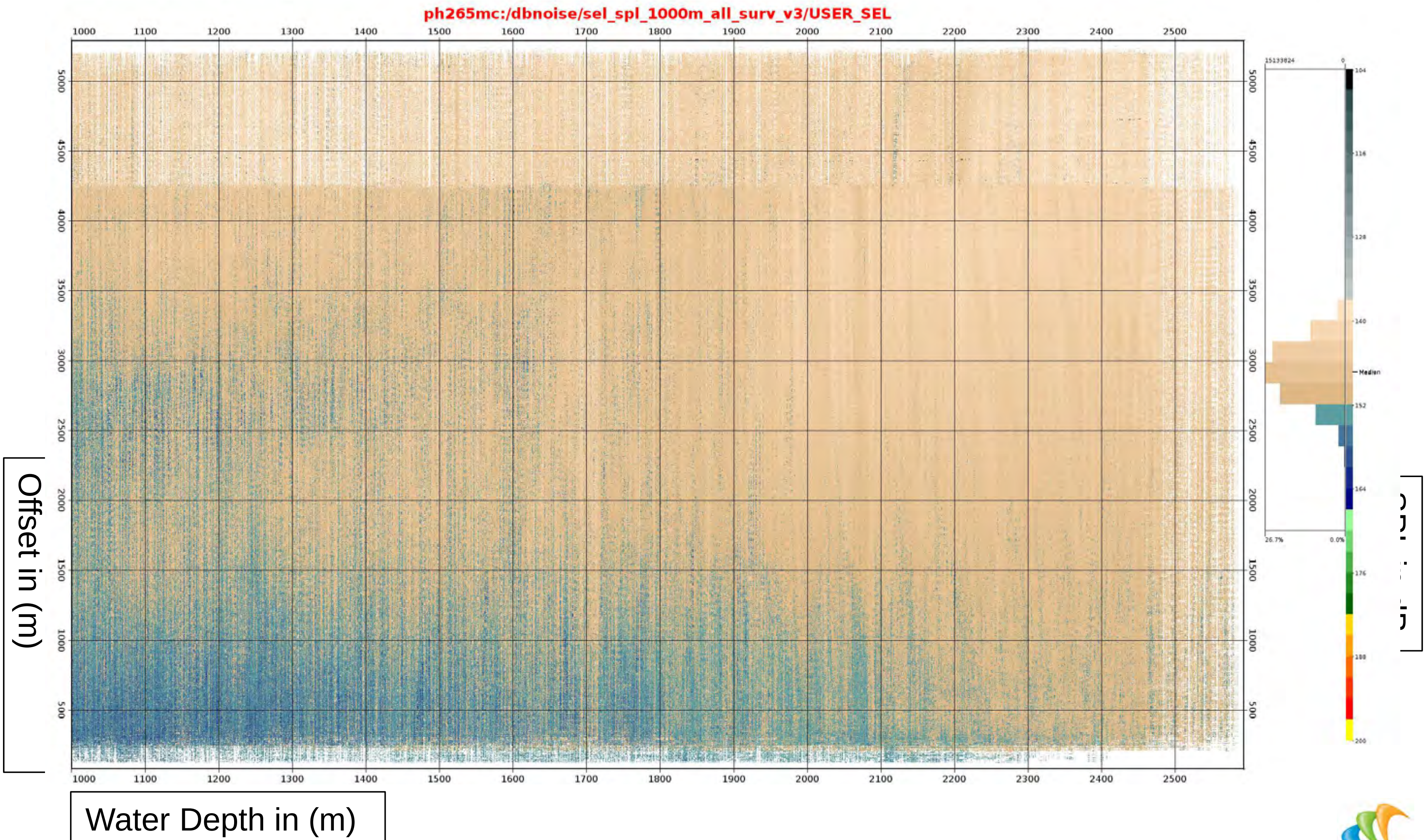
Offset in (m)

Water Depth in (m)

Survey: Elver
Shot water depth: 1000 m

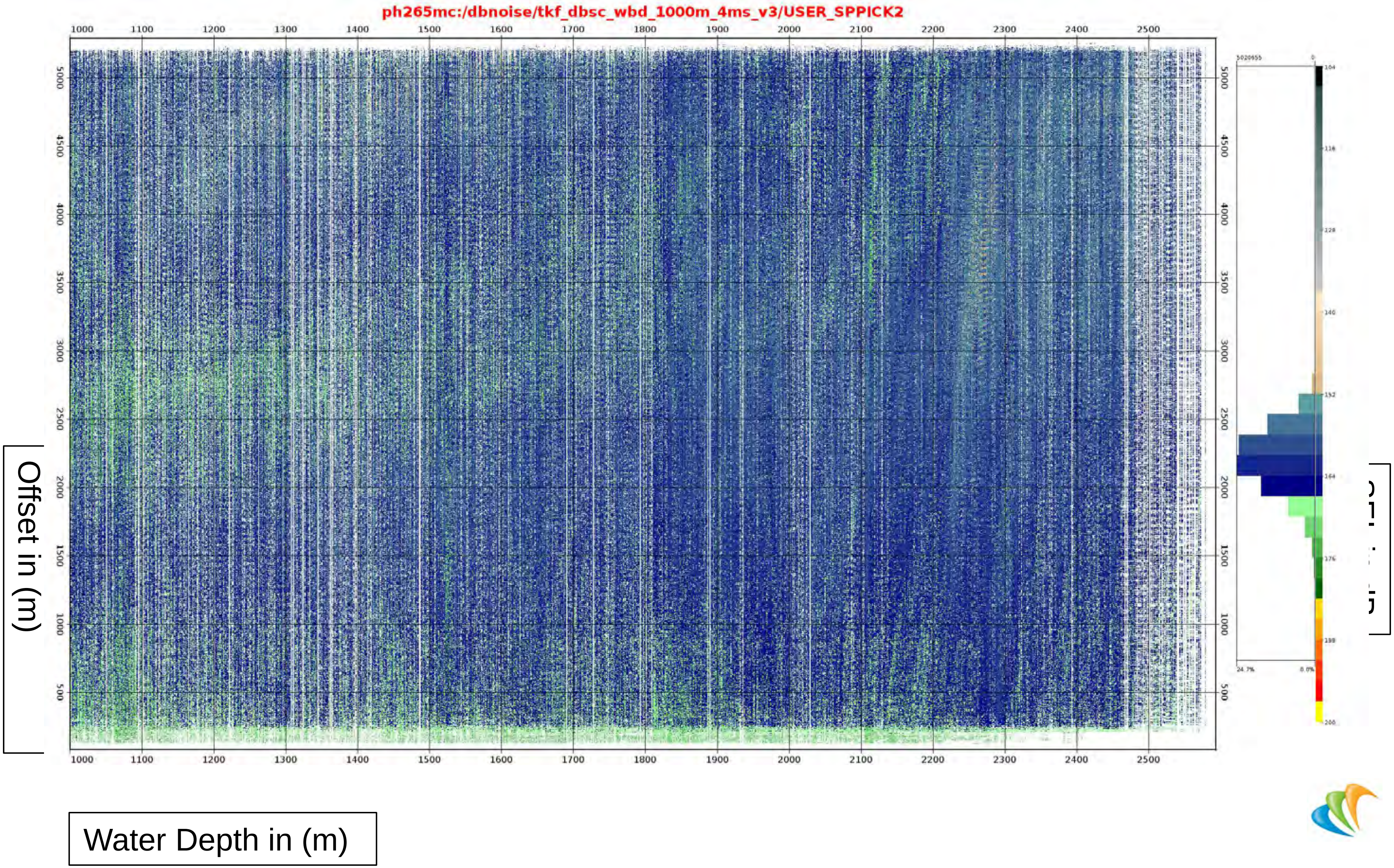


Survey: All surveys
Shot water depth: 1000 m

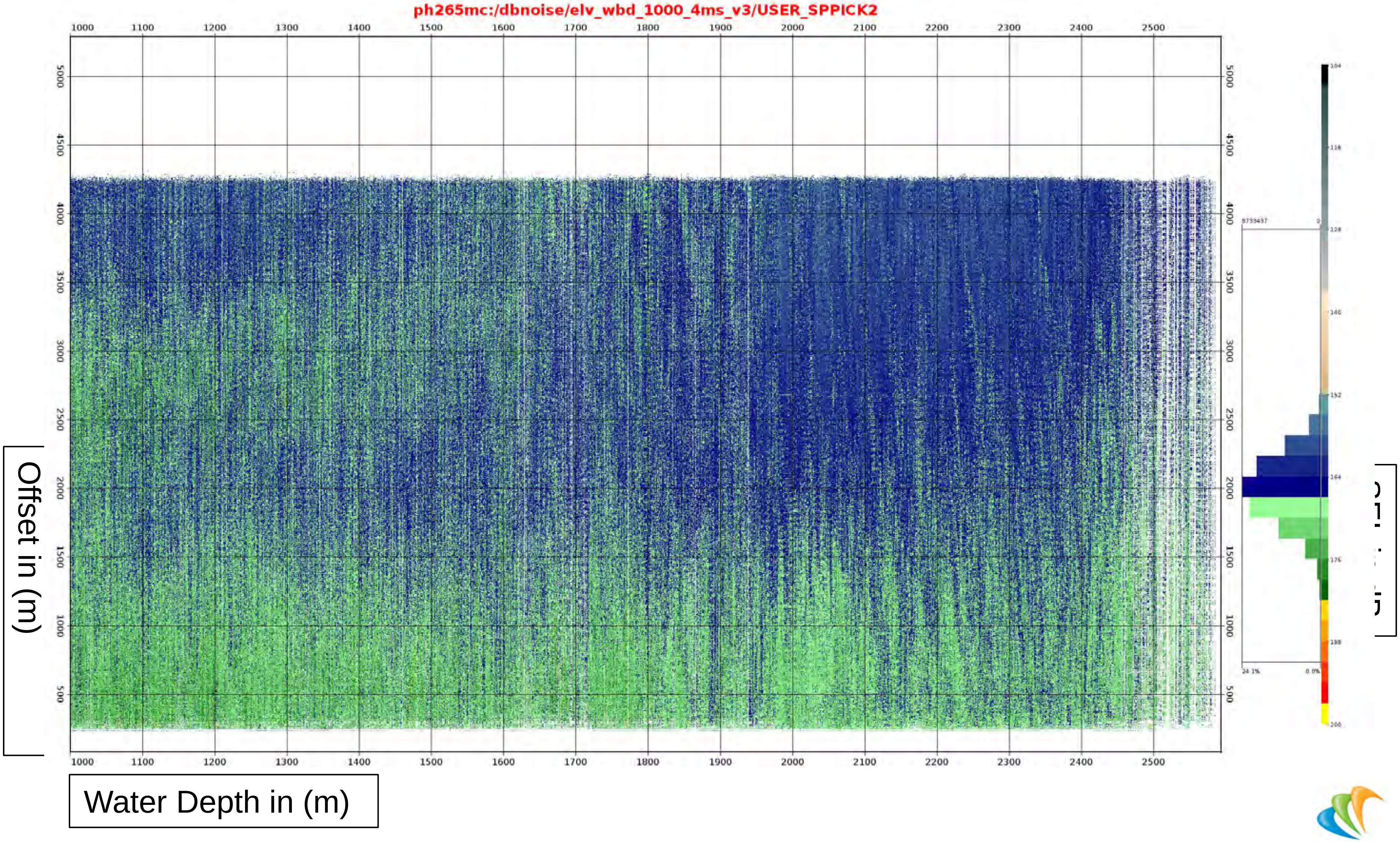


SPL
Water Depth
1000 m

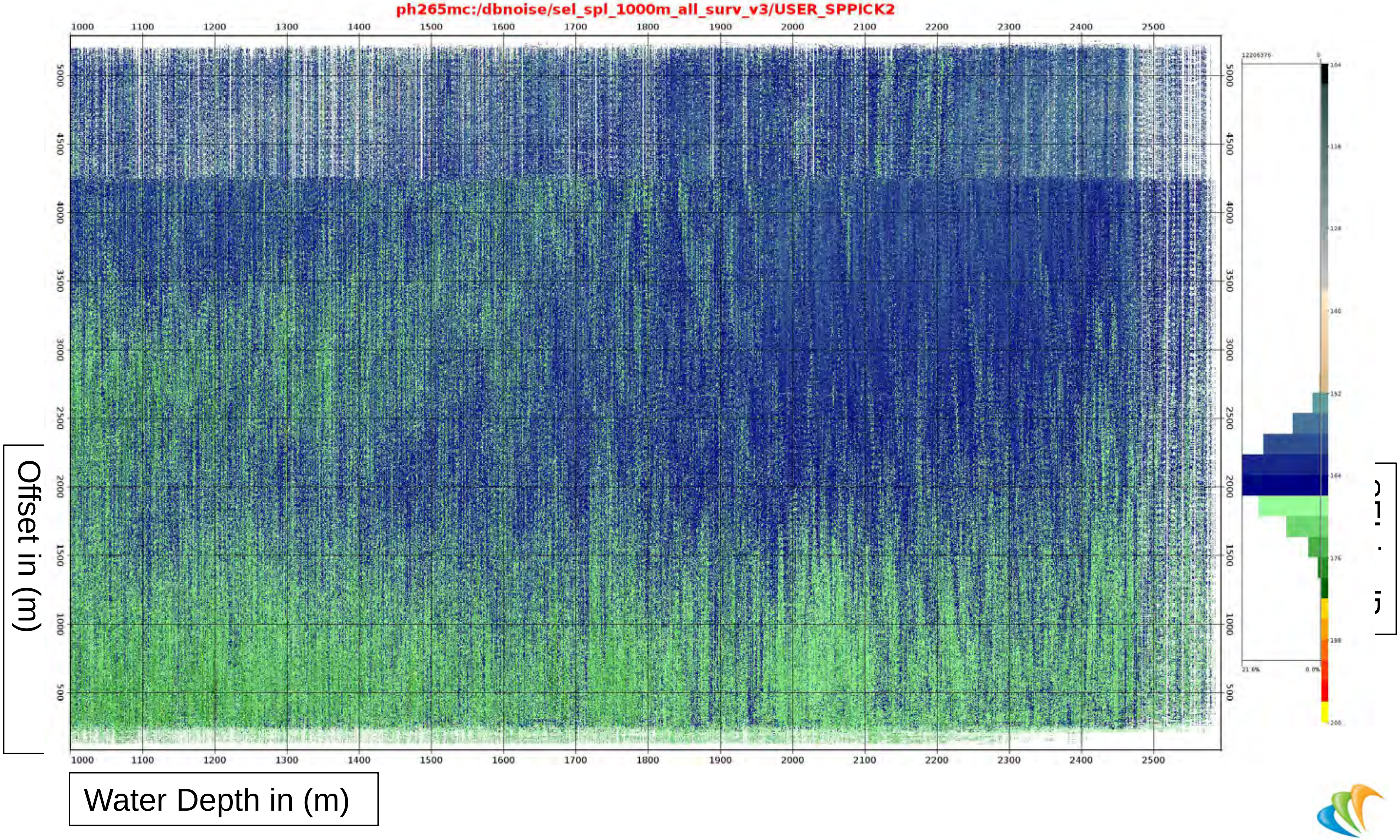
Survey: Tuskfish
Shot water depth: 1000 m



Survey: Elver
Shot water depth: 1000 m



Survey: All surveys
Shot water depth: 1000 m



Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
G01A Northern Fields	Geco Beta	3900	85/265	6144	3/18	180/72	2	50	18.75	6	2000	3542	6	20 V/Bar	T^2	Scale 0.001	0
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

					For Water bottom Range 1000 m and greater										
Survey	Offset		Water depth		Number of samples	SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572											
Tuskfish	127	5247	72	2579	20333447	23.8	169.9	145.1	145.236	3.613	58.9	188.5	161.5	161.74	4.666
Elver	234	4358	110	2592	36282880	115.1	167.8	148.5	148.4	3.759	129.6	189.3	165.9	165.9	4.653
Sue	236	5084	19.1	57.6											
Bazzard	237	5082	59	79.9											
Oscar	236	5104	120	607											
HGP	168	4842	70.9	785.4											
All surveys	127	5247	12	2592	56616327	23.8	169.9	147.2	147.3	4.017	58.9	189.3	164.3	164.4	5.059

Gippsland Seismic Amplitudes
5 to 20 m water depth

G01a (Northern fields)
Tuskfish
Elver
Sue
Bazzard
Oscar
HGP

10-Dec-2018

A.Winch

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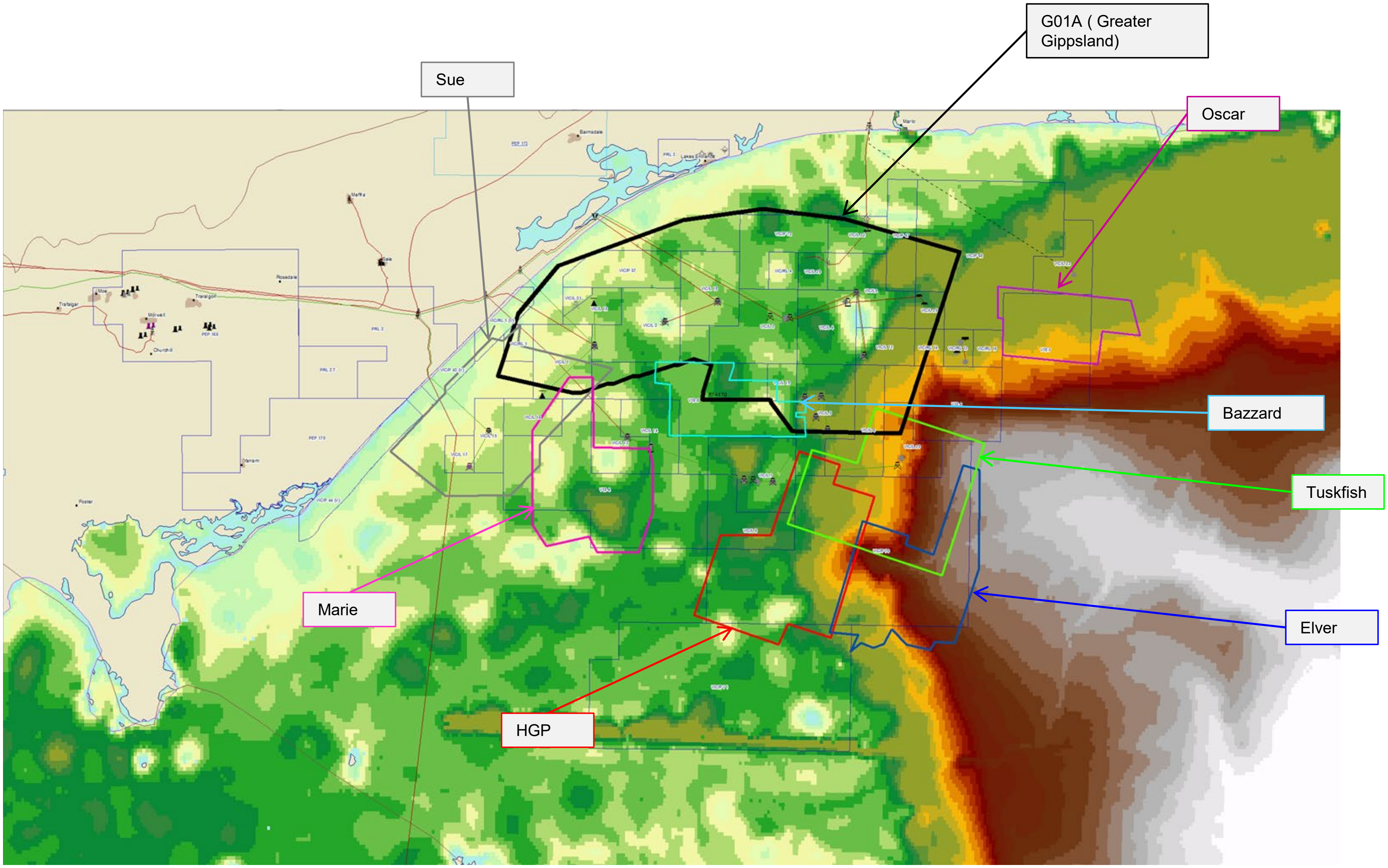
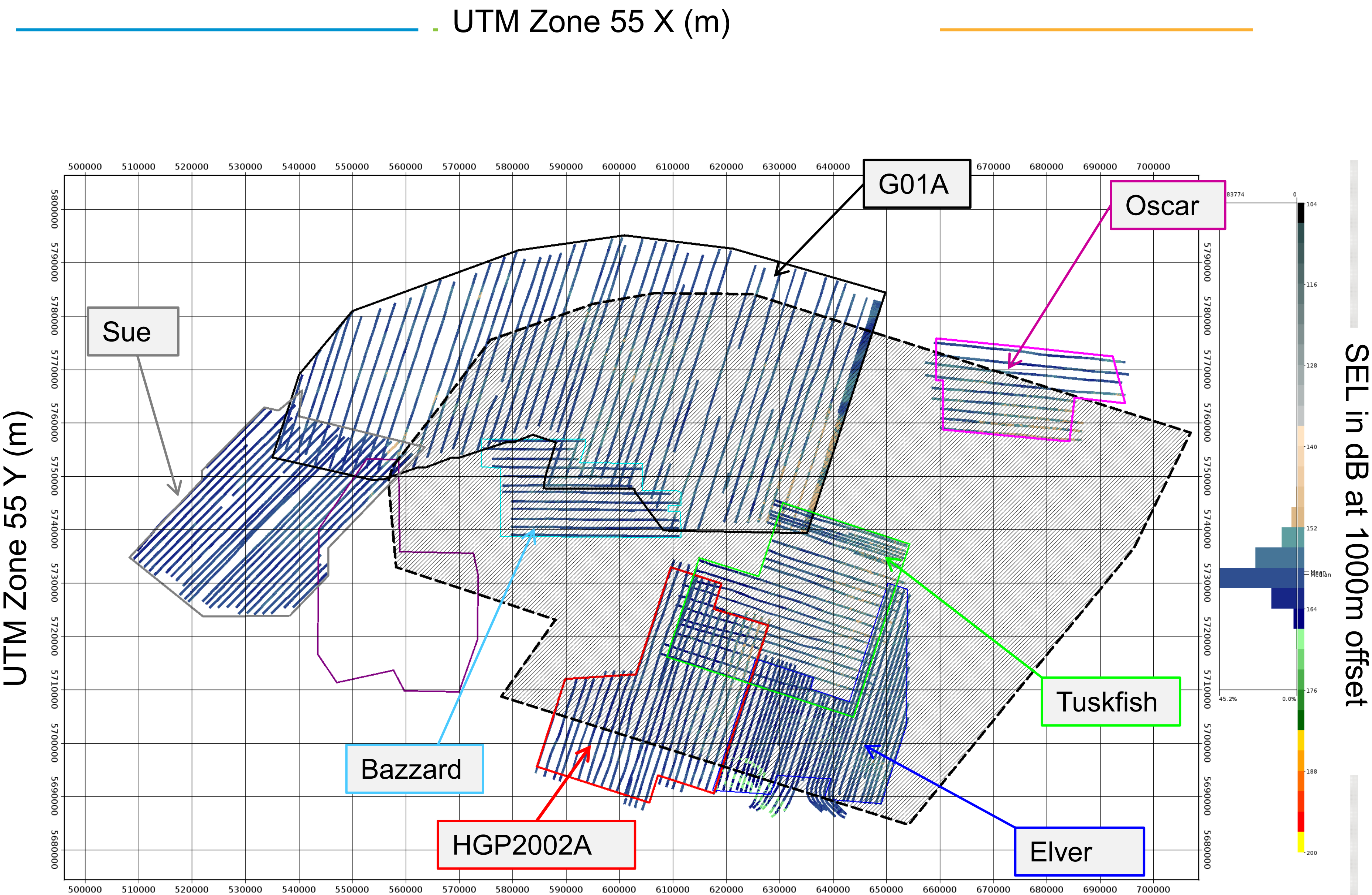
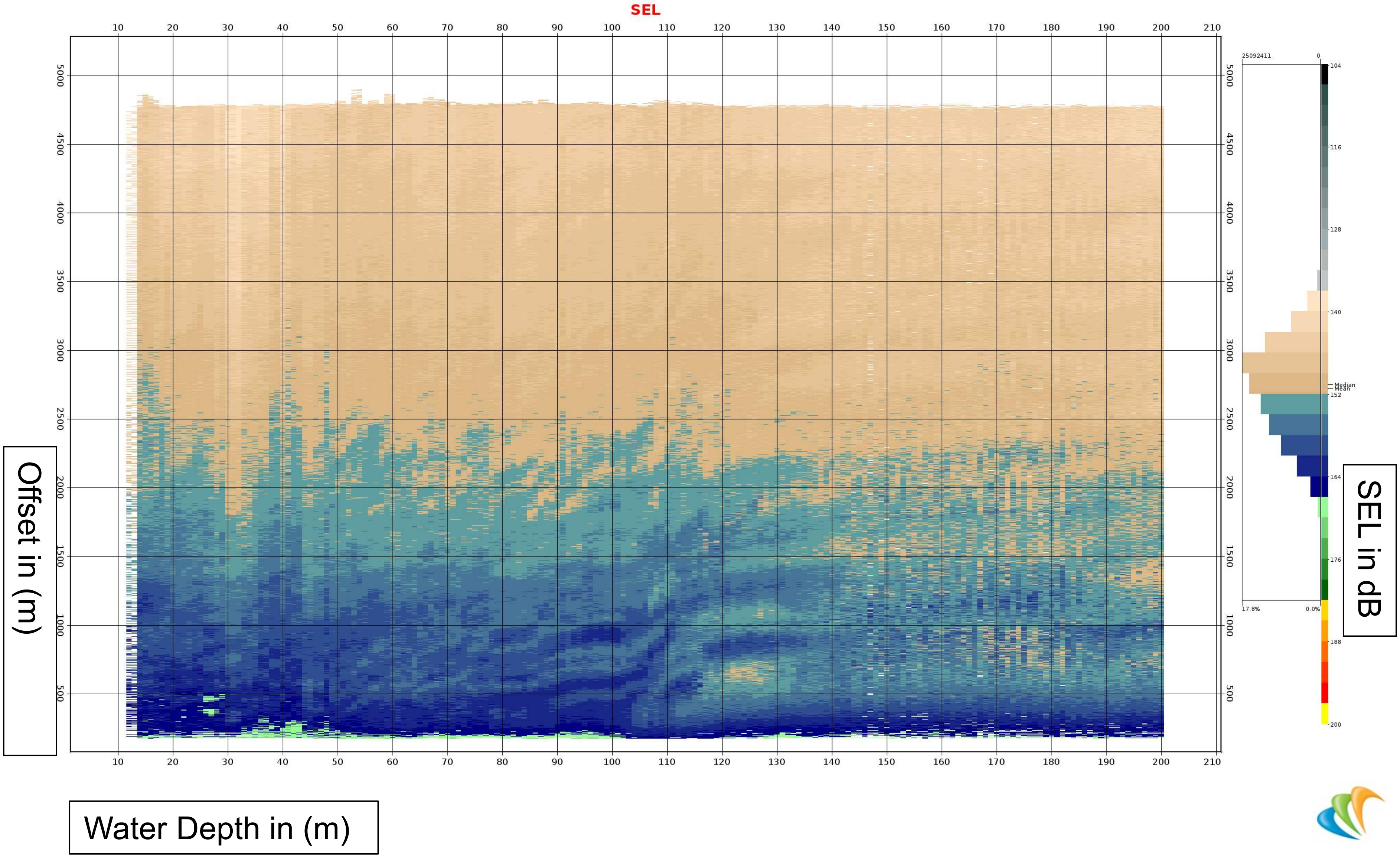

G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Marie
Elver
HGP

Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay



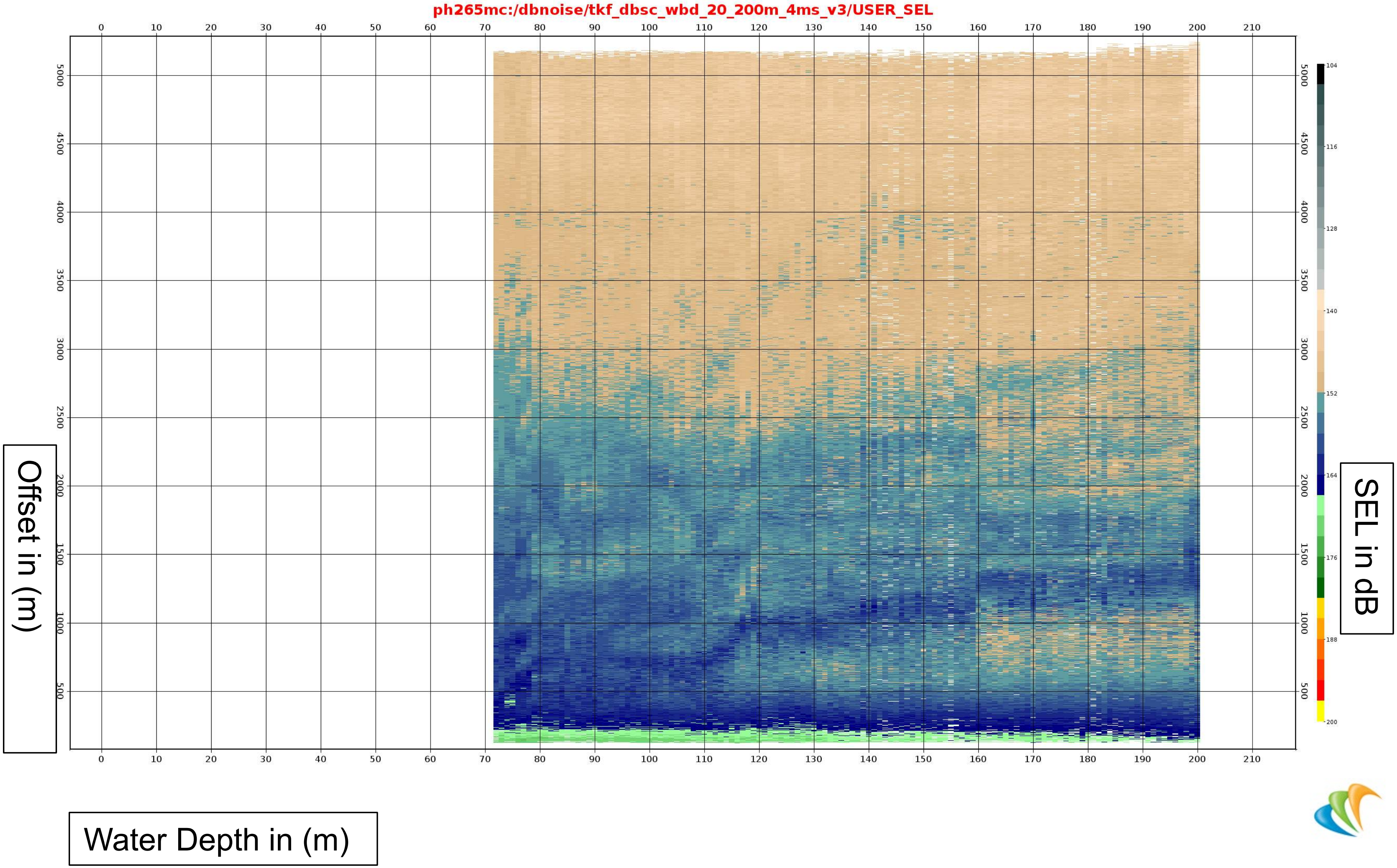
SEL
Water Depth
5m to 200m

Survey: G01A (Northern Fields)
Shot water depth: 5 m to 200m

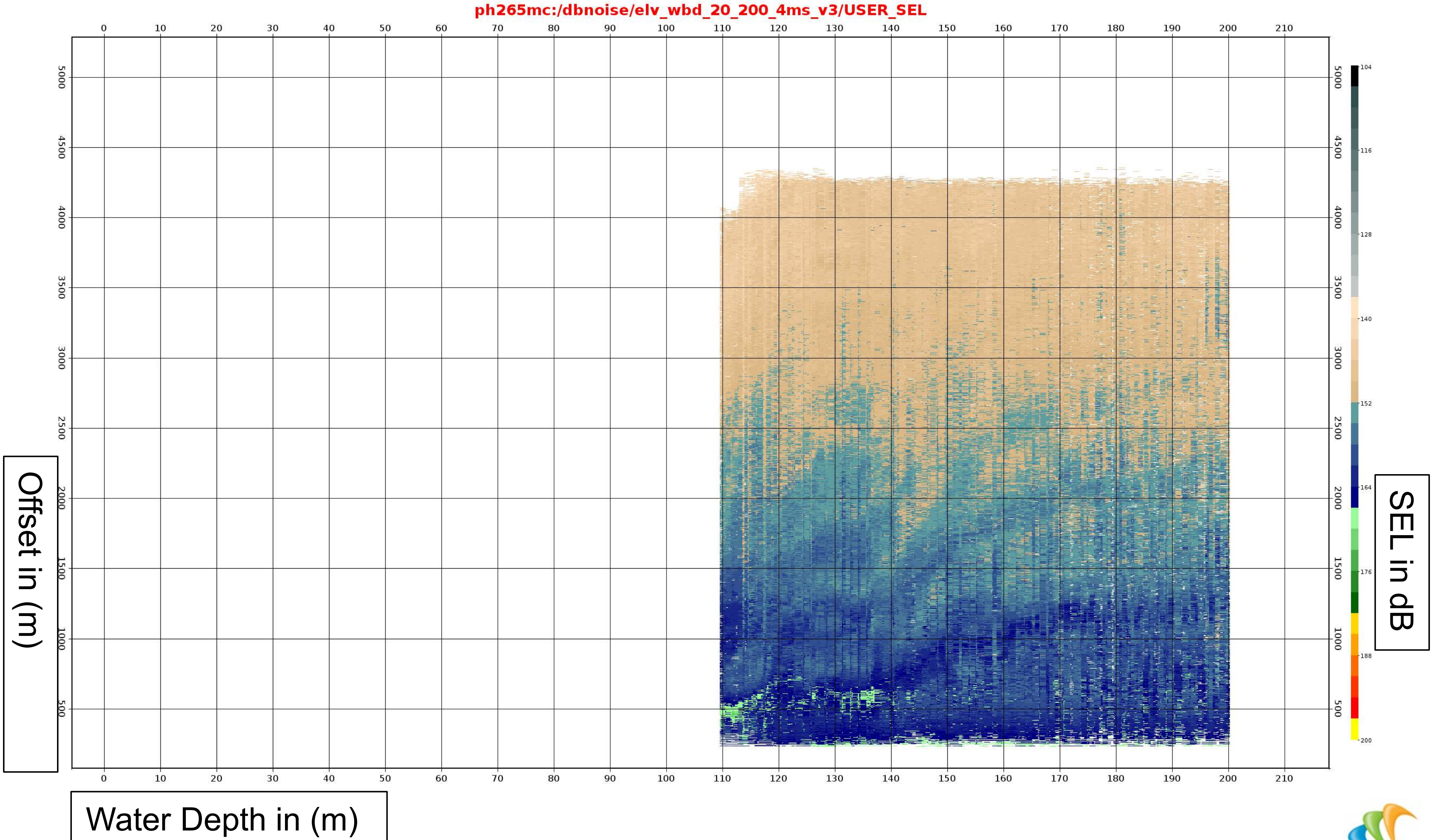


Survey: Tuskfish

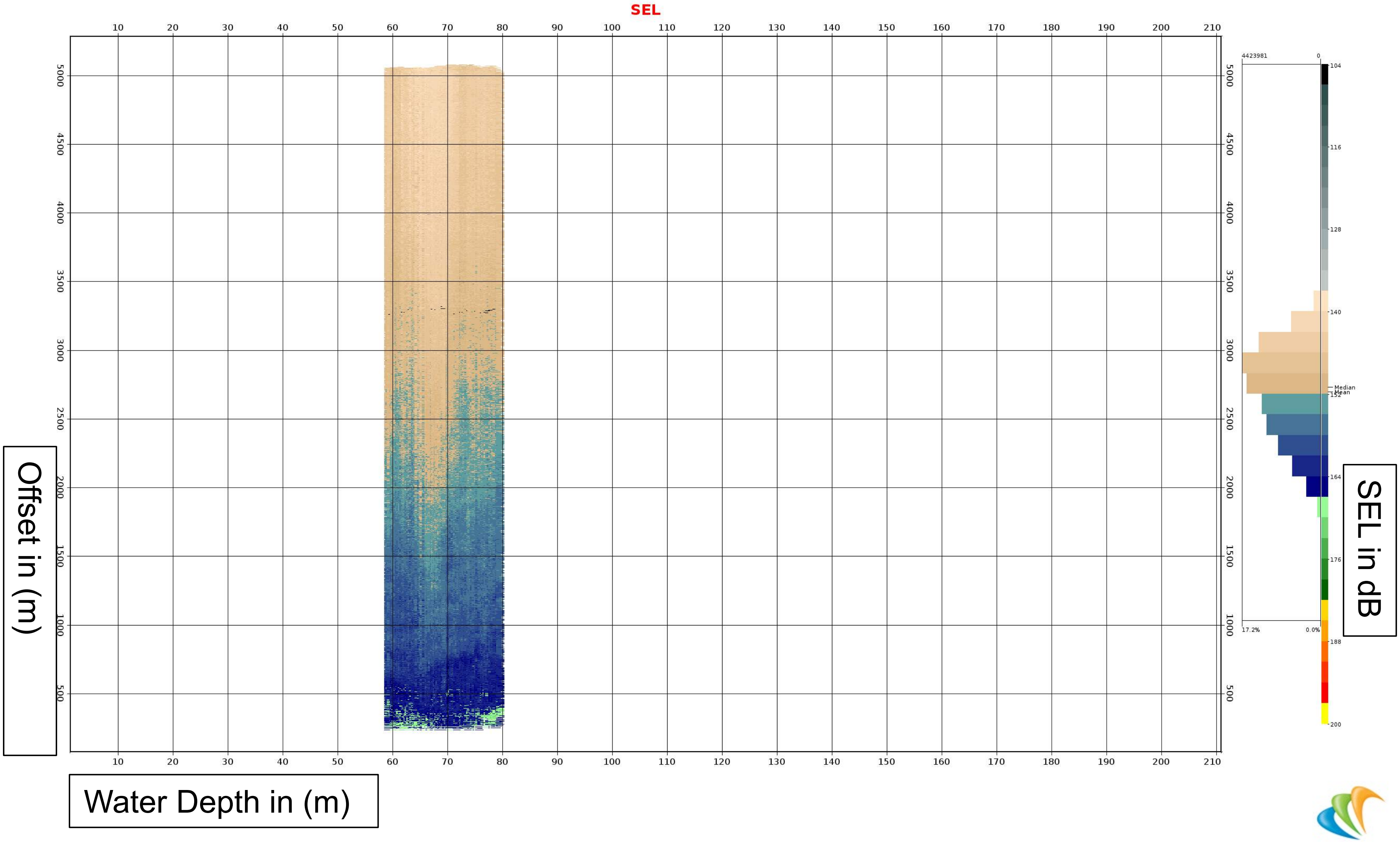
Shot water depth: 5 m to 200m



Survey: Elver
Shot water depth: 5 m to 200m

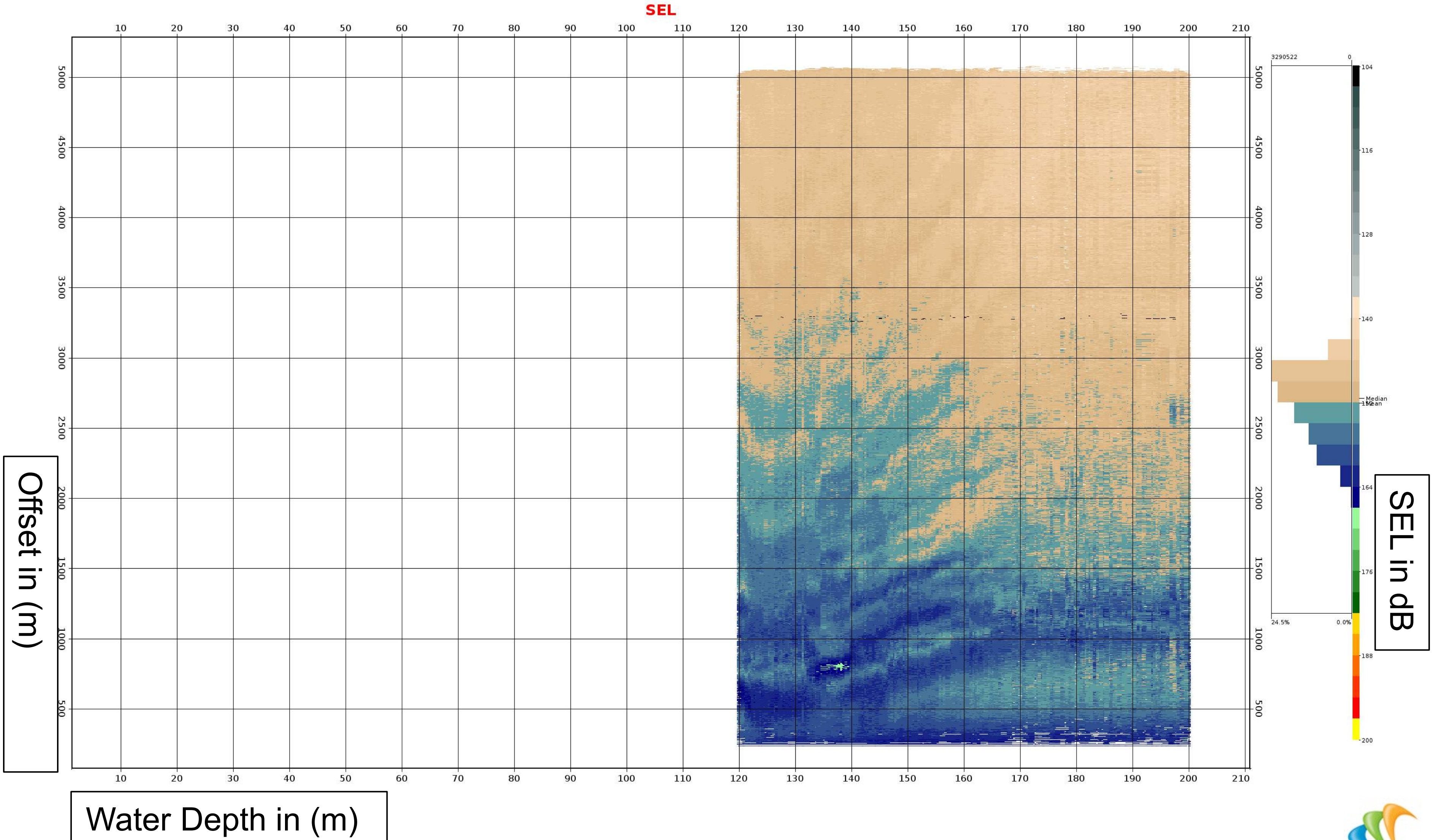


Survey: Bazzard
Shot water depth: 5 m to 200m

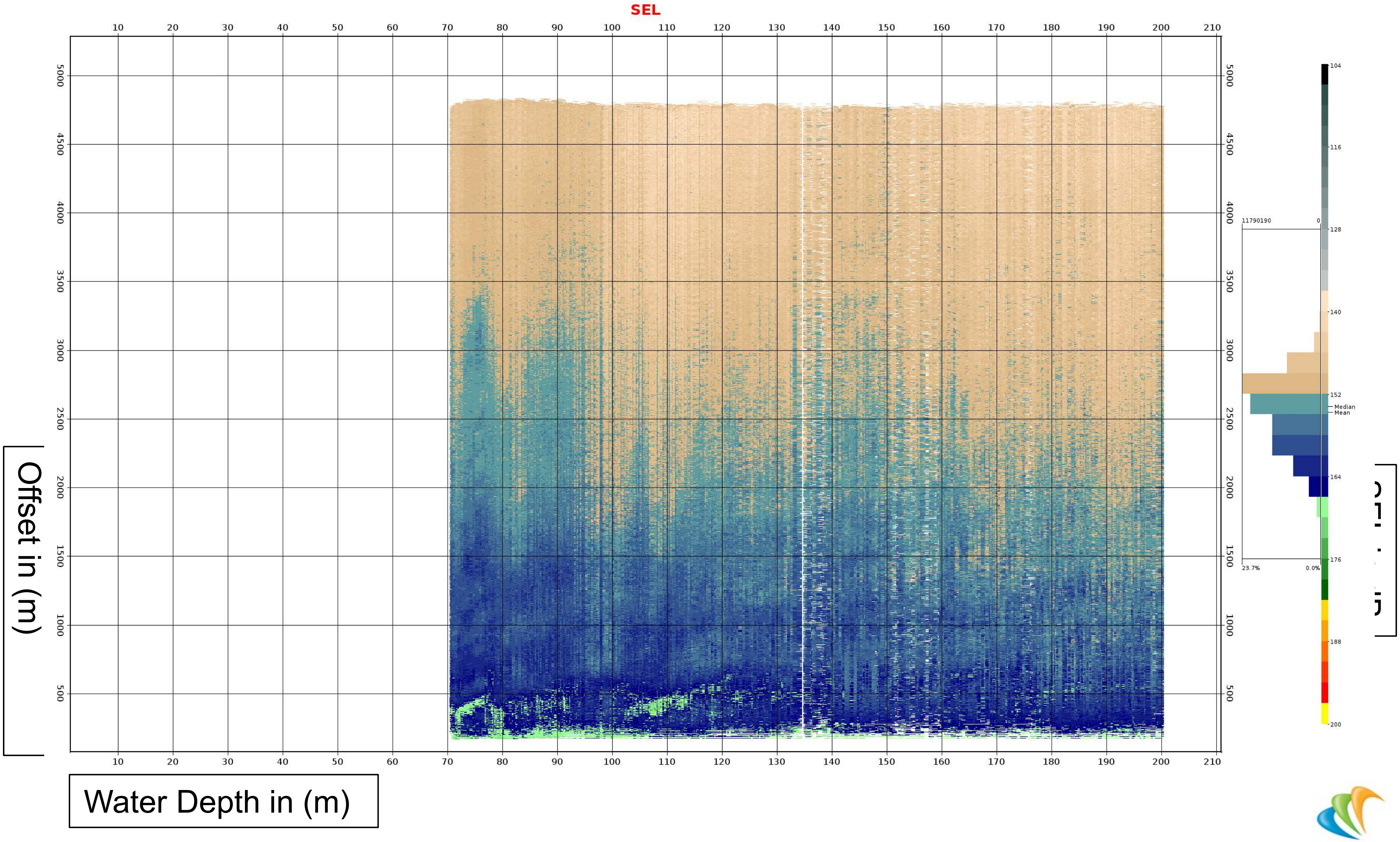


Survey: Oscar

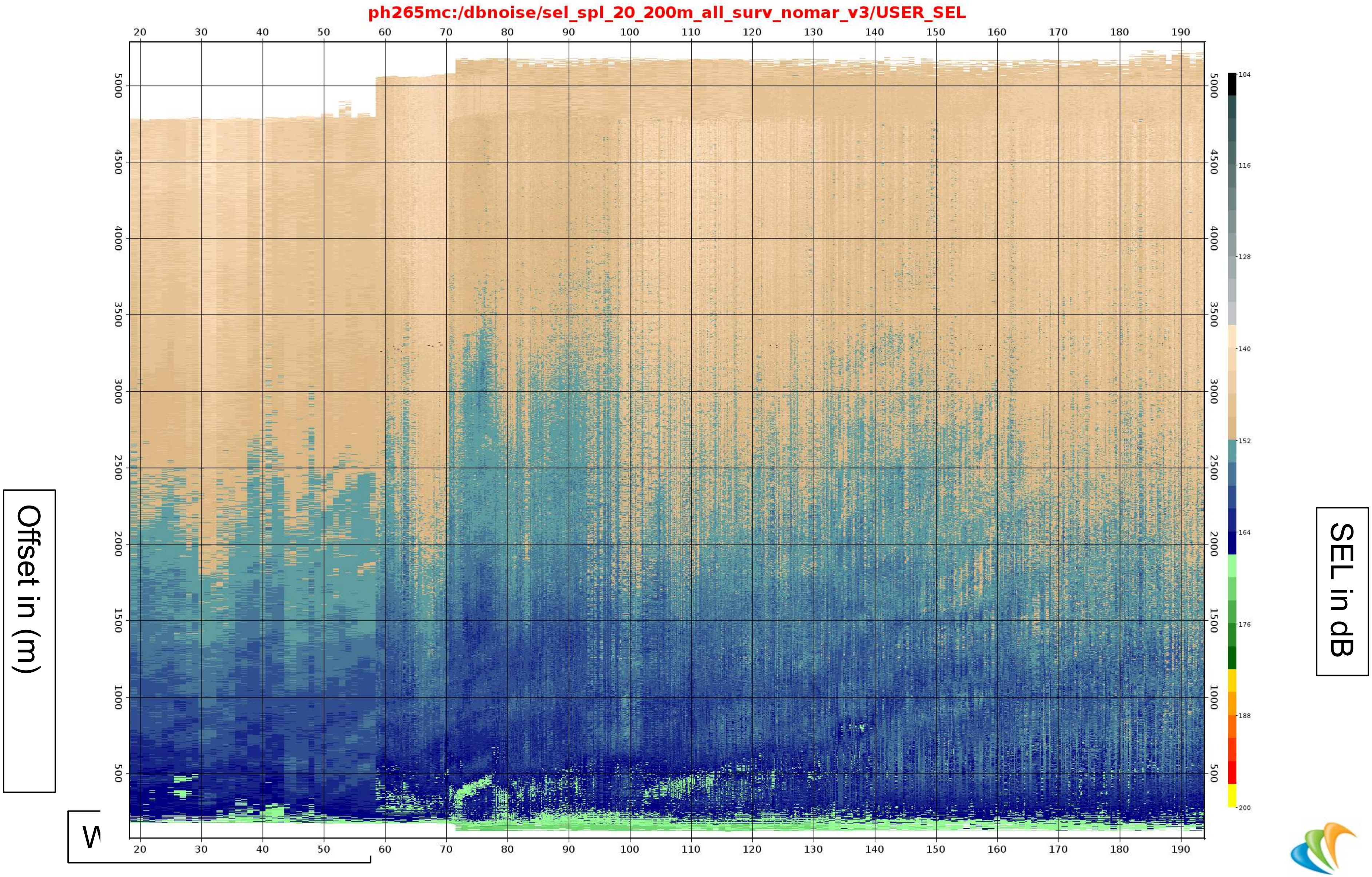
Shot water depth: 5 m to 200m



Survey: HGP
Shot water depth: 5 m to 200m

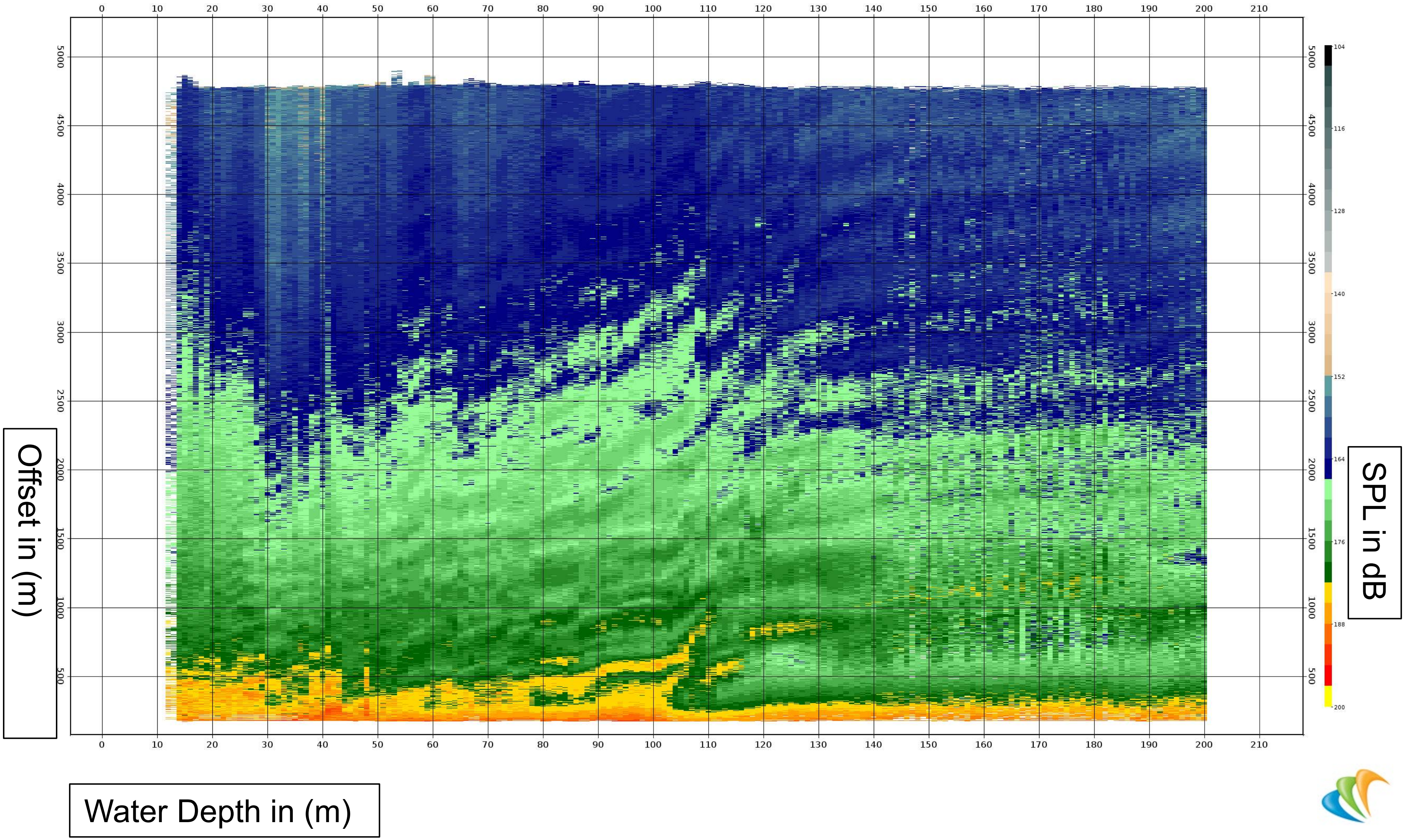


Survey: All surveys
Shot water depth: 5 m to 200m



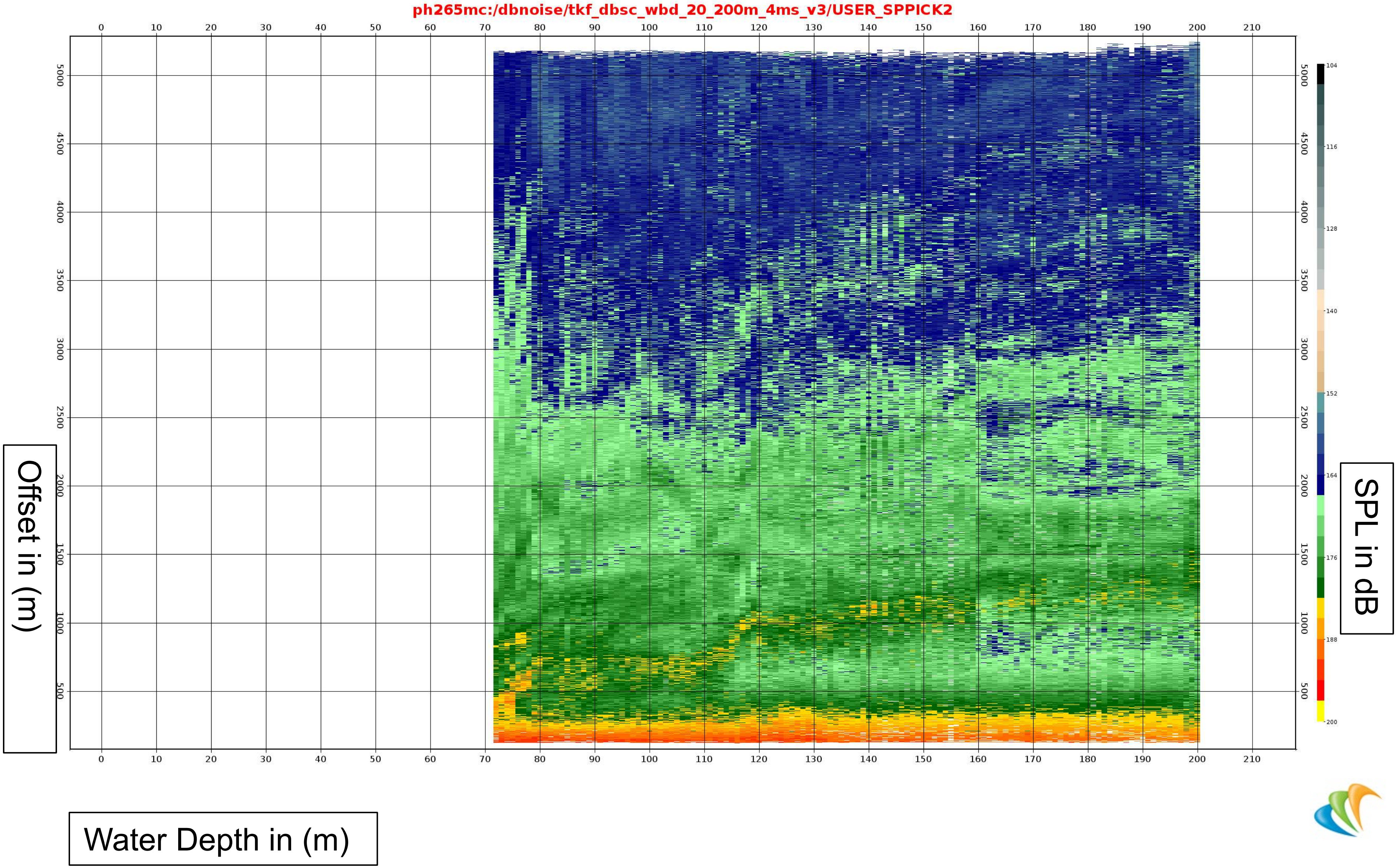
SPL
Water Depth
5m to 200m

Survey: G01A (Northern Fields)
Shot water depth: 5 m to 200m

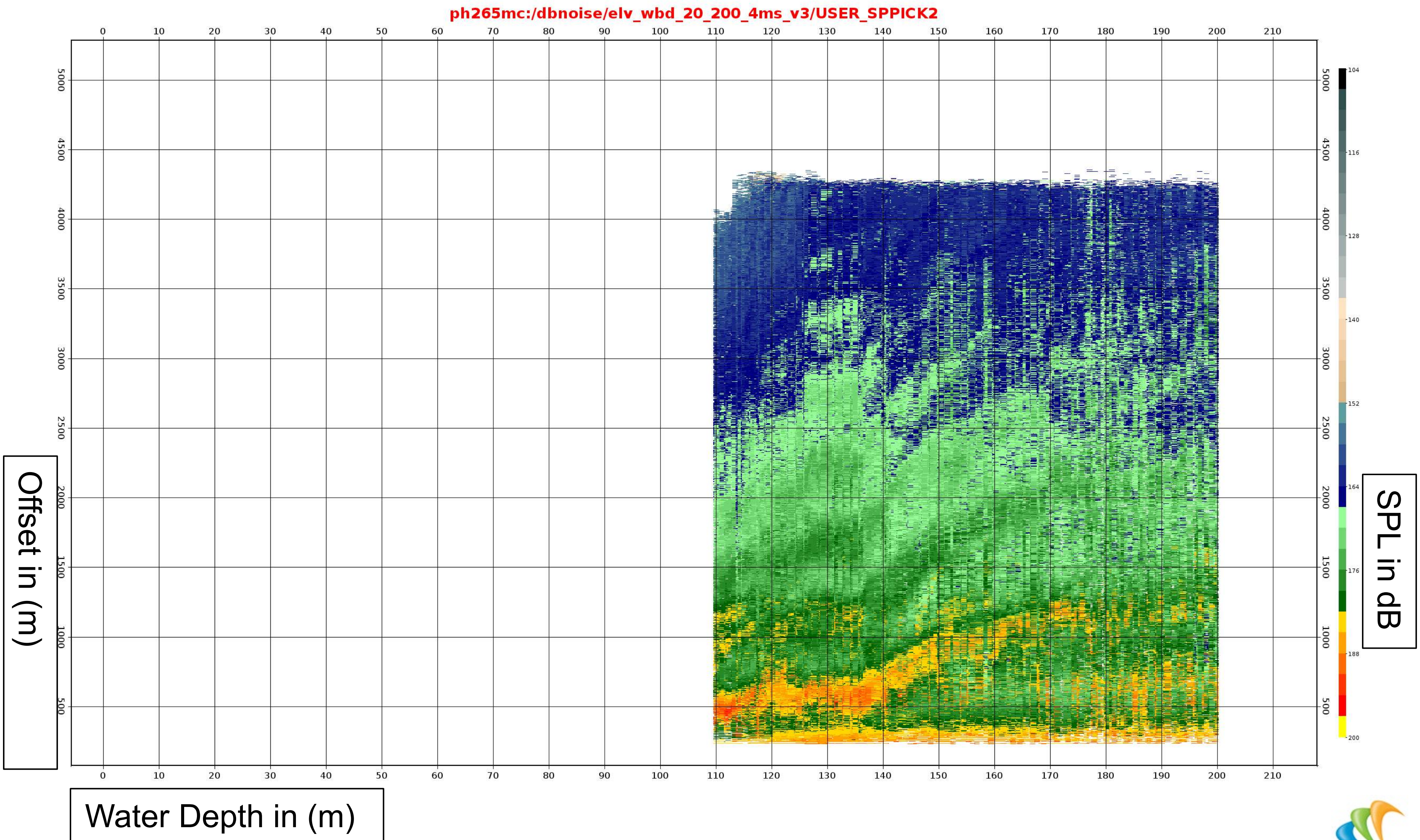


Survey: Tuskfish

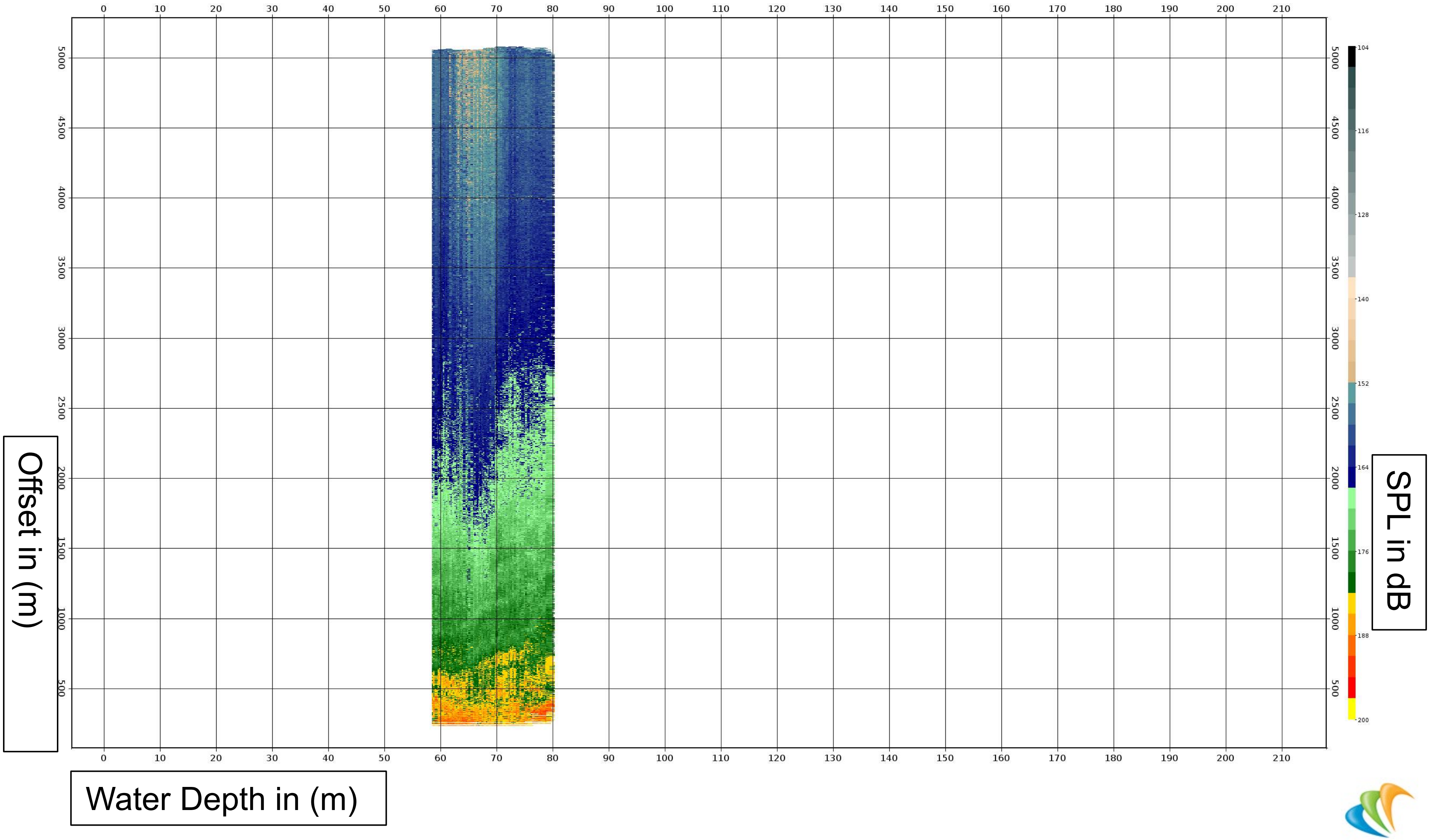
Shot water depth: 5 m to 200m



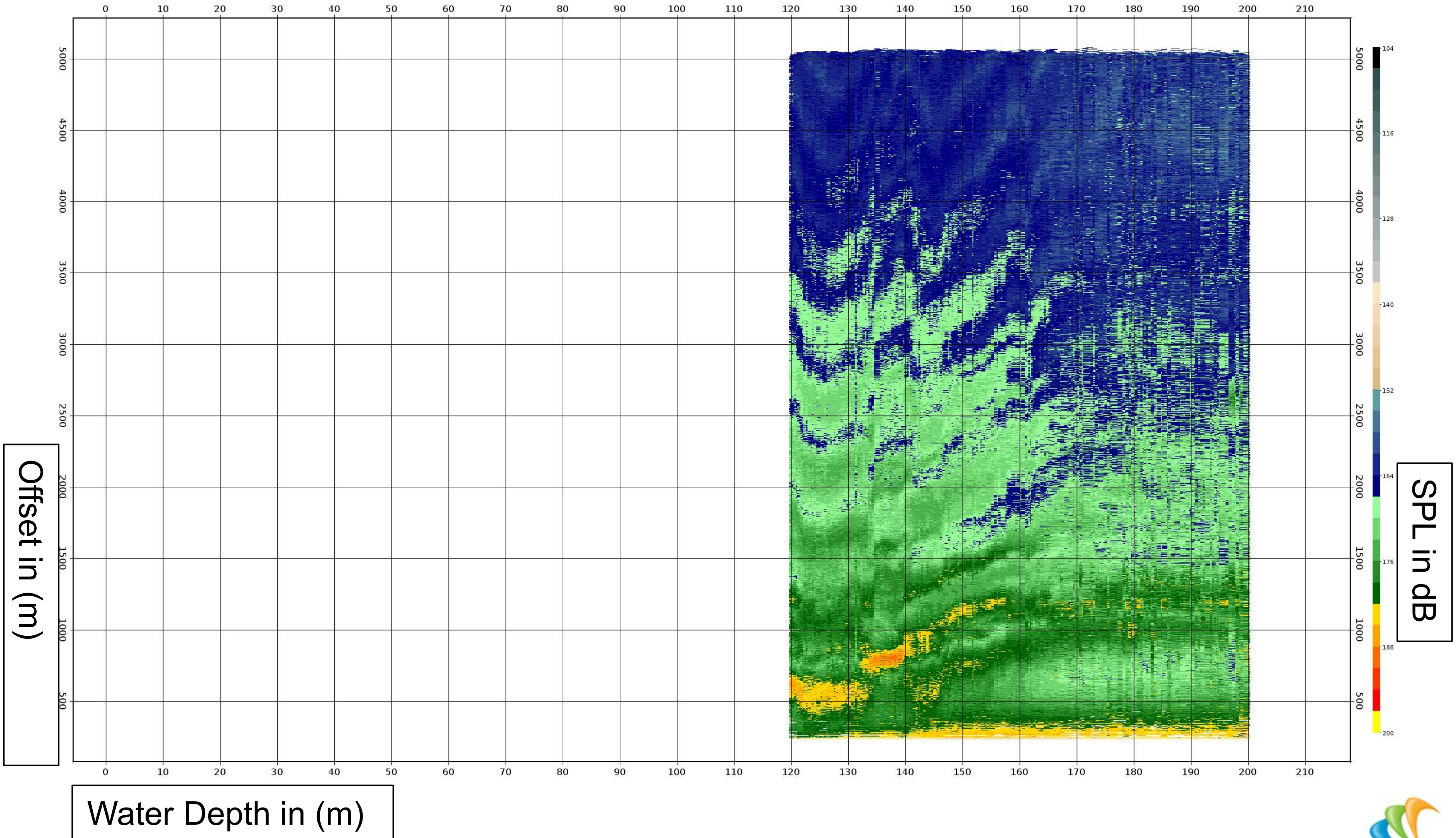
Survey: Elver
Shot water depth: 5 m to 200m



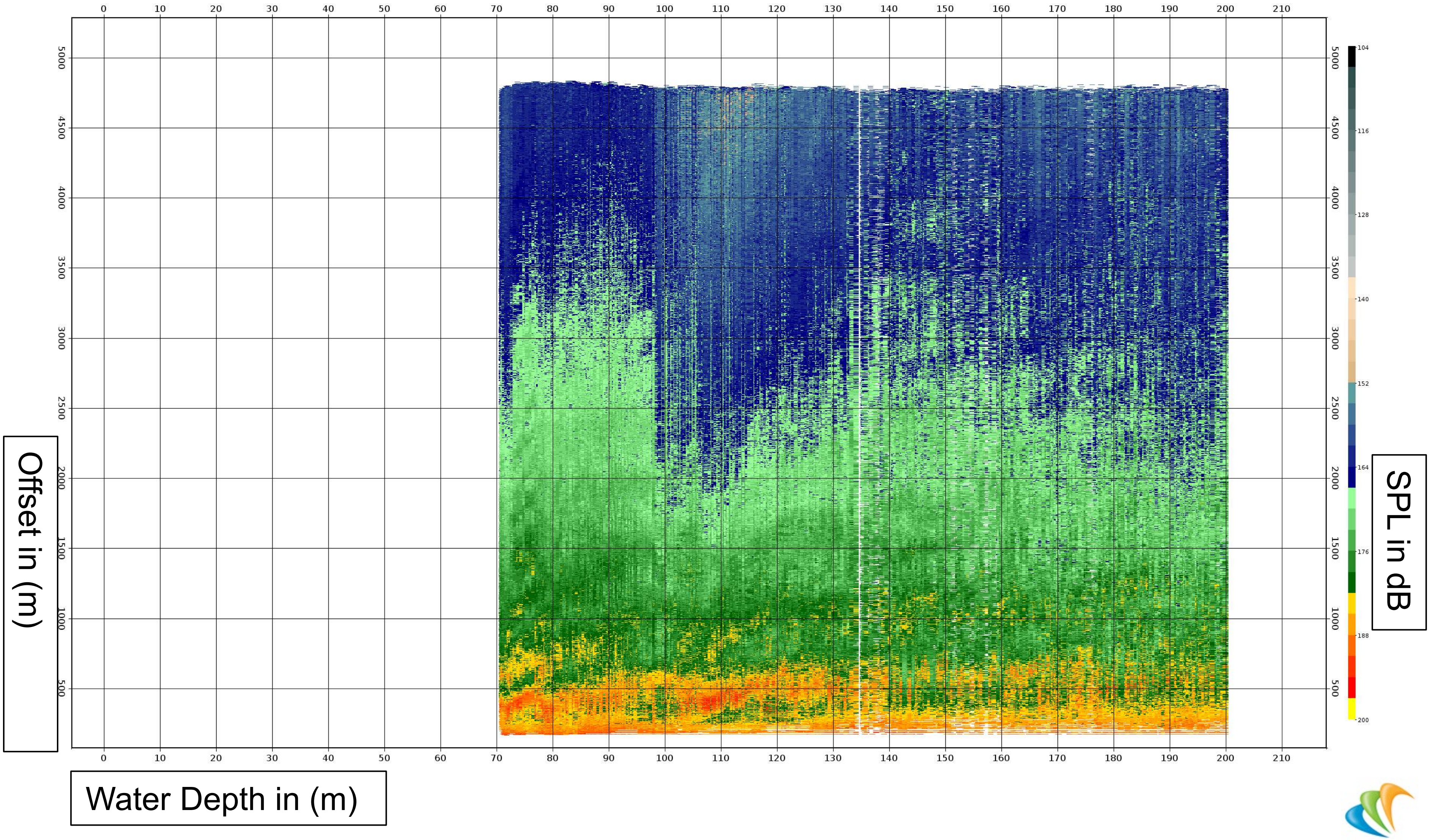
Survey: Bazzard
Shot water depth: 5 m to 200m



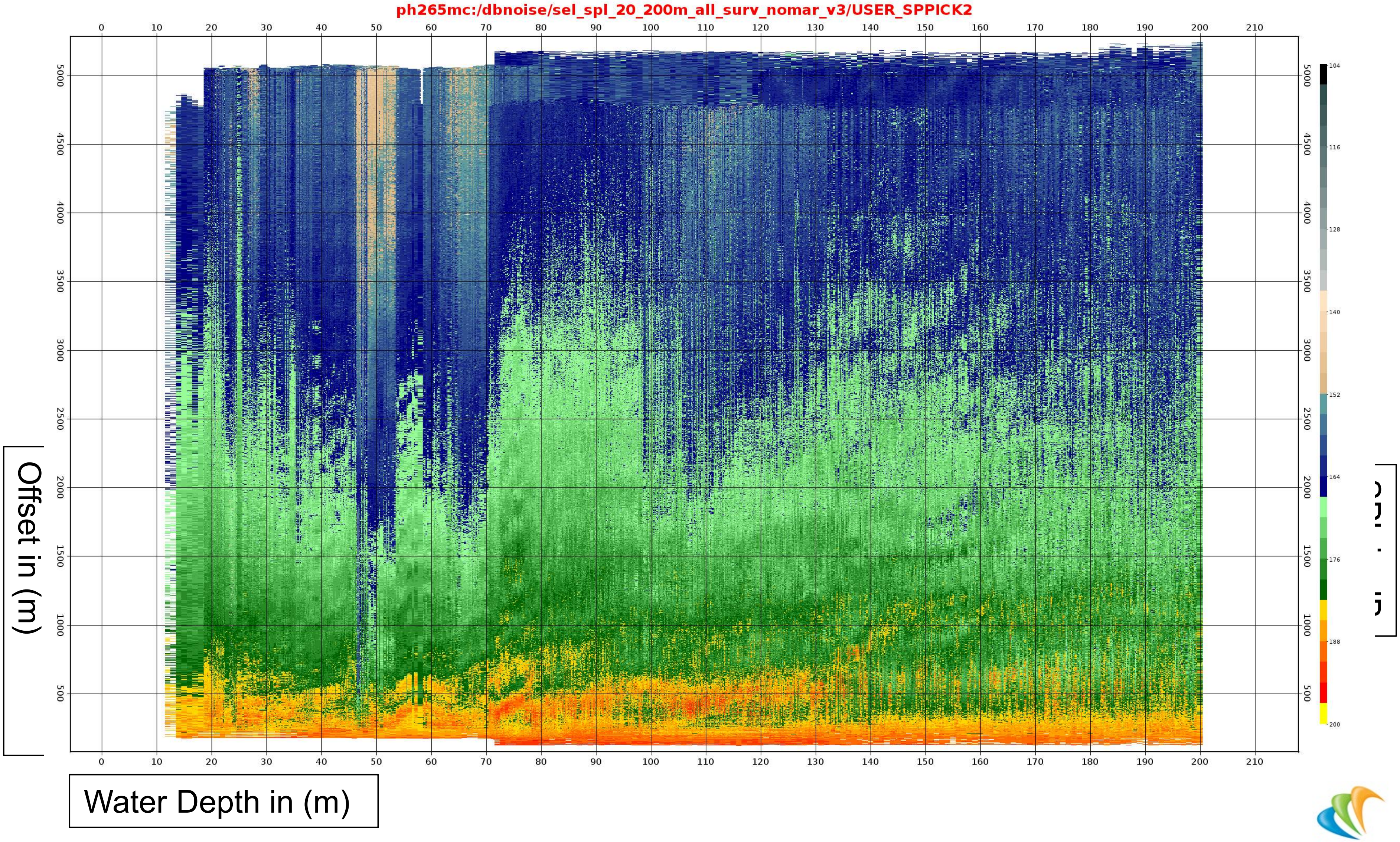
Survey: Oscar
Shot water depth: 5 m to 200m



Survey: HGP
Shot water depth: 5 m to 200m



Survey: All surveys
Shot water depth: 5 m to 200m

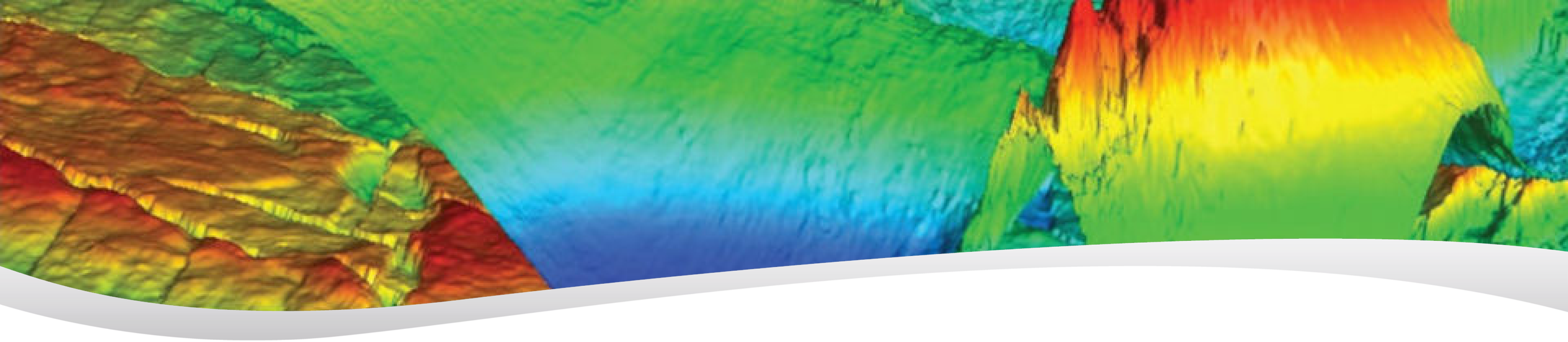


Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
G01A Northern Fields	Geco Beta	3900	85/265	6144	3/18	180/72	2	50	18.75	6	2000	3542	6	20 V/Bar	T^2	Scale 0.001	0
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

Survey	Offset		Water depth		Number of samples	For Water bottom Range 20 to 200 m									
						SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572	140908652	3.5	180.3	150.6	151.2	6.702	124.6	205.8	165.9	166.6	9.013
Tuskfish	127	5247	72	2579	9424066	23.2	174.5	152.6	153.2	5.149	58.9	195.5	169.1	170.1	6.679
Elver	234	4358	110	2592	4695040	110	175.9	152.9	153.6	6.281	118.9	197.5	171.2	171.2	7.941
Bazzard	237	5082	59	79.9	25666220	100.748	182.9	150.1	151.7	6.697	105.162	209.86	164.5	165.8	9.268
Oscar	236	5104	120	607	134275479	100.522	181	151.3	152	4.854	108.137	207.9	168.094	169.2	6.29
HGP	168	4842	70.9	785.4	49834206	128.9	174.9	153.8	154.6	5.266	144.5	197.1	170.3	171.4	7.158
All surveys	127	5247	12	2592	243955760	3.5	182.9	151.6	152.1	6.428	58.9	209.86	167.3	167.9	8.718



Gippsland Seismic Amplitudes
200 to 1,000 m water depth

G01a (Northern fields)
Tuskfish
Elver
Bazzard
Oscar
HGP

10-Dec-2018

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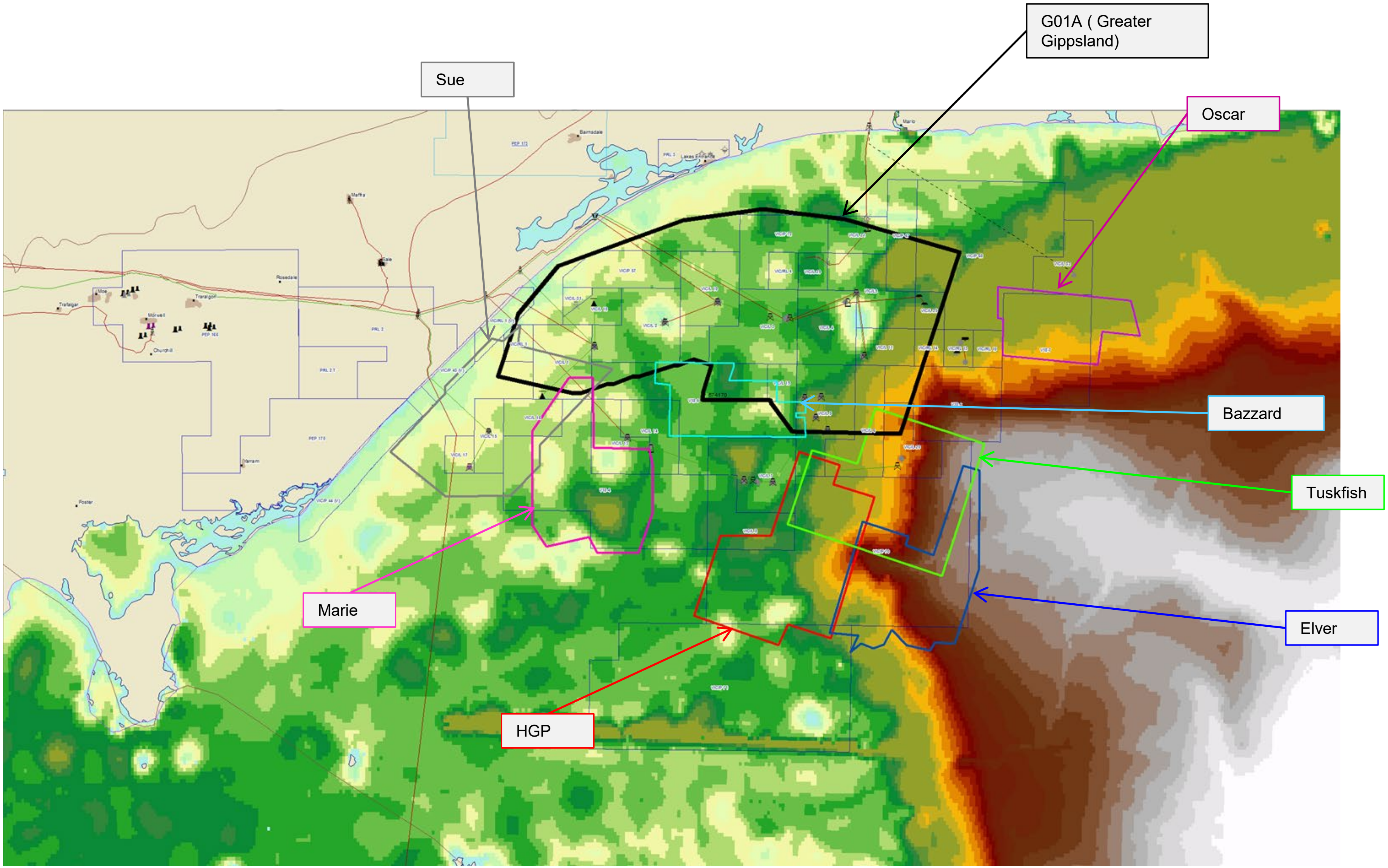
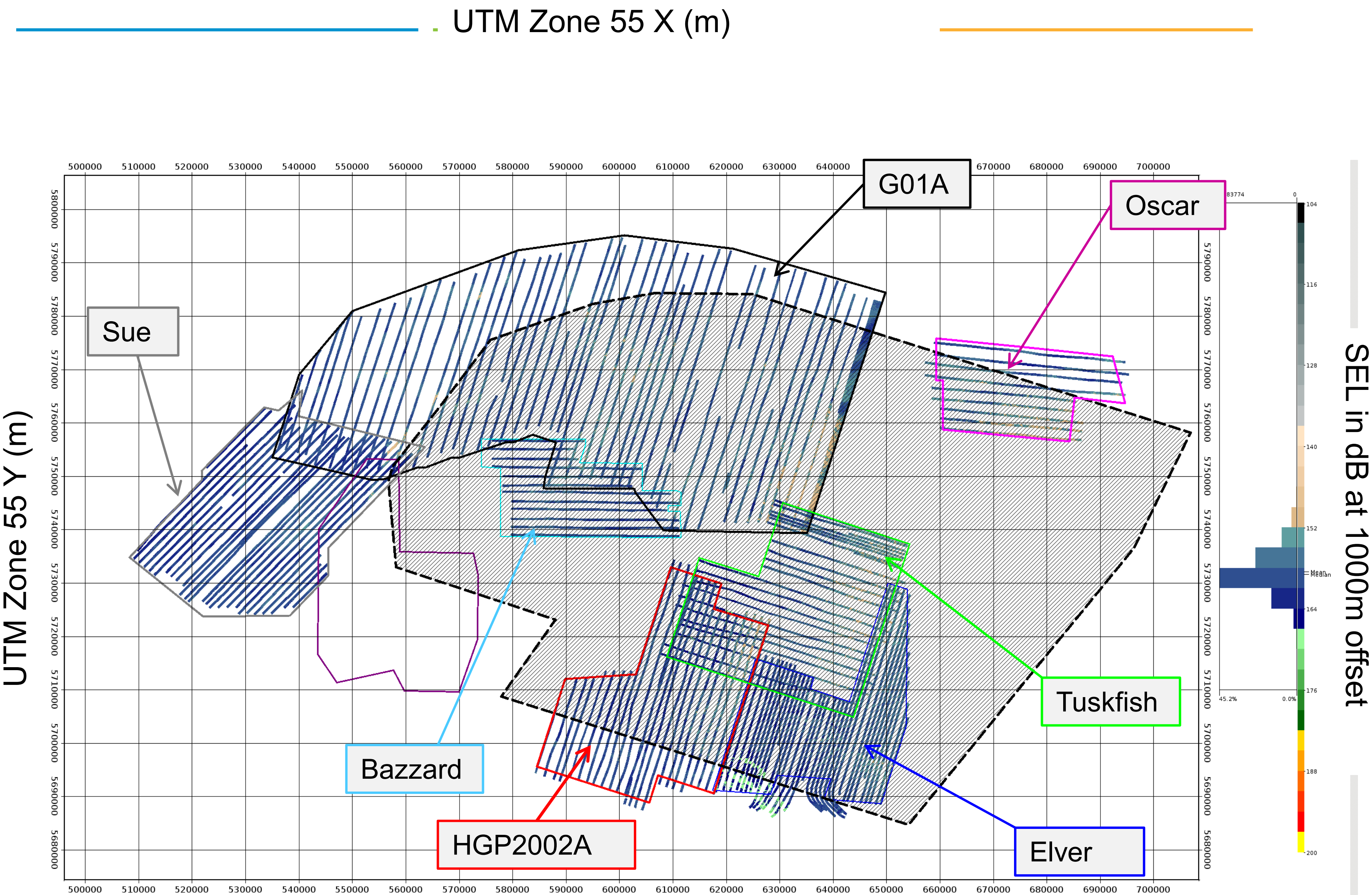
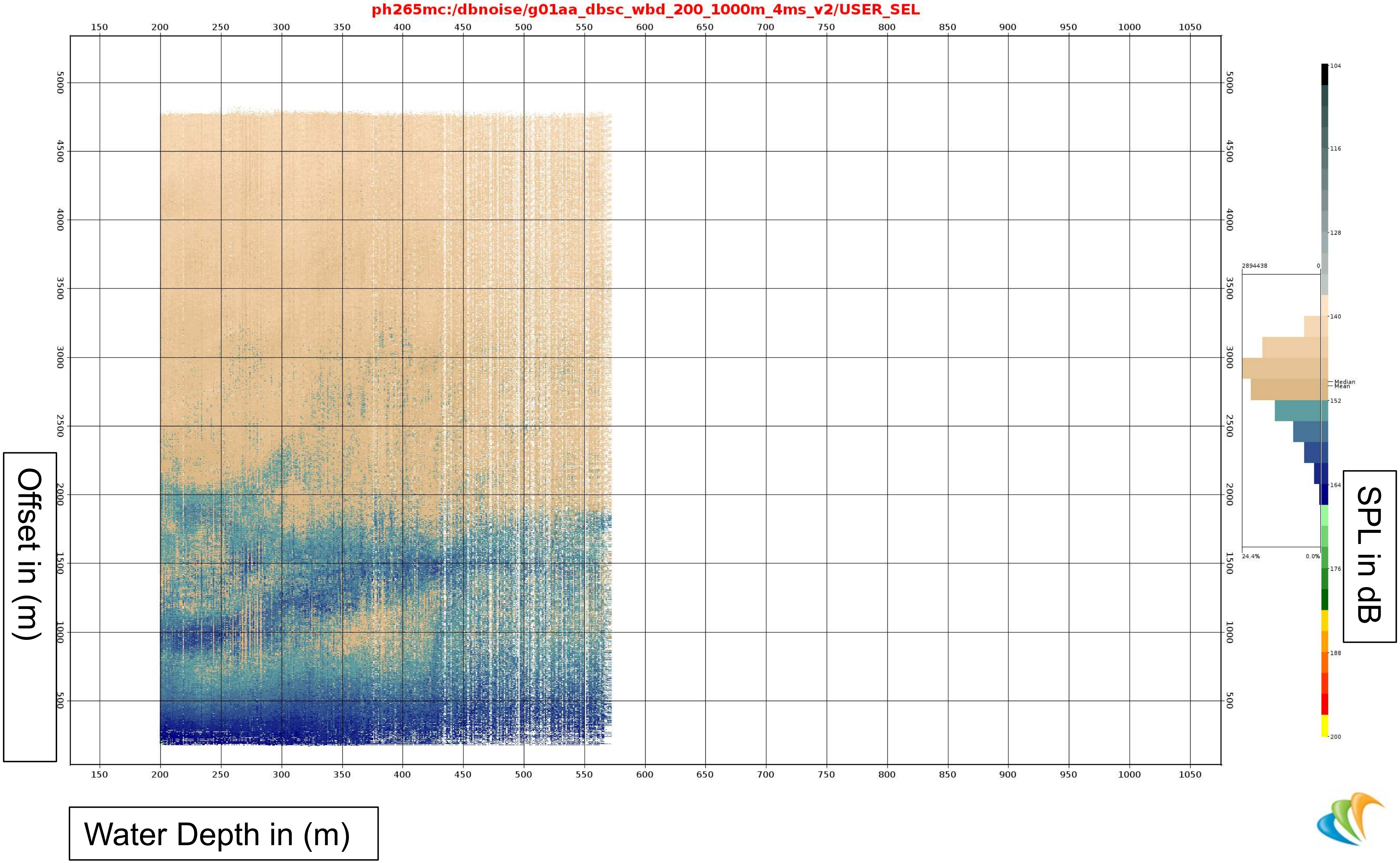

G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Elver
Marie
HGP

Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay

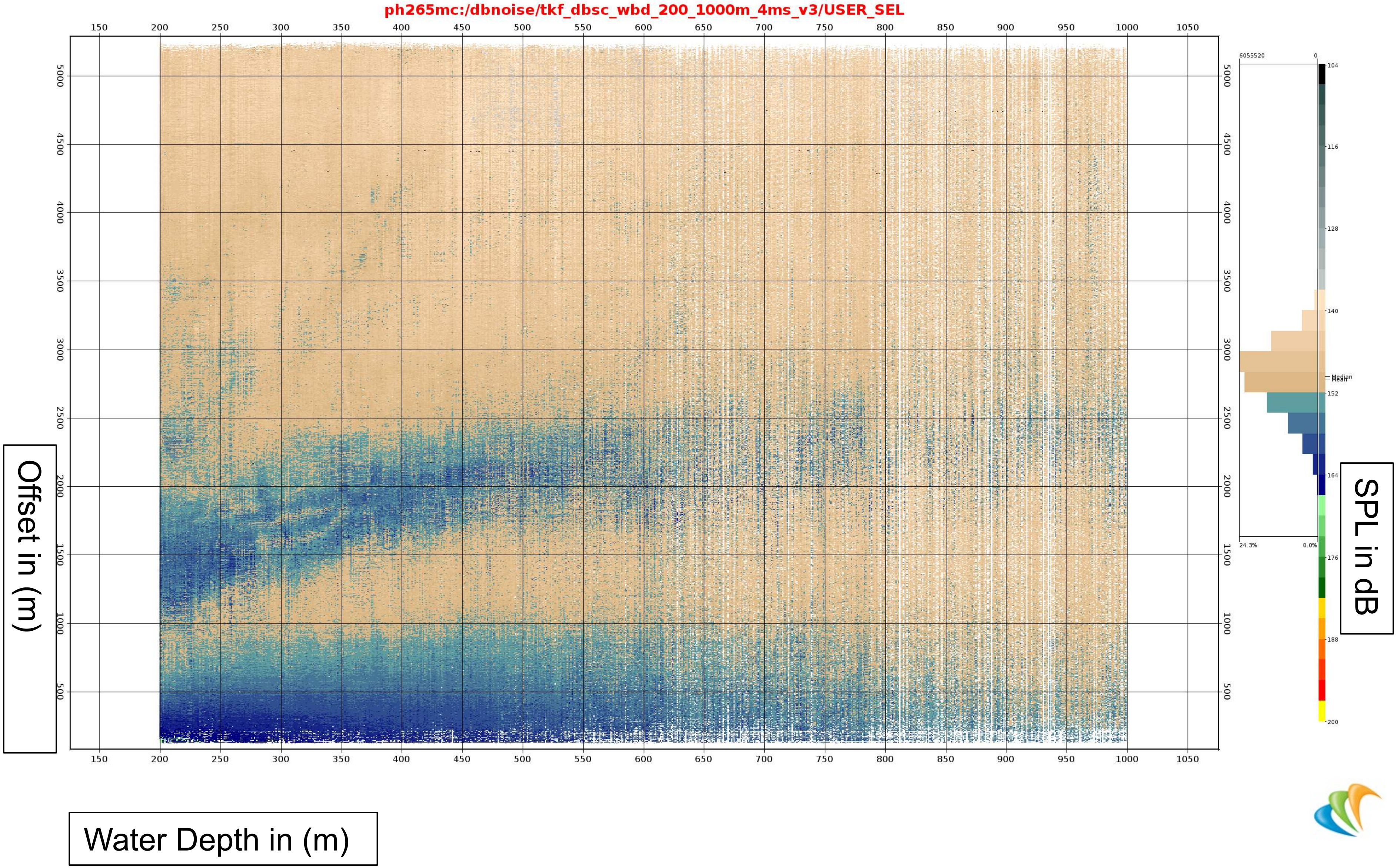


SEL
Water Depth
200m to 1000m

Survey: G01A (Northern Fields)
Shot water depth: 200 m to 1000 m

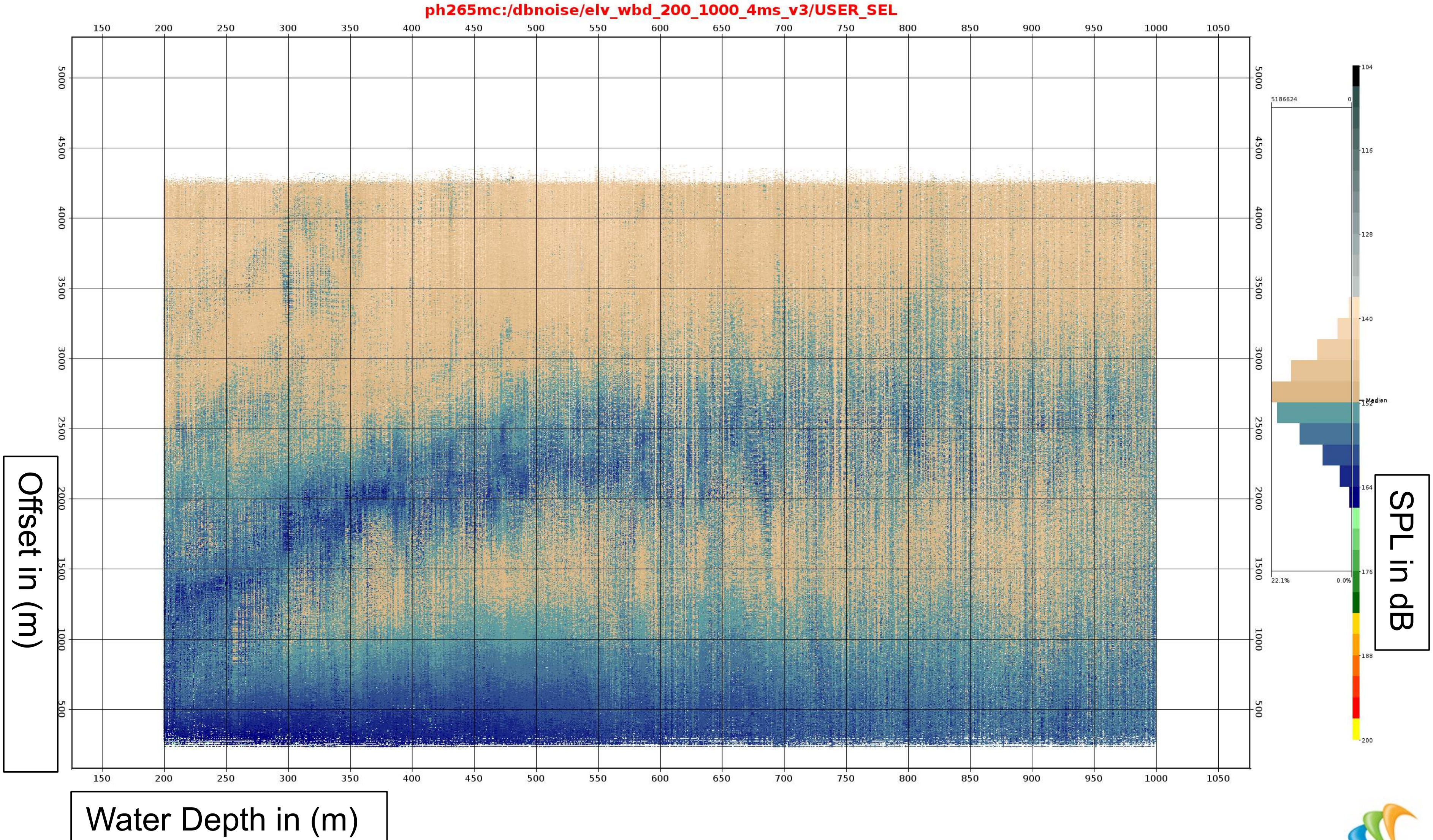


Survey: Tuskfish
Shot water depth: 200 m to 1000 m

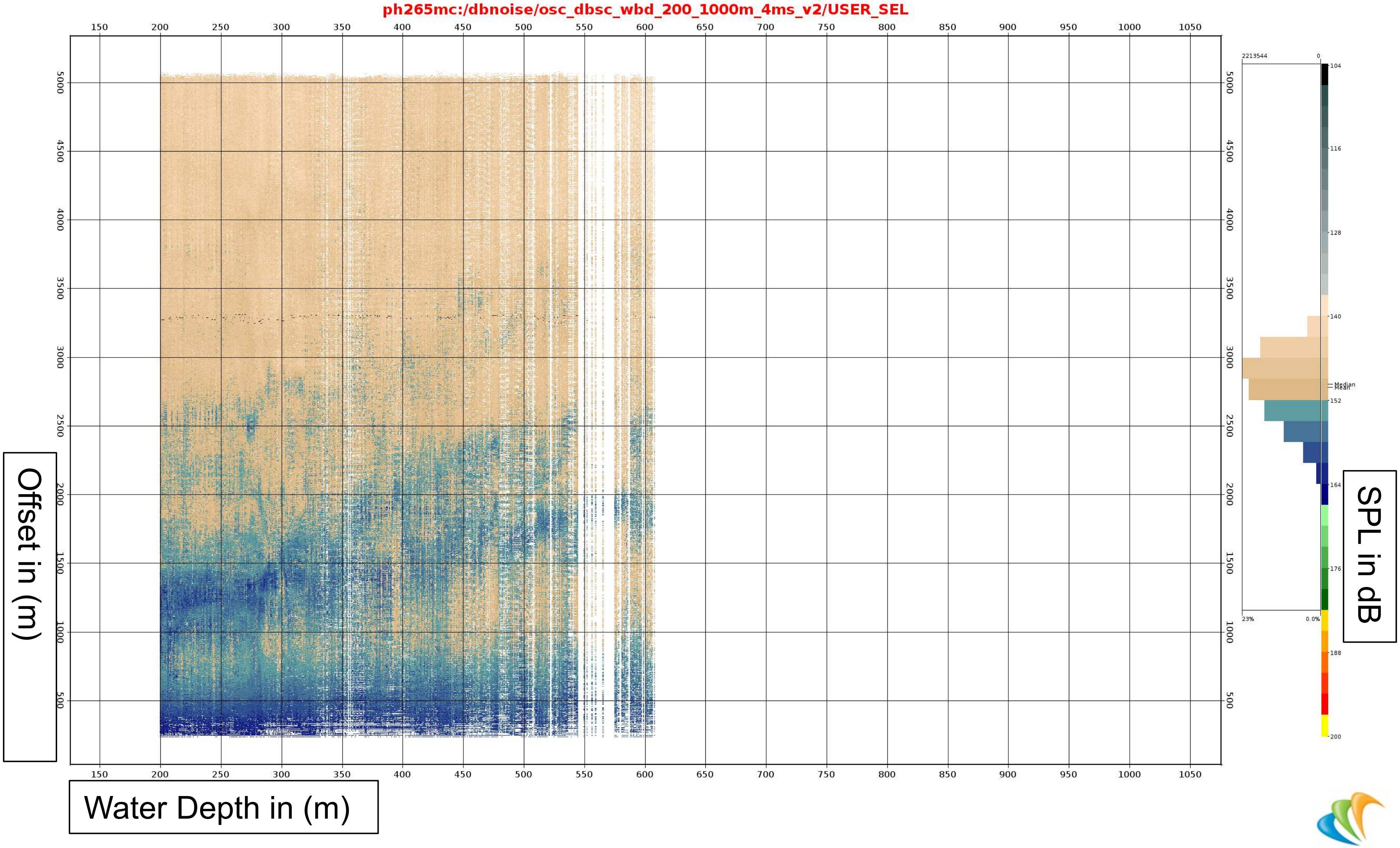


Survey: Elver

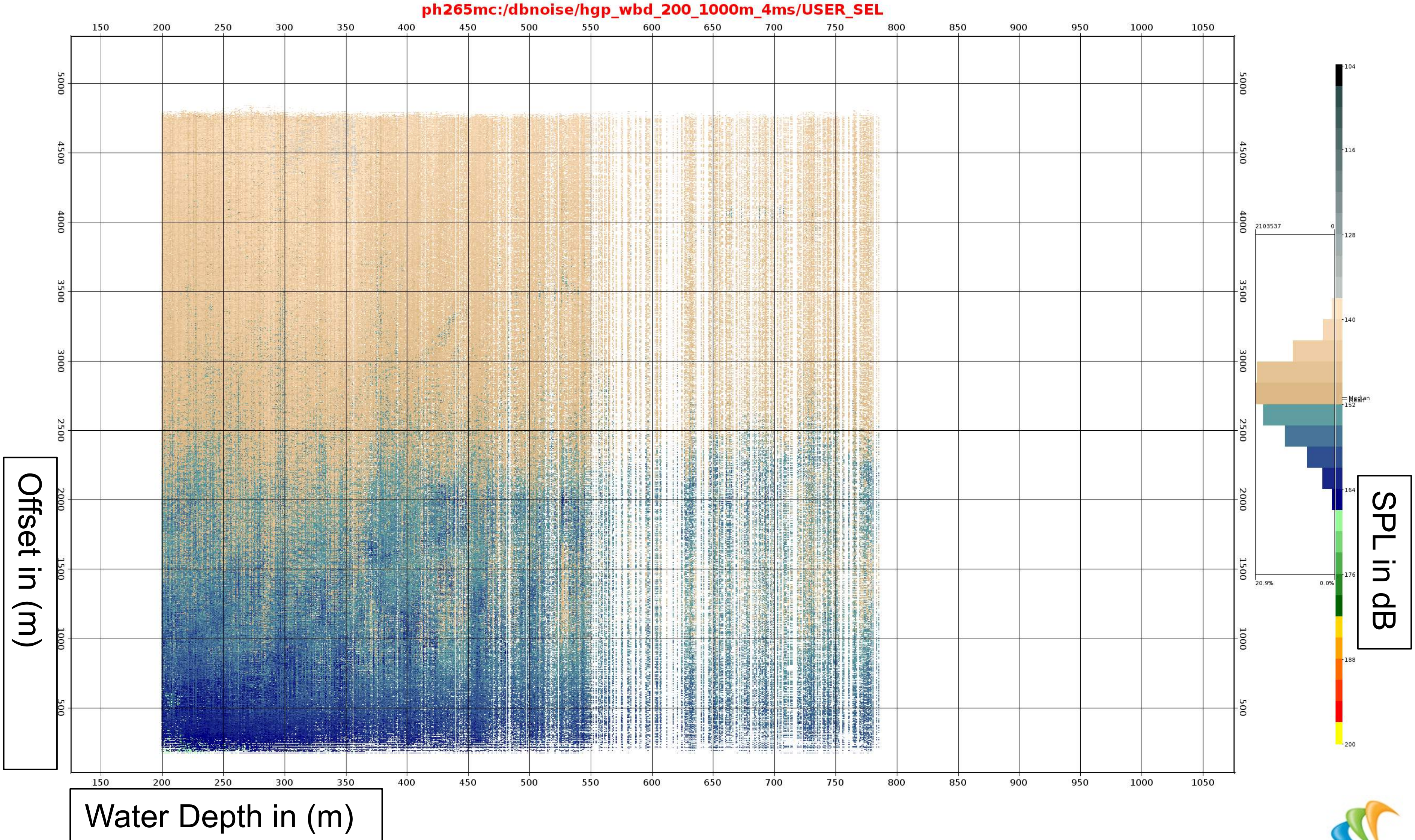
Shot water depth: 200 m to 1000 m



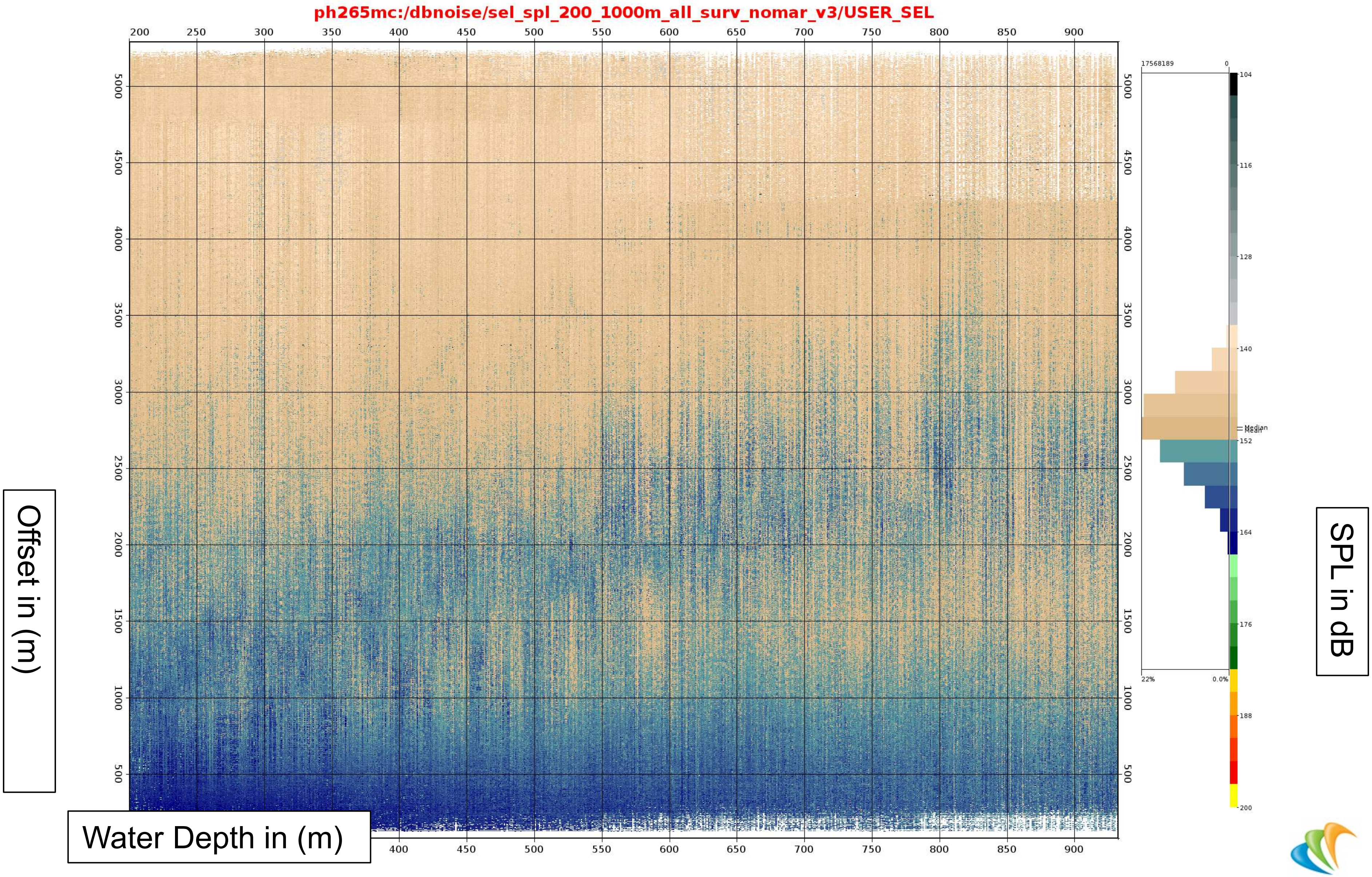
Survey: Oscar
Shot water depth: 200 m to 1000 m



Survey: HGP
Shot water depth: 200 m to 1000 m

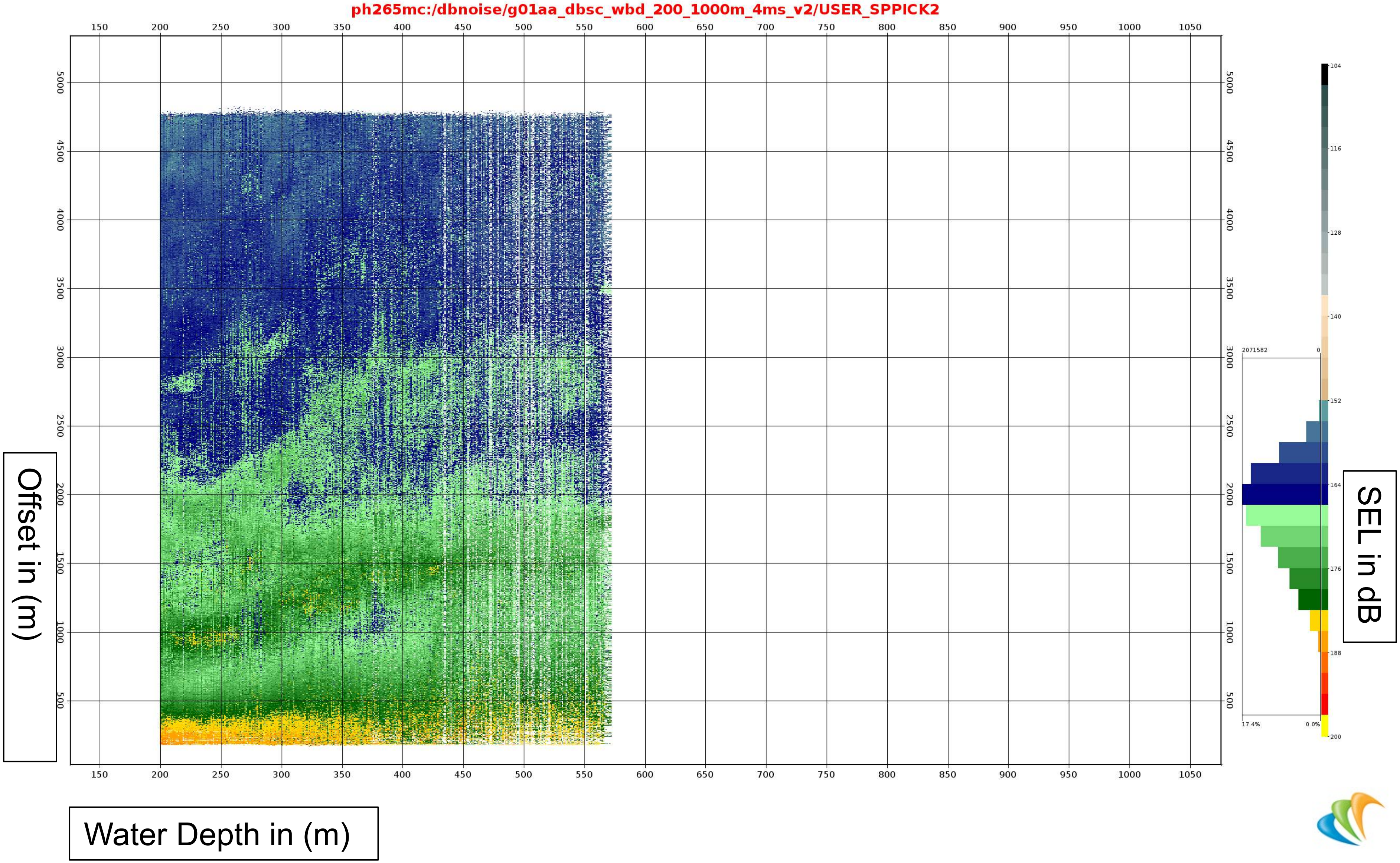


Survey: All surveys
Shot water depth: 200 m to 1000 m

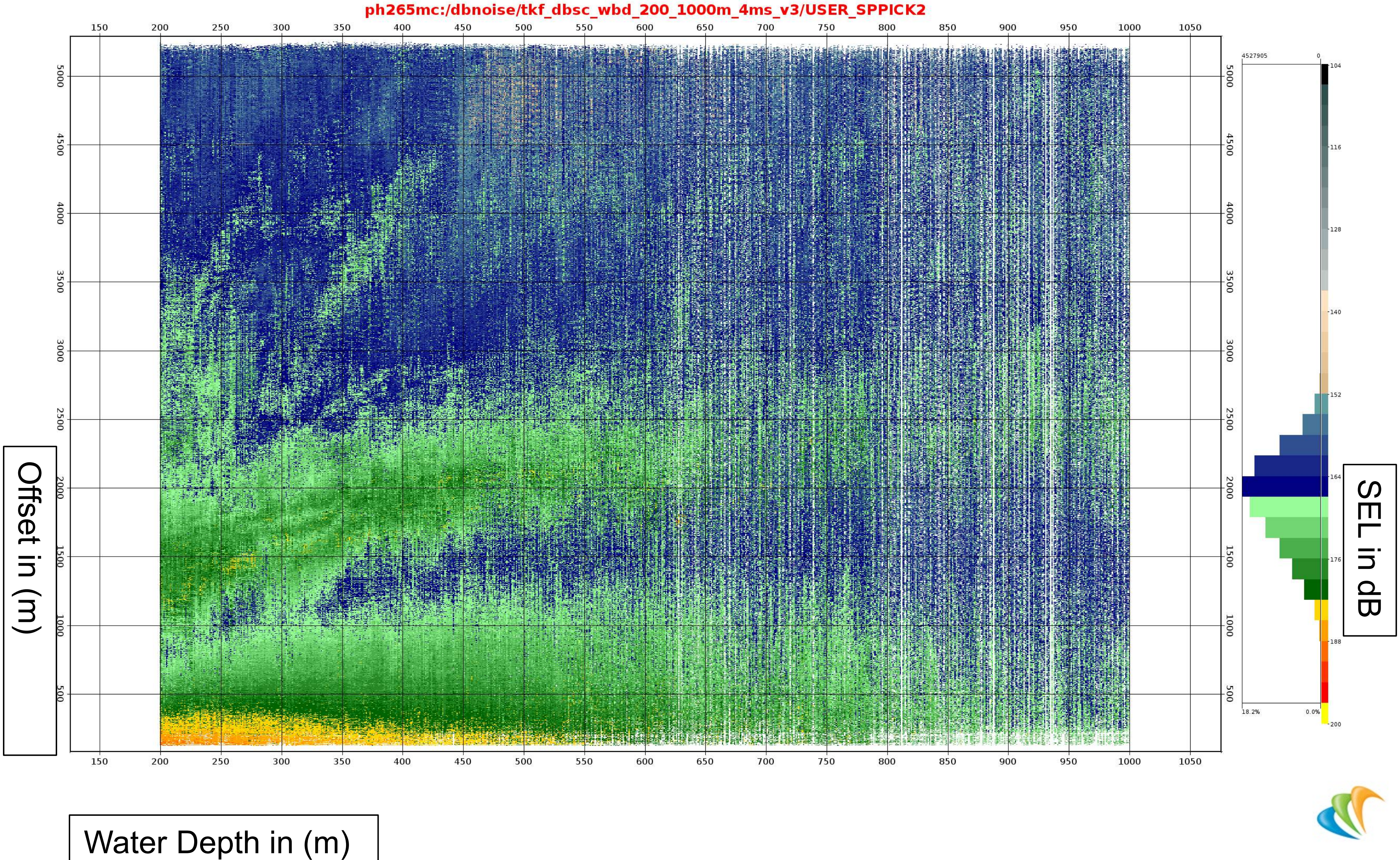


SPL
Water Depth
200m to 1000m

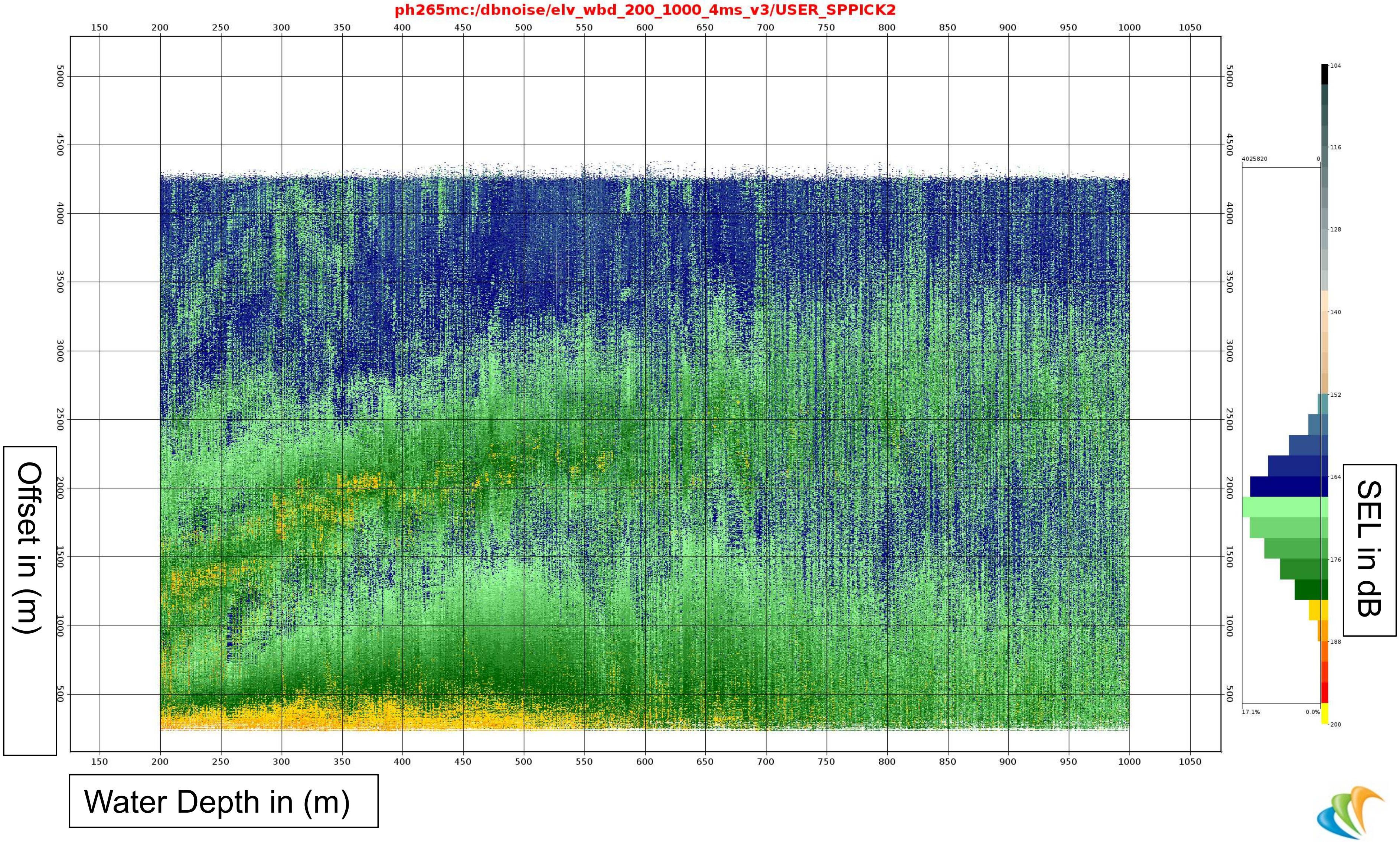
Survey: G01A (Northern Fields)
Shot water depth: 200 m to 1000 m



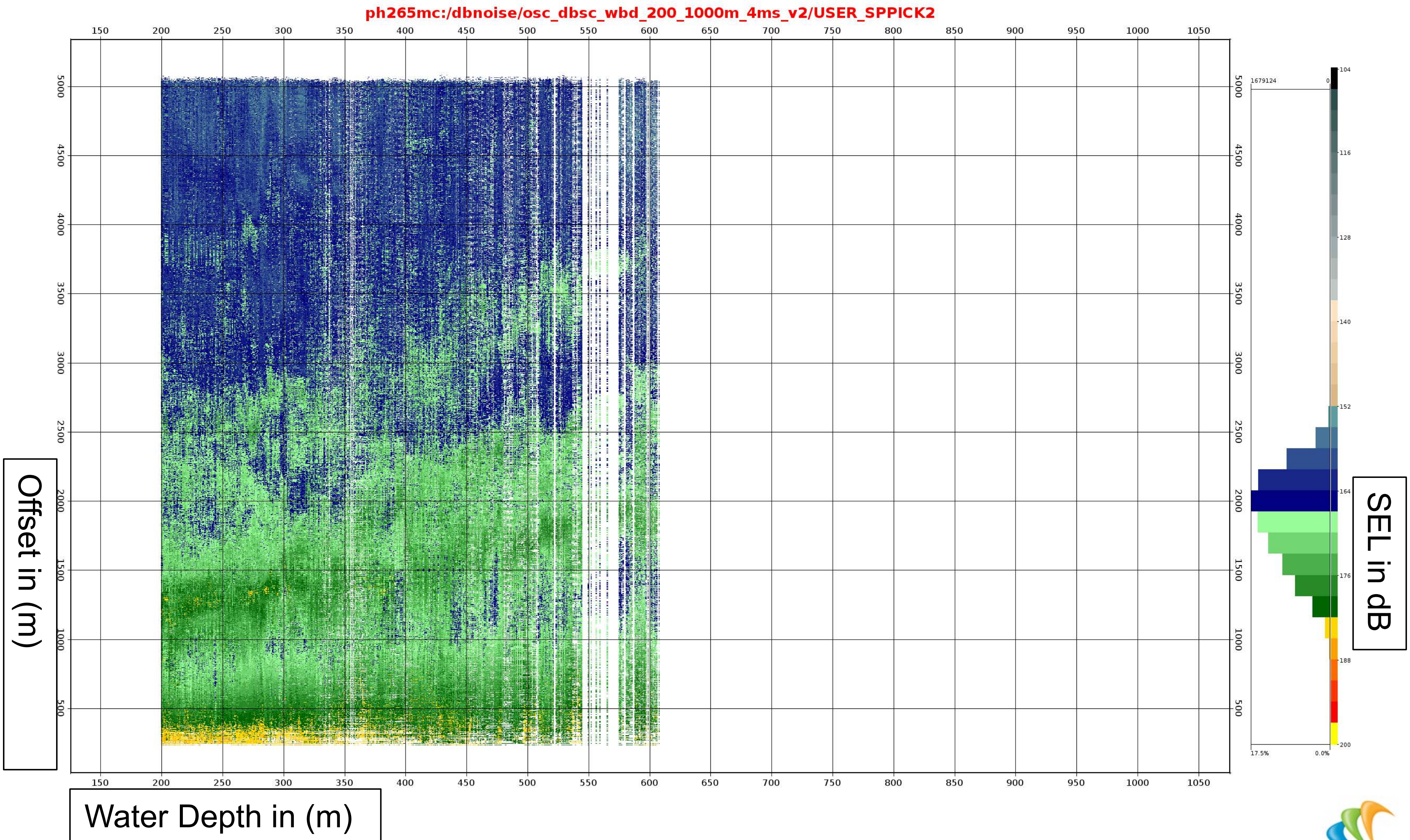
Survey: Tuskfish
Shot water depth: 200 m to 1000 m



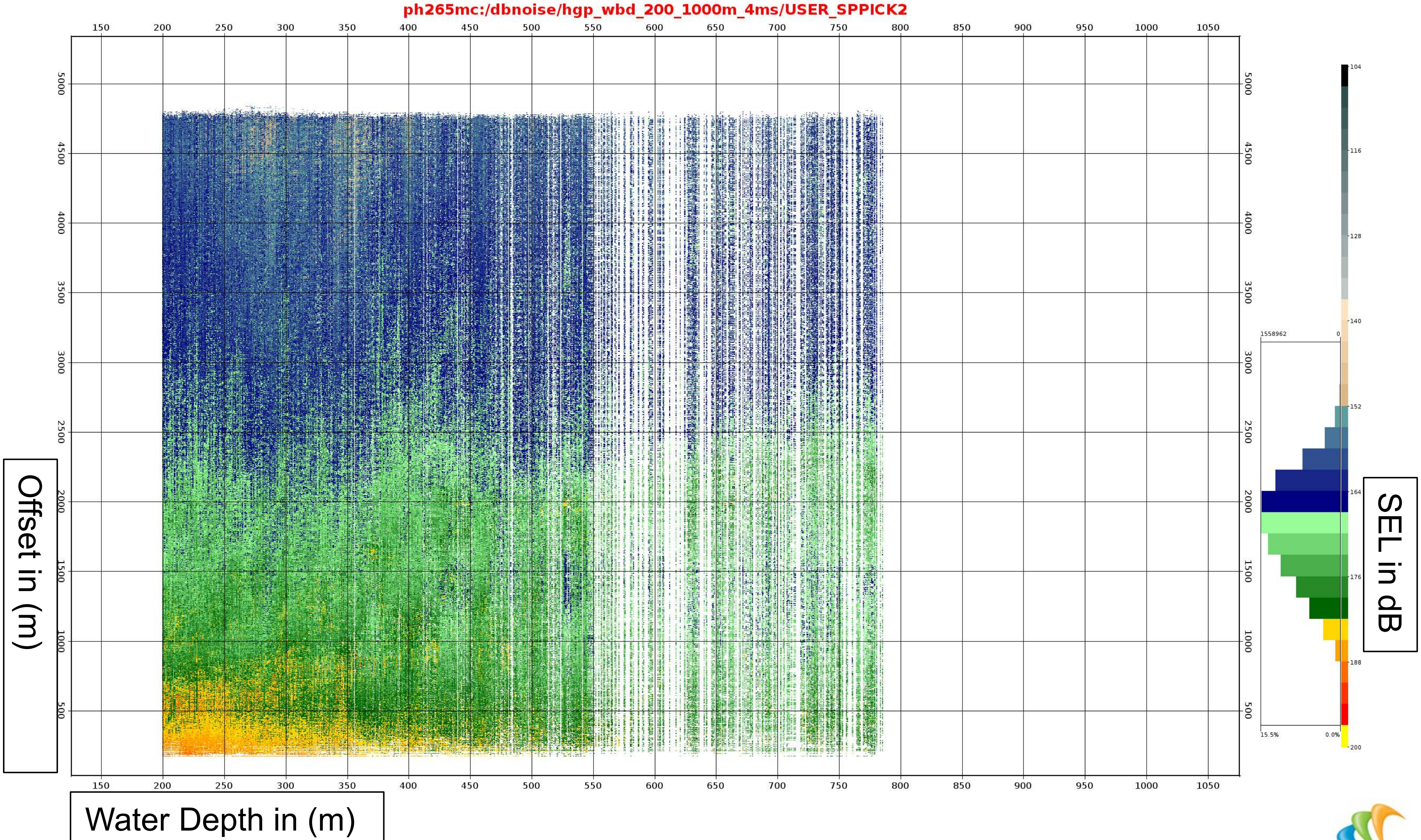
Survey: Elver
Shot water depth: 200 m to 1000 m



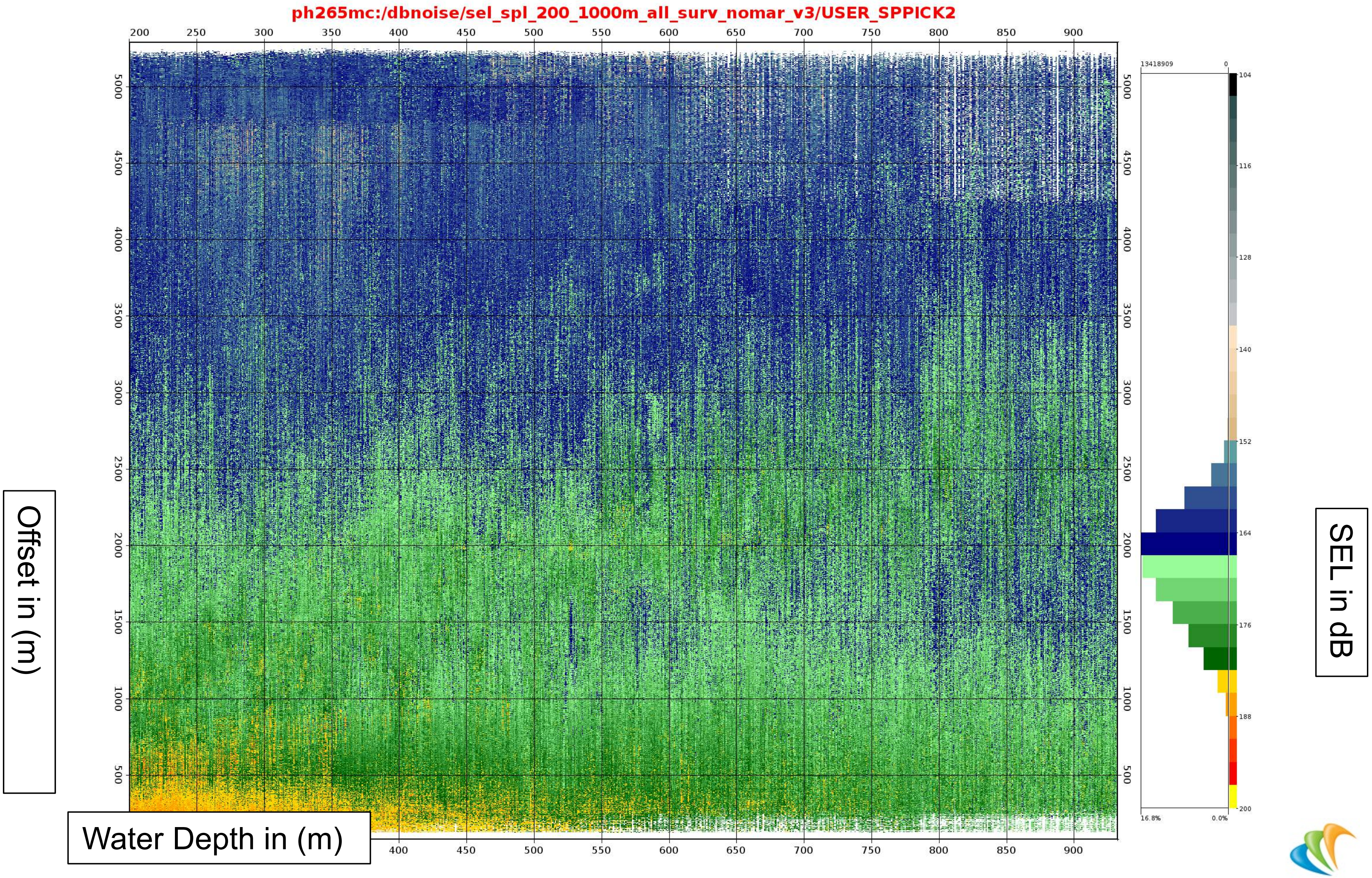
Survey: Oscar
Shot water depth: 200 m to 1000 m



Survey: HGP
Shot water depth: 200 m to 1000 m



Survey: All surveys
Shot water depth: 200 m to 1000 m

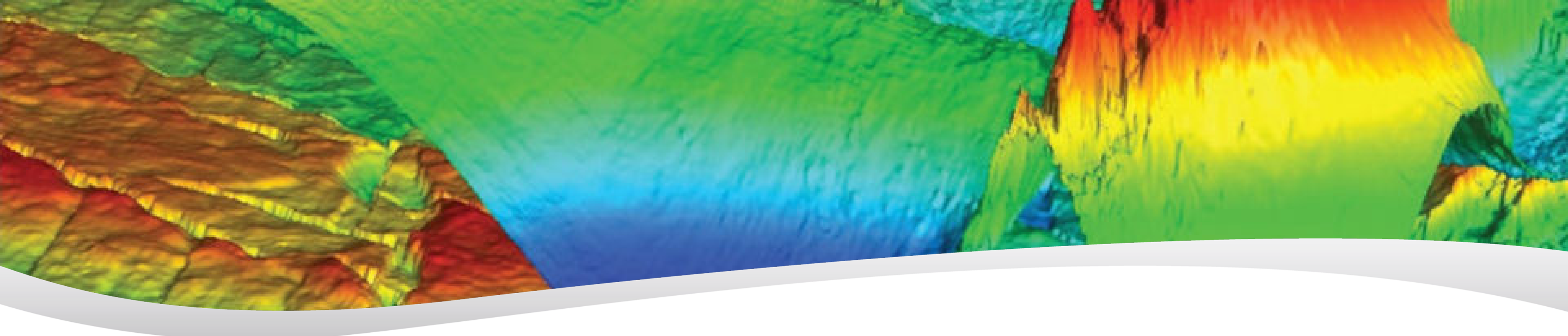


Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
G01A Northern Fields	Geco Beta	3900	85/265	6144	3/18	180/72	2	50	18.75	6	2000	3542	6	20 V/Bar	T^2	Scale 0.001	0
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

						For Water bottom Range 200 to 1000 m									
Survey	Offset		Water depth		Number of samples	SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572	11884854	135.7	172.4	149.3	149.9	4.995	147.8	195.3	167.7	168.4	6.677
Tuskfish	127	5247	72	2579	24899918	23.8	172.7	149.6	149.9	5.034	58.9	207.7	168.1	168.6	6.748
Elver	234	4358	110	2592	23503360	111.2	173.755	151.597	151.7	5.254	119.5	195.6	169.2	169.5	6.702
Sue	236	5084	19.1	57.6											
Bazzard	237	5082	59	79.9											
Oscar	236	5104	120	607	9608978	100.1	180.1	149.7	150.2	4.861	107.7	207.7	167.6	168.1	6.386
HGP	168	4842	70.9	785.4	10062592	129.5	174.3	151.1	151.4	5.216	145.1	196.1	168.9	169.3	7.097
All surveys	127	5247	12	2592	79959702	23.8	180.7	150.3	150.66	5.151	58.9	207.7	168.1	168.6	6.748



Gippsland Seismic Amplitudes
>1,000 m water depth

G01a (Northern fields)
Tuskfish
Elver
Bazzard
Oscar
HGP

10-Dec-2018

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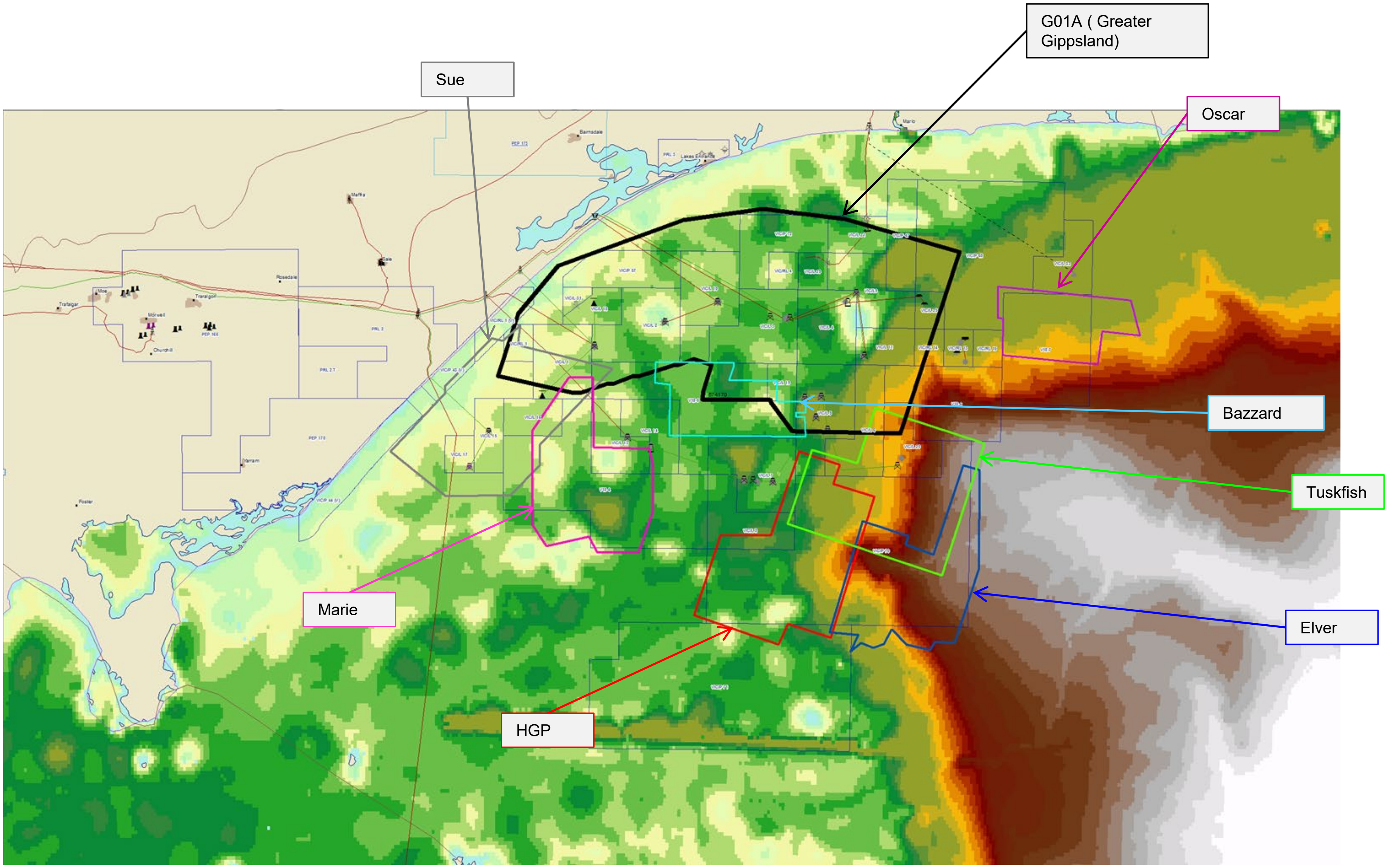
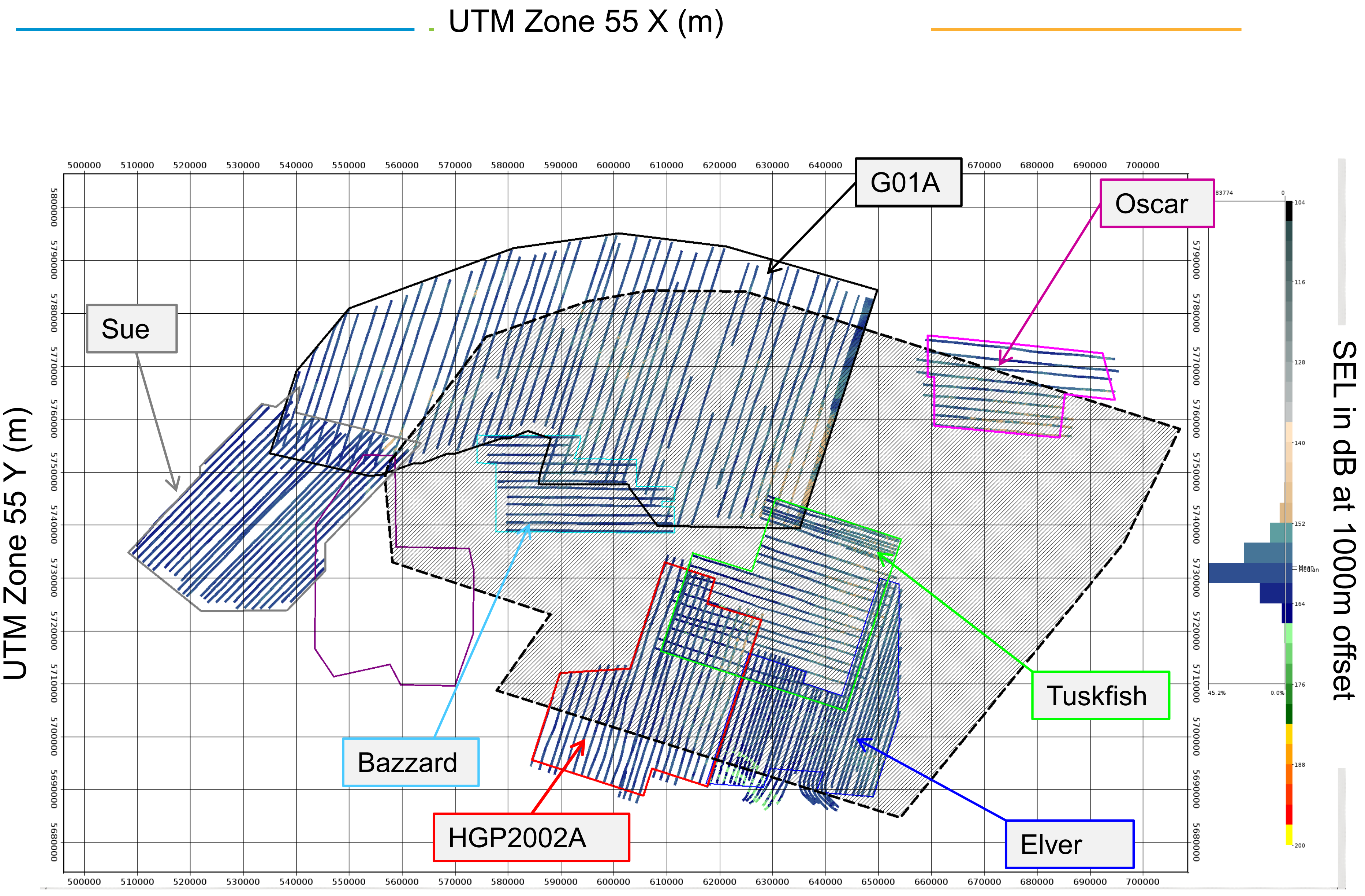
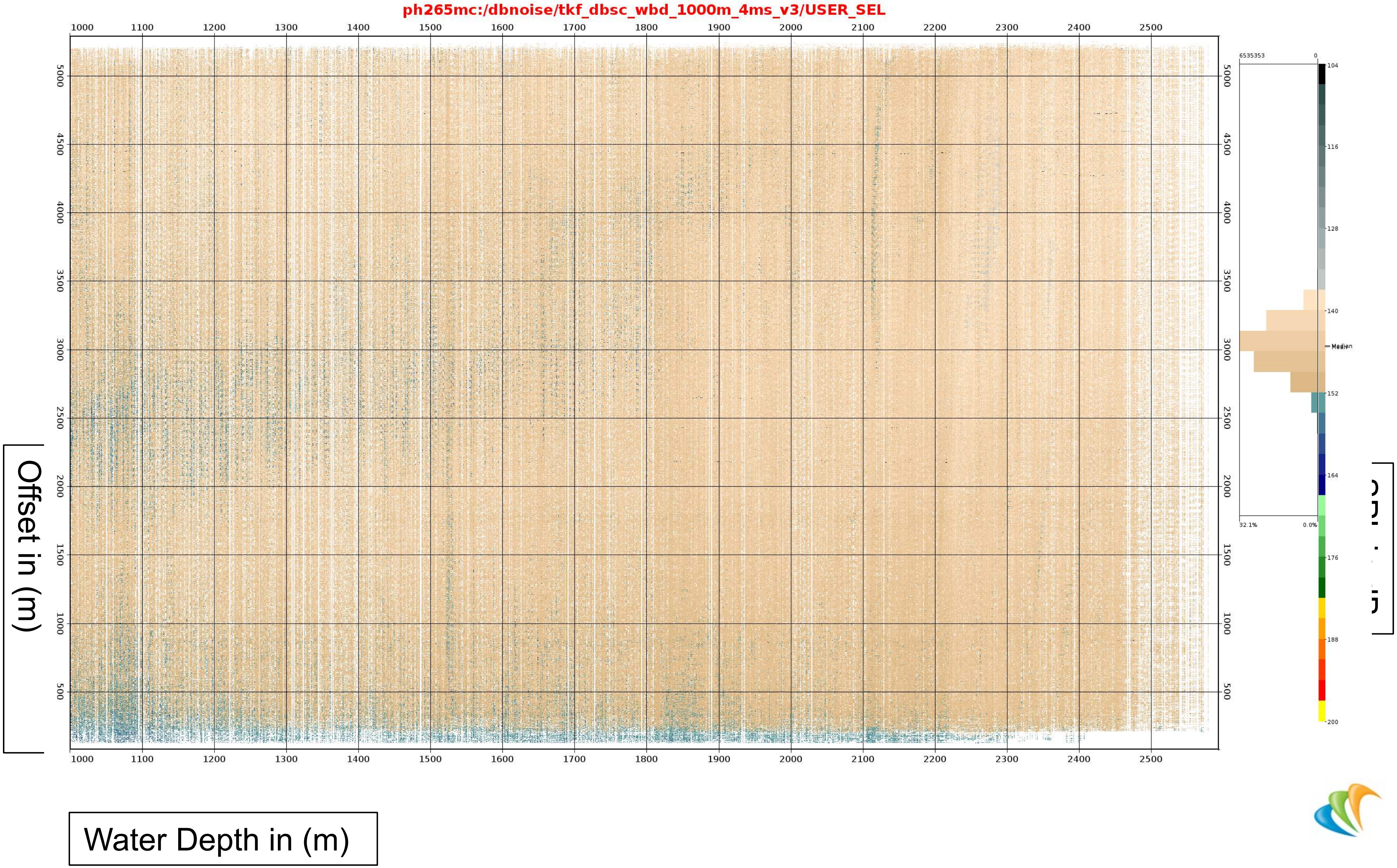

G01A (Greater Gippsland)
Sue
Oscar
Bazzard
Tuskfish
Marie
Elver
HGP

Location of analyzed data from Legacy Surveys: Gippsland Full Fold area overlay

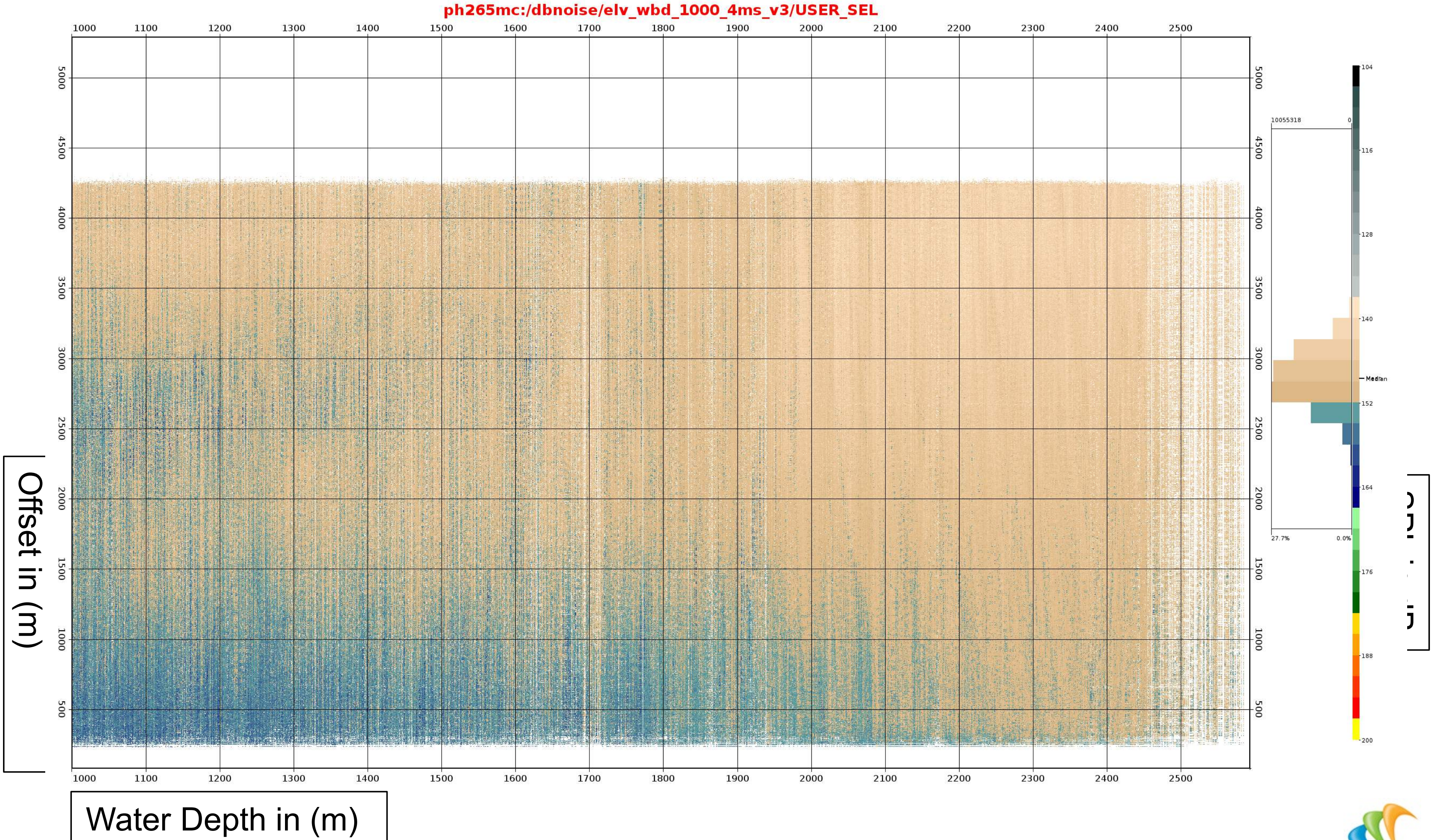


SEL
Water Depth
1000 m

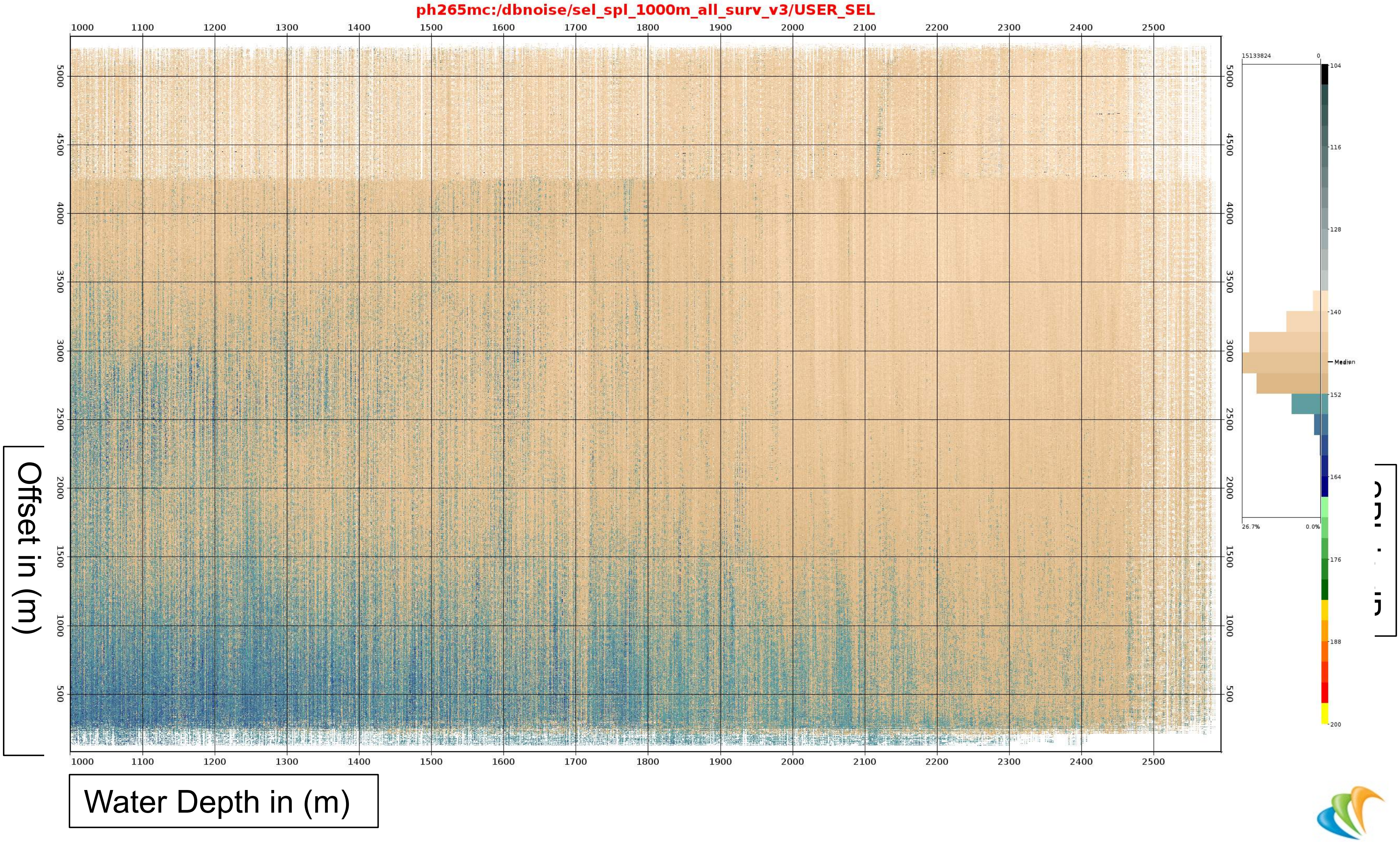
Survey: Tuskfish
Shot water depth: 1000 m



Survey: Elver
Shot water depth: 1000 m



Survey: All surveys
Shot water depth: 1000 m



SPL
Water Depth
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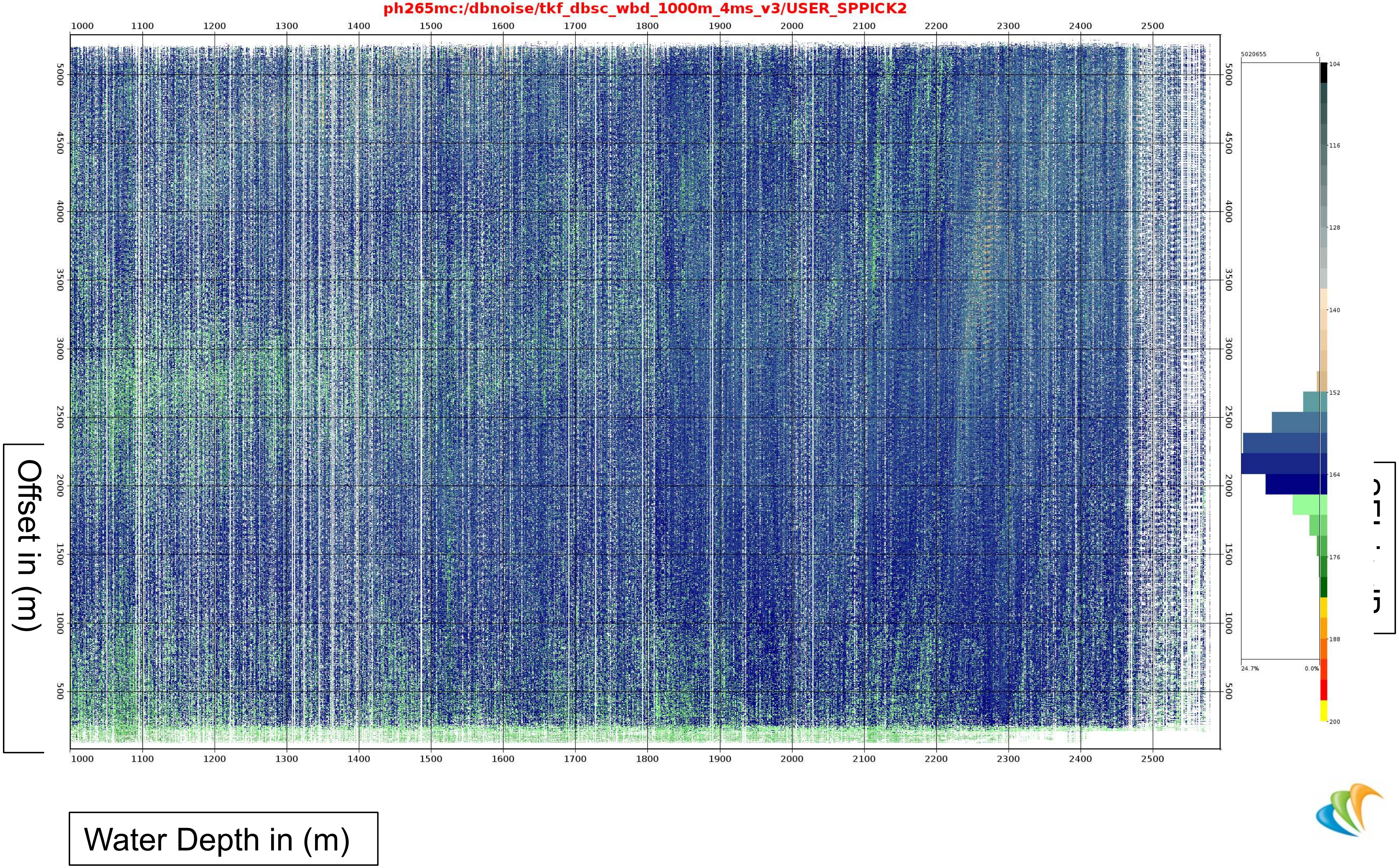
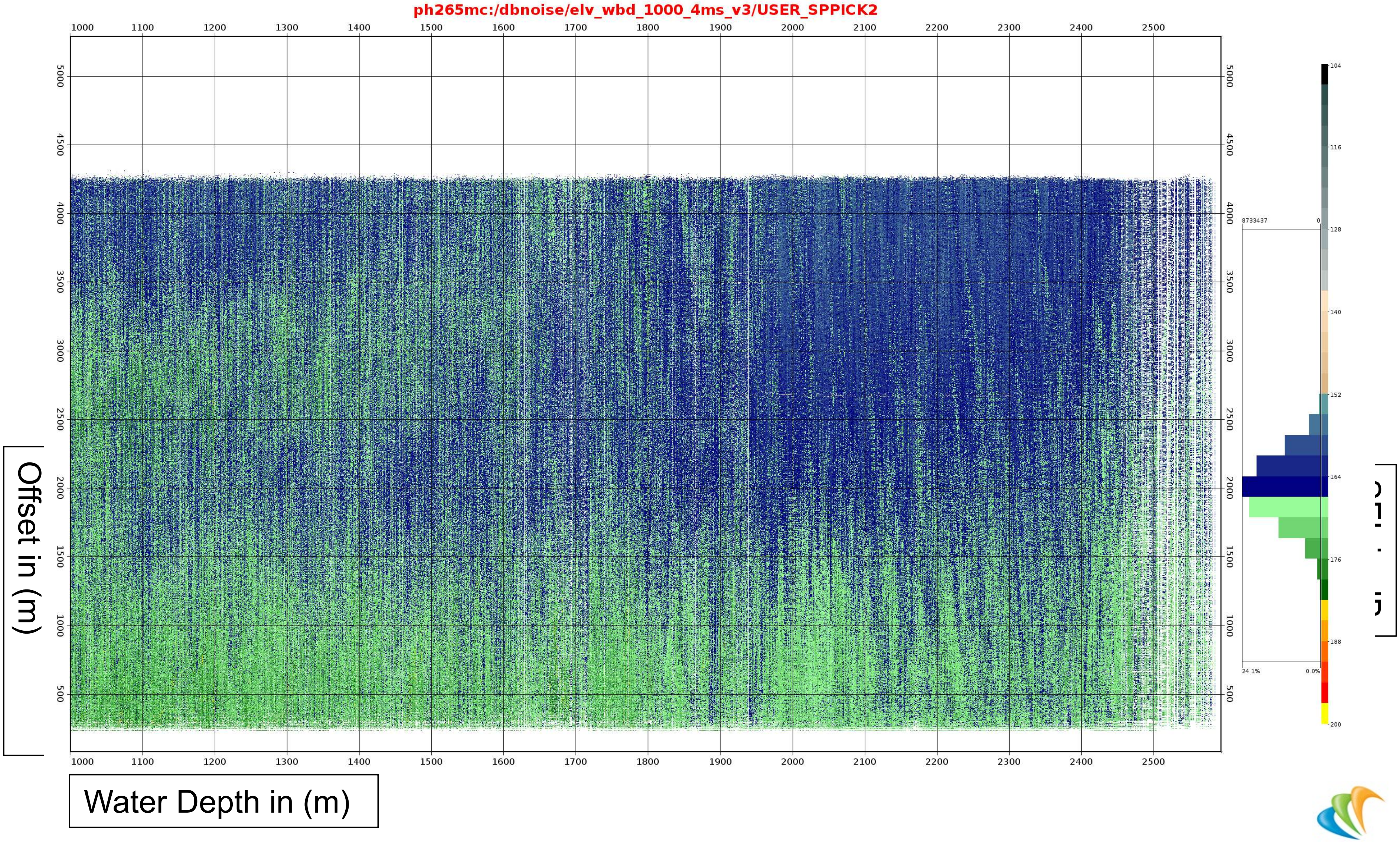
Survey: Tuskfish
Shot water depth: 1000 m



Survey: Elver
Shot water depth: 1000 m



Survey: All surveys
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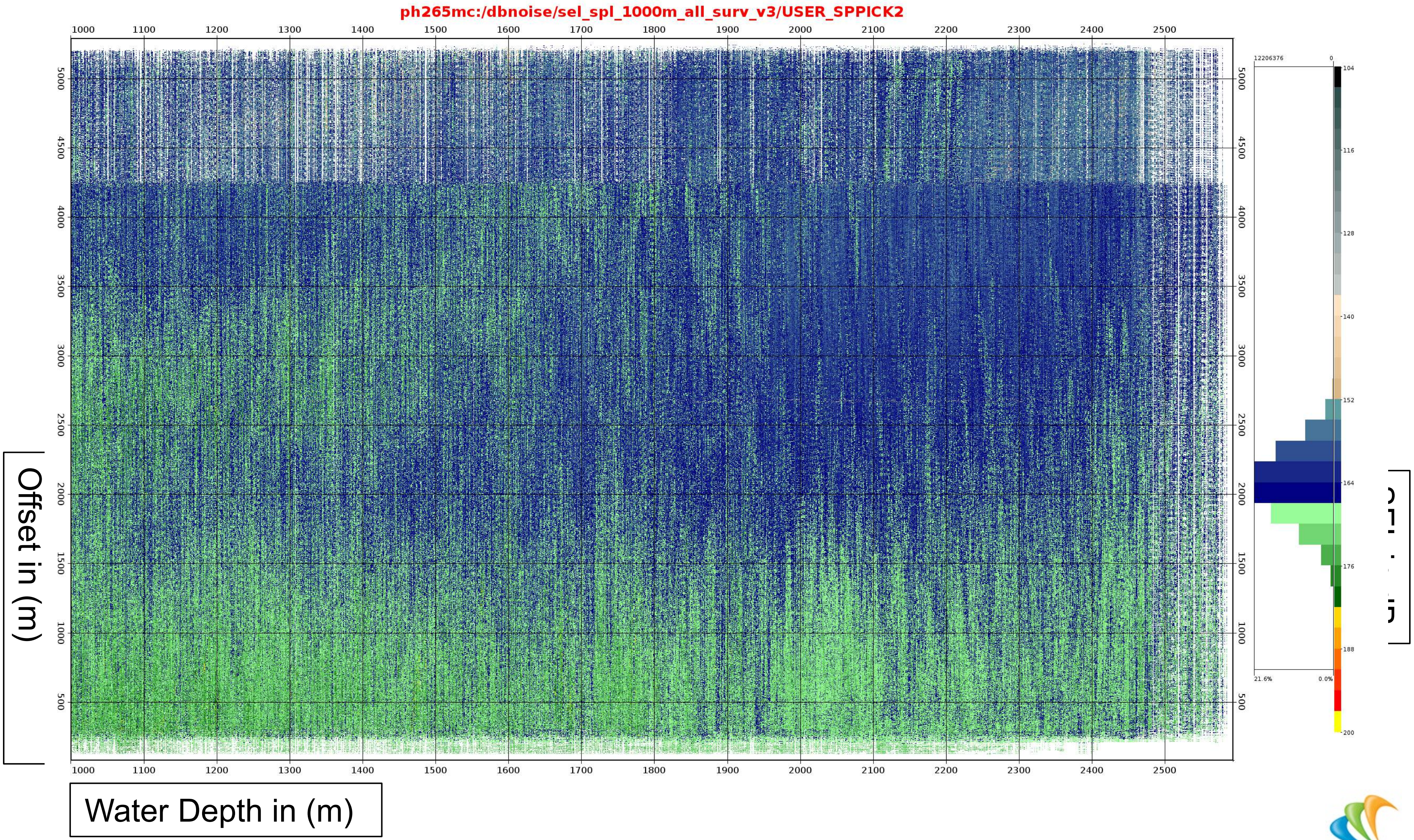

Acquisition parameters

Survey	Vesssel	Area km2	Azimuth	Trace length (ms)	lcf field	HCF field	No. Guns	source sepration (m)	sp interval (m)	source depth (m)	Nom pressure	total per gun (cu. In)	cable depth	Reciever sensitivity V/Bar	Spherical diveregence removal	Scalars applied to nav mereged data	Additional gain removal as per Acqustion report
G01A Northern Fields	Geco Beta	3900	85/265	6144	3/18	180/72	2	50	18.75	6	2000	3542	6	20 V/Bar	T^2	Scale 0.001	0
Tuskfish	Western monarch	530	108	6500	2/12	206 / 264	2	50	18.75	8	2000	3000		14 V/Bar		Scale 0.001	0
Elver	western trident	657	17.89/197.898	6000	2/12	206/264	2	50	18.75	7	2000	3147	8	13.8 V/Bar	N/A	Scale 0.001	6
Sue	western trident	1066	44.56/224.566	5000	2/12	206/264	2	50	18.75	8	2000	3000	8	13.8 V/Bar	N/A	Scale 0.001	6
Bazzard	western trident	470	090/270	5120	2/12	206/264	2	50	18.75	7	2000	3000	8	13.8 V/Bar	N/A	Not applied	6
Oscar	western trident	493	95.75/275.785	5000	2/12	206/264	2	50	18.75	7	2000	3000	7	13.8 V/Bar	N/A	Not applied	6
HGP	Geco Beta	996	198/18	6000	3/18	180/72	2	50	18.75	7	2000	3542	8	20 V/Bar	N/A	Not applied	0

Statistics

					For Water bottom Range 1000 m and greater										
Survey	Offset		Water depth		Number of samples	SEL (DB)					SPL(dB)				
	Min	Max	Min	Max		Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD
G01A2	173	4907	12	572											
Tuskfish	127	5247	72	2579	20333447	23.8	169.9	145.1	145.236	3.613	58.9	188.5	161.5	161.74	4.666
Elver	234	4358	110	2592	36282880	115.1	167.8	148.5	148.4	3.759	129.6	189.3	165.9	165.9	4.653
Sue	236	5084	19.1	57.6											
Bazzard	237	5082	59	79.9											
Oscar	236	5104	120	607											
HGP	168	4842	70.9	785.4											
All surveys	127	5247	12	2592	56616327	23.8	169.9	147.2	147.3	4.017	58.9	189.3	164.3	164.4	5.059

RPS

Appendix E

Commercial fisheries overview

Appendix E Overview of commercial fisheries relevant to the Gippsland MSS

Commonwealth managed fisheries

The Australian Fisheries Management Authority (AFMA) manages Commonwealth fisheries under the *Fisheries Management Act 1991*. The gross value of production of Commonwealth fisheries was $439 million in 2015–16, accounting for 14.5% of Australia's total fisheries and aquaculture production (ABARES 2017).

There are seven Commonwealth-managed commercial fisheries that intersect the Activity EMBA:

- Bass Strait Central Zone Scallop Fishery (BSCSF)
- Eastern Tuna and Billfish Fishery (ETBF)
- Eastern Skipjack Tuna Fishery (ESTF)
- Small Pelagic Fishery (SPF)
- Southern and Eastern Scalefish and Shark Fisheries (SESSF)
  - Commonwealth Trawl Sector (CTS)
  - Gillnet, Hook and Trap Sector (GHaTS)
- Southern Bluefin Tuna Fishery (SBTF)
- Southern Squid Jig Fishery (SSJF).

Up-to-date assessments of these fisheries are provided in the ABARES fisheries reports (available at this link). Relative catch levels of all Commonwealth fisheries from 2014-2016 are shown in Figure C1 (Patterson et. al 2017). The area within which the Activity EMBA lies is an area of generally low to medium relative catch levels.

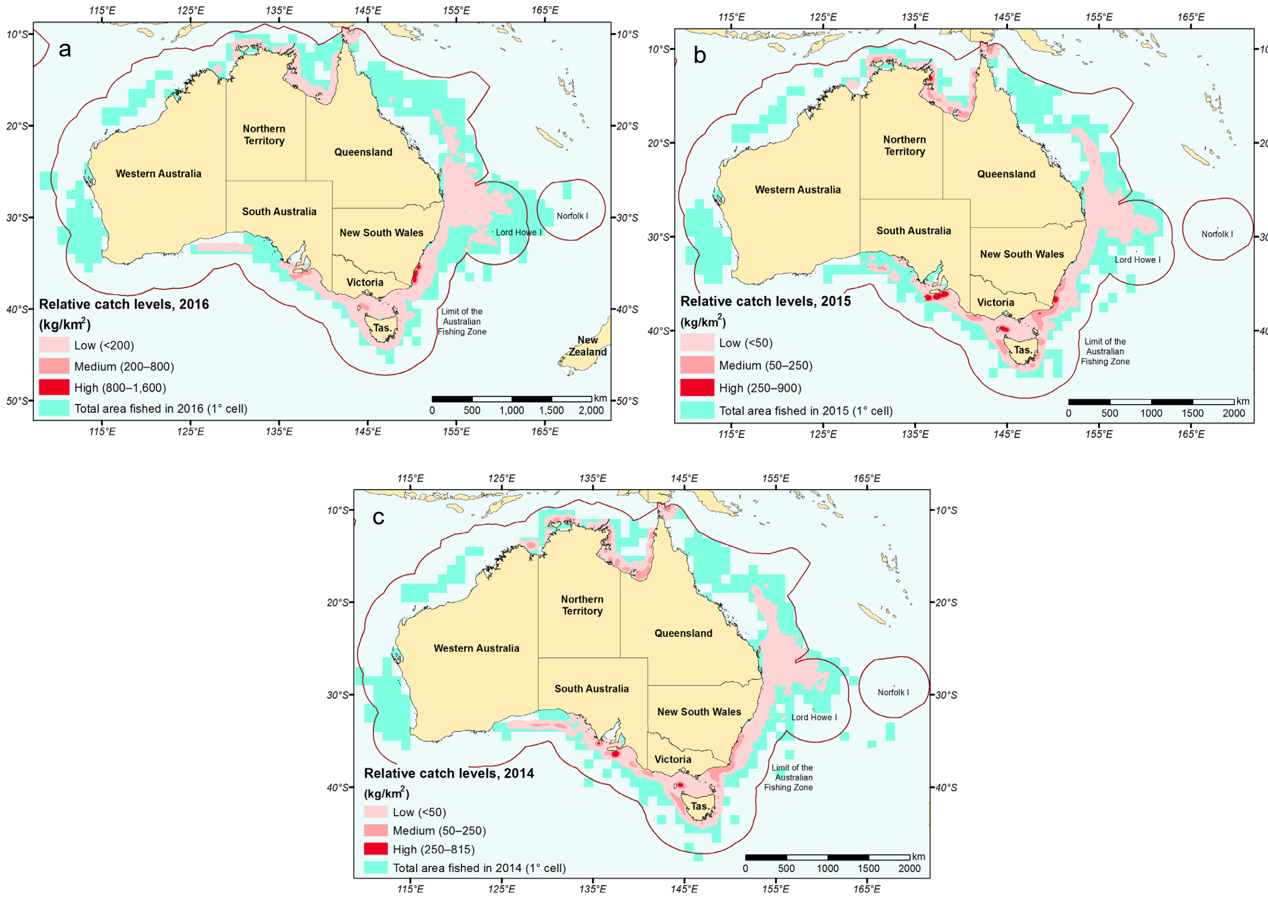

Figure E.1 Relative catch levels for Commonwealth managed fisheries 2014–2016

Bass Strait Central Zone Scallop Fishery

The Bass Strait Central Zone Scallop Fishery (BSCZSF) operates in the Bass Strait above Tasmania and extends from the VIC–NSW border, around southern Australia to the VIC–SA border. The fishery is located between the VIC and TAS scallop fisheries that lie within 20 NM of their respective coasts (Figure E.2). The target species of the fishery are commercial scallops, fished using the dredging method. Commercial scallops are mainly found at depths of 10-20 m, occurring down to 60 m in the Bass Strait (DAWR 2018). The season for the Bass Strait Central Zone Fishery will be 19 July to 31 December in 2018 (http://www.afma.gov.au/fisheries/bass-strait-central-zone-scallop-fishery/bass-strait-central-zone-scallop-fishery-2018-fishing-season/ accessed 13 Aug 2018). Catches by this fishery vary significantly (Figure E.2) and in 2015 and 2016 were 2,260 and 2,885 t, respectively (Patterson et. al 2017). The number of fishing vessels in this fishery has dropped significantly in recent years with only twelve active vessels in 2016 (Patterson et. al 2017). Although the management area of the fishery overlaps the Activity EMBA, no effort was recorded in this area in 2016 (Figure E.2) and industry advice indicates that this is also likely to be the case in 2018 because recent surveys have revealed no significant beds of scallops and little evidence of recruitment (Koopman et. al, 2018 in SETFIA 2018).

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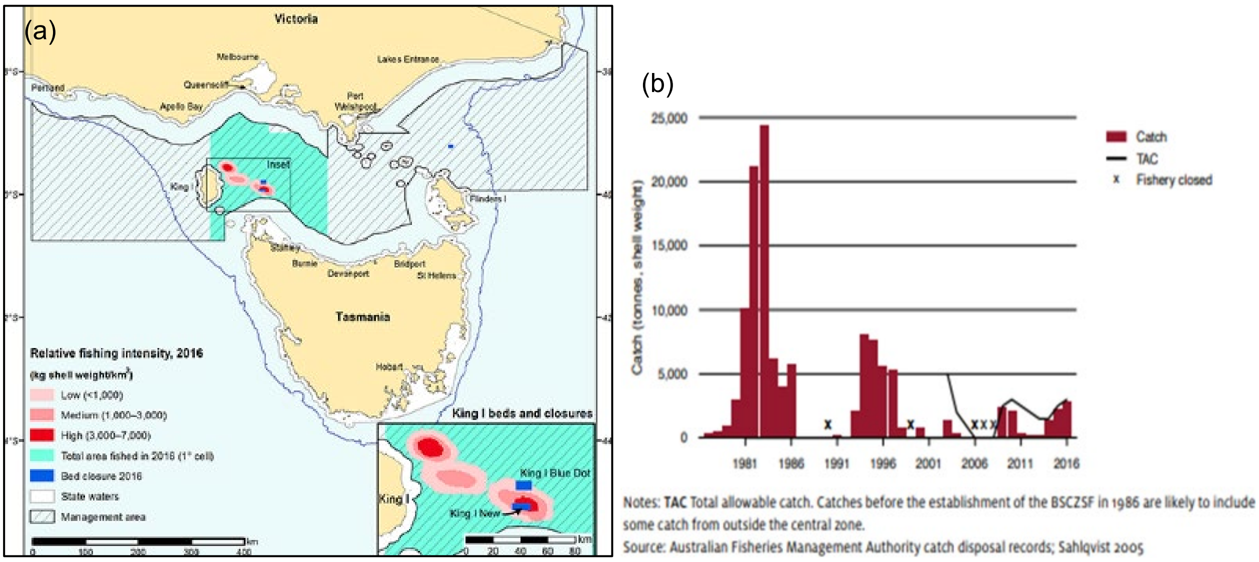


Figure E.2 (a) Area and relative fishing intensity in the Bass Strait Central Zone Scallop Fishery, 2016 and (b) catch and TAC of commercial scallop in the BSCZSF, 1977 to 2016

Eastern Tuna and Billfish Fishery

This Eastern Tuna and Billfish Fishery (ETBF) operates throughout the EEZ, from Cape York in north QLD to the VIC–SA border, including waters around TAS and the high seas of the Pacific Ocean (Figure E.3). Target species are albacore tuna, bigeye tuna, yellowfin tuna, broadbill swordfish and striped marlin, captured using longline and minor line (including handline, troll, rod and reel) (Patterson et al. 2017). The fishing season typically extends over 12 months, however in 2018 it will run for 10 months from 1 March to 31 December (http://www.afma.gov.au/fisheries/eastern-tuna-and-billfish-fishery-page/ accessed 13 August 2018).The species caught in this fishery are also caught in many other countries, and Australia's catch is a very small part of the total catch internationally. Management of the ETBF is via total allowable catches allocated as individual transferable quotas. The number of active vessels has decreased substantially in the past decade (from around 150 in 2002 to 37 in 2016). Total catch in the fishery during 2015 and 2016 was 5,408 and 5,139 t, respectively (Figure E.3). Less than five vessels in this fishery fished within the Activity EMBA between 2008 to 2017 (SETFIA 2018), with no fishing in this area during 2016 (Figure E.3). The ETBF has traditionally focussed on waters further north than the Activity EMBA as this is the preferred habitat of the target species, and it is unlikely that this will change in the near future (SETFIA 2018).

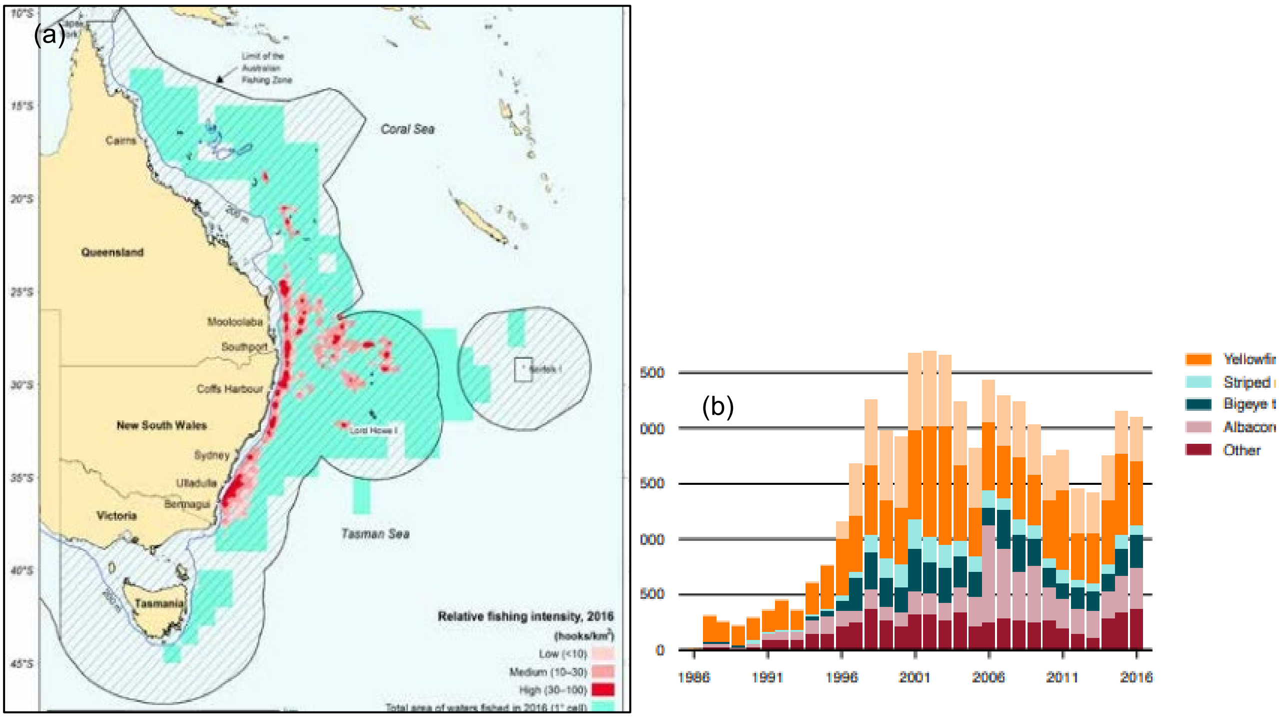


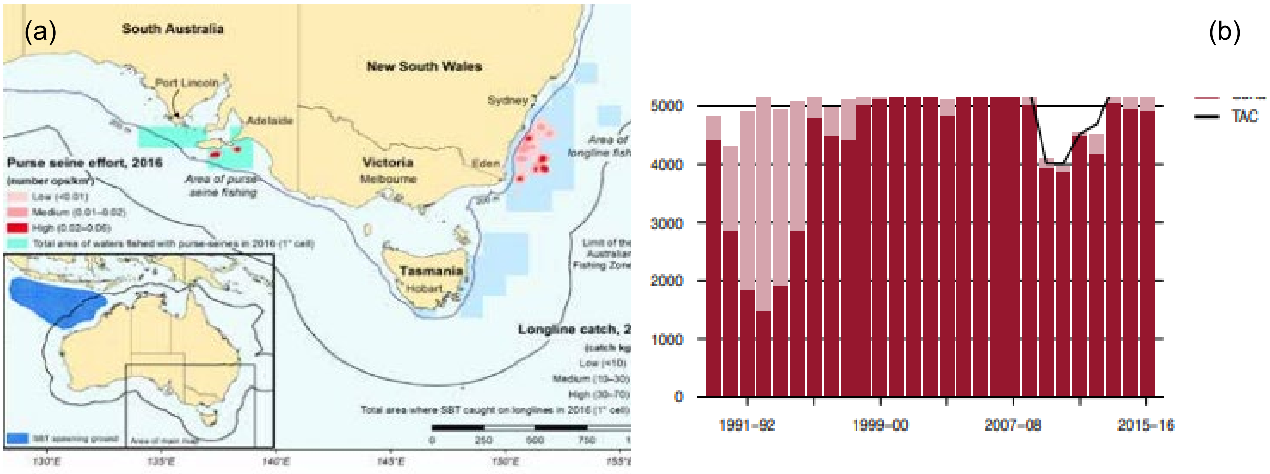
Figure E.3 (a) Relative fishing intensity in the Eastern Tuna and Billfish Fishery, 2016 and (b) total catch (from logbook data) for all methods, by species, in the ETBF, 1987–2016

Skipjack Tuna Fishery

The Skipjack Tuna Fishery (STF) is split into east and west sectors, with the east sector extending through the same area as the ETBF described above. The target species is skipjack tuna, with most caught using purse-seine gear. Australian waters are at the edge of the species range and as such catches are highly variable (Patterson et. al 2017). There has been no fishing effort in the broader STF since the 2008-09 fishing season during which time effort was focussed in South Australia (http://www.afma.gov.au/fisheries/skipjack-tuna-fishery/ accessed 14 Aug 2018).

Southern Bluefin Tuna Fishery

The Southern Bluefin Tuna Fishery (SBTF) operates in all AFZ waters (3–200 nm). The target species is the southern bluefin tuna. Most of the Australian catch is taken in the Great Australian Bight, with small amounts taken off south-east Australia (Figure E.4; Patterson et al. 2017). The SBTF targets surface-schooling juveniles, mainly using purse seine gear, although pelagic longlines are also used in east coast waters (Patterson et.al 2017). The number of longline vessels fishing for southern bluefin tuna off the east coast has been variable over time and largely dependent on available quota. In 2016 the catch was 5, 636 t, with recent data showing that the fishery is not operating within the Activity EMBA (Figure E.4; Patterson et al. 2017).



: TAC Total allowable catch.

Figure E.4 (a) Purse-seine effort and longline catch in the Southern Bluefin Tuna Fishery, 2016 and (b) Southern bluefin tuna catch and total allowable catch (Australia), 1989–1990 to 2015–2016

Southern and Eastern Scalefish and Shark Fishery

The Southern and Eastern Scalefish and Shark Fishery (SESSF) is a multisector, multigear fishery that targets a variety of finfish, squid and shark stocks. The management area covers almost half of the AFZ, with the Commonwealth Trawl, the Gillnet, Hook and Trap, and the Scalefish Hook Sectors of the SESSF overlapping the Activity EMBA (Figure E.5; Patterson et. al 2017). More than 100 species are regularly landed in the SESSF but only the main species are managed under quotas. At present there are 34 fish stocks subject to total allowable catches (TACs; Table E.1). Only those in bold are generally found in the vicinity of the Activity EMBA (SETFIA 2018). The *Southern and Eastern Scalefish and Shark Fishery (SESSF) Management Arrangements Booklet* (CoA 2018) is a guide to the management arrangements that will apply to SESSF concession holders in the 2018-19 fishing year. This document describes species specific stock rebuilding strategies for several species listed in Table E.1, including for eastern gemfish, school shark and blue warehou. These strategies include a prohibition of targeted fishing of these species. There are also voluntary catch restrictions for pink ling and closed areas to fishers not included in this restriction (including Seiner's Horseshoe located within the Activity EMBA (Figure E.13). In addition there is a 200 kg trip limit for the capture of snapper by the Commonwealth Trawl Fishery in waters relevant to Victoria.

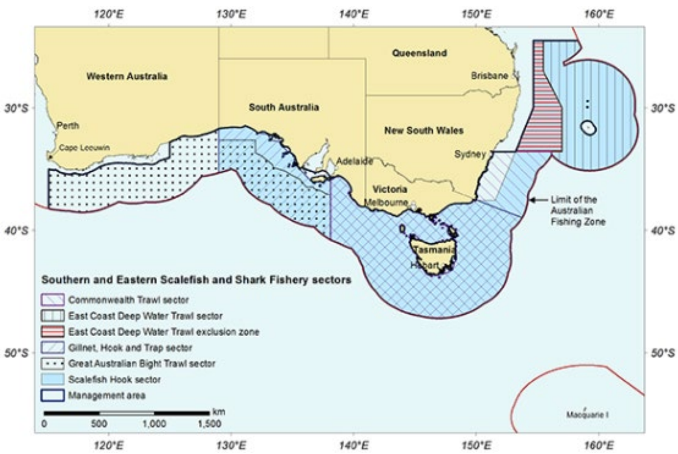


Figure E.5 Area and sectors of the Southern and Eastern Scalefish and Shark Fishery

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Table E.1 2018–2019 TACs (whole fish unless otherwise stated) for SESSF quota species (AFMA, 2018 in SETFIA 2018)

Species	TAC (t)	Species	TAC (t)
Alfonsino	1,017	Orange roughy (GAB)	50
Bight redfish (GAB)	800	Orange roughy (Cascade)	500
Blue eyed trevalla	462	Orange roughy (east)	698
Blue grenadier	8,810	Orange roughy (south)	53
Blue warehou	118	Orange roughy (west)	60
Deepwater flathead (GAB)	1,128	Oreo (smooth Cascade)	150
Deepwater shark (east)	23	Oreo (smooth other)	90
Deepwater shark (west)	264	Oreo (basket)	185
Elephant fish	114	Pink ling	1,117
Flathead	2,501	Redfish	100
Gemfish east	100	Ribaldo	430
Gemfish west	200	Royal red prawn	381
Gummy shark	1,736	Saw shark	430
Jackass morwong	505	School shark	215
John dory	263	School whiting	820
Mirror dory	253	Silver trevally	307
Ocean perch	241	Silver warehou	600

Note: Species that are likely to be caught in the operational area are underlined

Commonwealth Trawl Sector

The Commonwealth Trawl Sector (CTS) extends from Sydney southwards around Tasmania to Cape Jervis, SA. The sector catches a range of fish species but target species include pink ling, blue grenadier, flathead and silver warehou (Patterson et al. 2017). The fishery operates year-round using demersal otter trawl and Danish seine nets. Effort of this fishery is widely distributed, however since 2005 – after the closure to trawling of most SESSF waters deeper than 700 m – the effort has become increasingly concentrated on the shelf rather than the slope or in deeper water (Patterson et al. 2017). Catch effort for 2016-17 in the CTS resulted in 7,634 t caught (Patterson et. al 2017). This catch and effort is low compared to historic levels, with the relative proportion caught by Danish seine increasing (Figure E.6). There are 57 boat statutory fishing rights allocated in the CTS, although in 2015-16 and 2016-17 the number of active vessels were 37 and 34, respectively. Recent catch effort data shows the fishery is operating within the Activity EMBA, and this area includes the main fishing area of Danish seiners (Figure E.7, Figure E.8). The number of Dutch seiners within this area has ranged from 13 – 16 between 2008 and 2017. The top two species landed by these vessels (by weight) were tiger flathead and eastern school whiting (SETFIA 2018).

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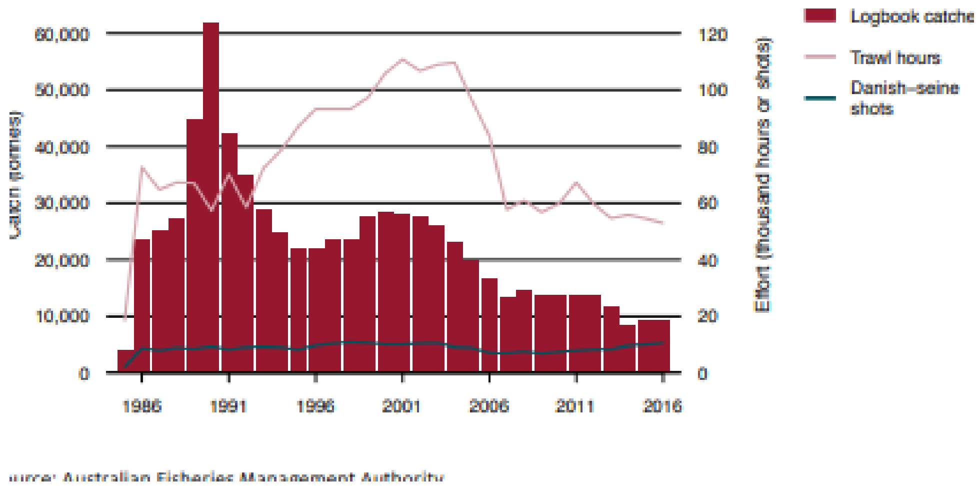

Figure E.6 Total catch and fishing effort for the CTS, 1985–2016

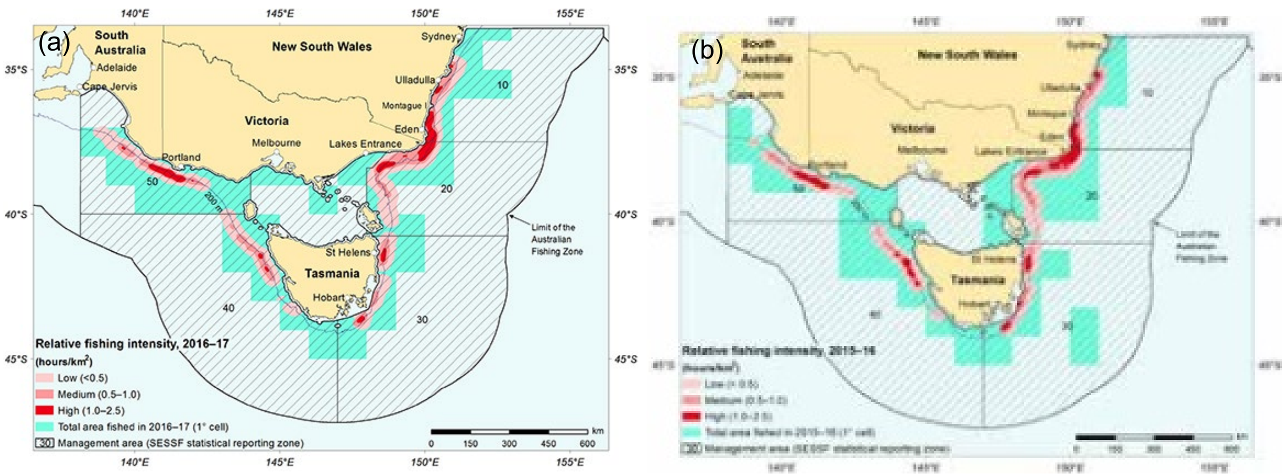

Figure E.7 Relative fishing intensity for the Commonwealth Trawl Sector, a) 2016–2017 and b) 2015–2016

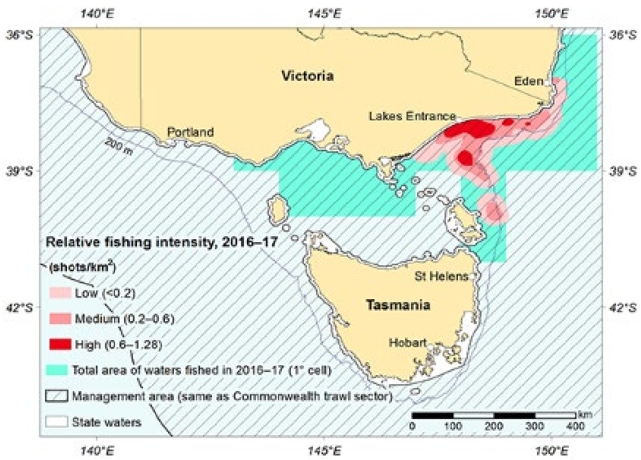

Figure E.8 Relative fishing intensity by Danish-seine operations in 2016–2017

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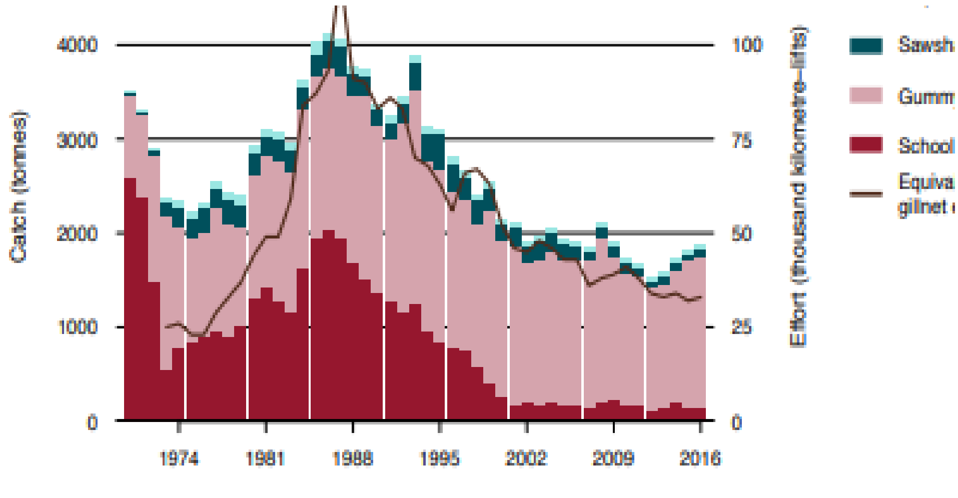
Shark Gillnet and Shark Hook Sectors

The Shark Gillnet and Shark Hook Sectors (SGSHS) of the SESSF extend from the NSW – VIC border to the SA – WA border. the fishery targets gummy shark but catches various bycatch species such as school shark, elephant fish and sawsharks. The fishery operates year round using demersal gillnet and longline (Patterson et. al 2017). Before spatial closures, which have been progressively implemented since 2003 to protect pupping areas and reduce the risk of interaction with Australian sea lions and dolphins, effort in the SGSHS was spread across the waters of SA and eastern Victoria. However, spatial closures have resulted in gillnet effort becoming concentrated in Victorian waters (Patterson et. al 2017). The fishery is managed using a combination of input and output controls including current closures of waters deeper than 183 m to gillnet fishing and closure of waters shallower than 183 m to auto-longlining fishing (Patterson et. al 2017).

Total catches by the SGSHS during 2015-16 and 2016-17 were 2,233 and 2,118 t, respectively, and remain relatively low compared to historic levels (Figure E.9). The number of gillnet permits in the sector was 61 during 2015-16 and 2016-17 although the number of active gillnetting vessels was 37 and 36, respectively, in these years (Patterson et. al 2017). Relative fishing intensity by the shark gillnet sector was high in western parts of the Activity EMBA (Figure E.10), but low by the shark hook sector for the same area (Figure E.11). Gillnet fishing effort in the Activity EMBA is also highly seasonal, peaking in May and low from September through to April (Figure E.12; SETFIA 2018).



Note: 'Equivalent gillnet effort' is an estimate of total effort after converting hook effort to the equivalent

Figure E.9 Annual landings and effort in the SGSHS by species, 1970–2016

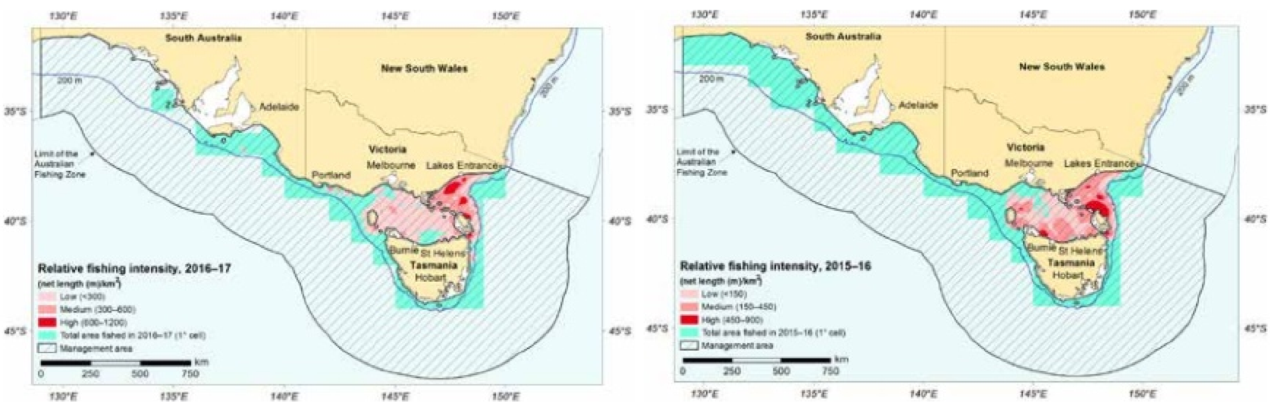


Figure E.10 Relative fishing intensity in the Shark Gillnet Sector, during 2016–2017 and 2015–2016

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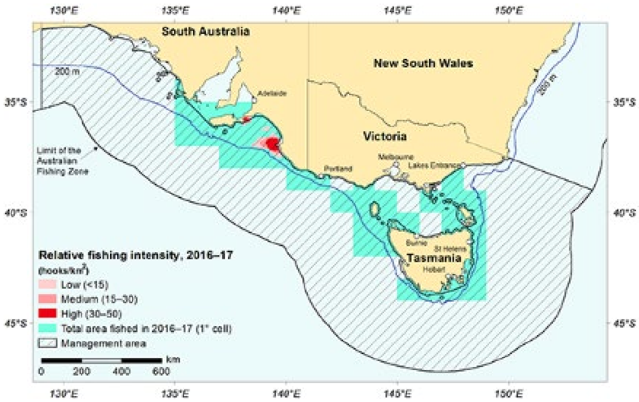

Figure E.11 Relative fishing intensity in the Shark Hook Sector, during 2016–2017

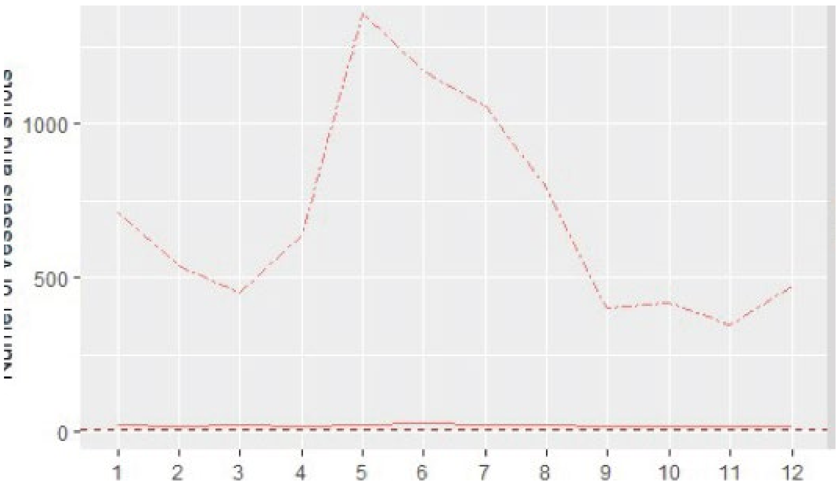

Figure E.12 Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) within the activity EMBA in each year from 2008–2017 by the Shark Gillnet Sector

Scalefish Hook Sector

The Scalefish Hook Sector (SHS) extends from Sydney southwards around TAS to the SA–WA border (Patterson et. al 2017). The key species targeted by the fishery are the same as the CTS and include mixed fish species, particularly blue-eyed trevalla, pink ling, blue grenadier, flathead and silver warehou. Because of this overlap, catch and effort statistics for the SHS are reported with data for the CTS despite the sector being managed as part of the Gillnet, Hook and Trap Sector of the SESSF. The SHS operates year round employing a variety of longline and dropline hook fishing methods, some of which are automated (Patterson et. al 2017).

There are currently 37 scalefish hook statutory fishing rights, with 18 and 17 vessels actively fishing in the sector during 2015-16 and 2016-17, respectively (Patterson et al. 2017). Because 100% and 74% of the TAC for two target species for this fishery (blue-eyed trevalla and pink ling, respectively), were caught during the 2016-17 season it is unlikely that there will be a significant increase in fishing effort by this fishery (SETFIA 2018). Effort by this fishery is widely distributed but concentrated in shelf and slope waters (<800 m). There is also an area closure in deeper waters within the Activity EMBA to protect pink ling stocks (Figure E.13). Automatic longlining is not allowed in waters shallower than 183 m (Patterson et al. 2017). Catches by the SHS were 656 and 729 t in 2015-16 and 2016-17, respectively (Patterson et al. 2017). These catches, and associated effort are at historically low levels (Figure E.14). Relative fishing intensity by the sector during these years was relatively low within the Activity EMBA (Figure E.15).

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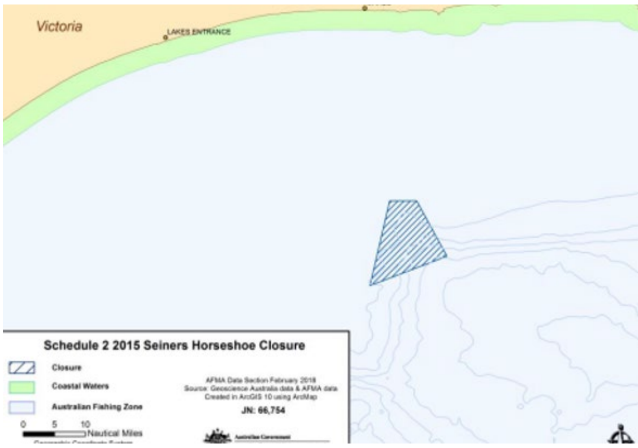

Figure E.13 Pink ling area closure – all fishing methods

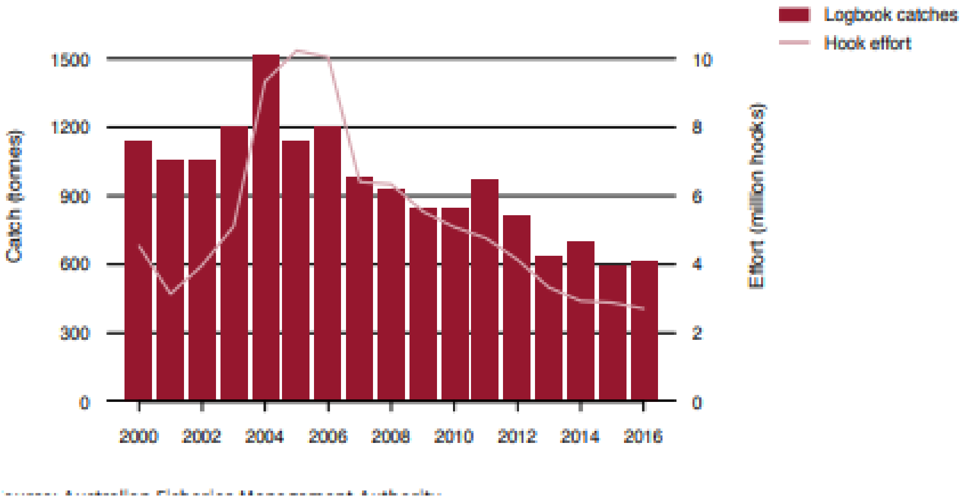

Figure E.14 Total catch and fishing effort for the SHS, 2000–2016

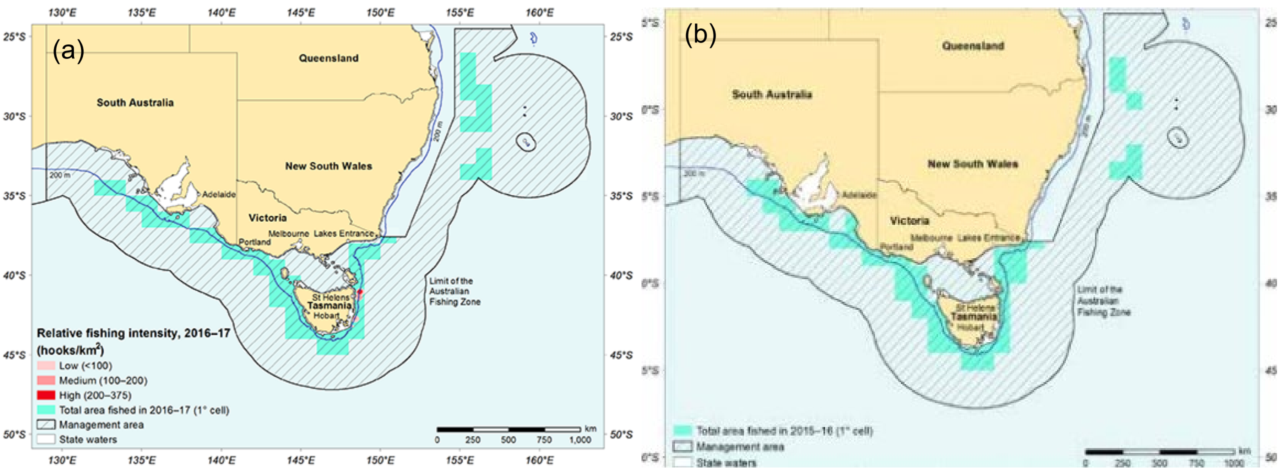

Figure E.15 Relative fishing intensity for the Scalefish Hook Sector, (a) 2016–2017 fishing season (b) 2015–2016 fishing season

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Small Pelagic Fishery

The Small Pelagic Fishery (SPF) encompasses AFZ waters from the QLD–NSW border across southern Australia to Lancelin, WA (DAWR 2018c). The fishery operates year round. Purse seining has been the main fishing method historically although midwater trawling has become more important since 2002 (Patterson et. al 2017). The fishery is managed using a combination of input and output controls.

The three main target species of the SPF west of Tasmania are jack mackerel, blue mackerel and redbait (Ward and Grammer 2018). These species are widespread. The mackerel species are found on continental shelf waters whilst redbait are captured to depths of 400 m. Generally a single species will be targeted during fishing operations. Catches in the SPF have historically been as high as 42,000 t in 1986-87, but in 2015-16 and 2016-17 were 8,038 and 12,004 t, respectively. Although 32 entities held quota in 2015-16 and 2016-17, there were only three active vessels in both years (Patterson et. al 2017). Data on the spatial location of catches show that the fishery did not operate within the area of the Activity EMBA during 2015-2016 and 2016-17 (Figure E.16). Recent effort in the fishery has been focussed in NSW and SA waters (SETFIA 2018).

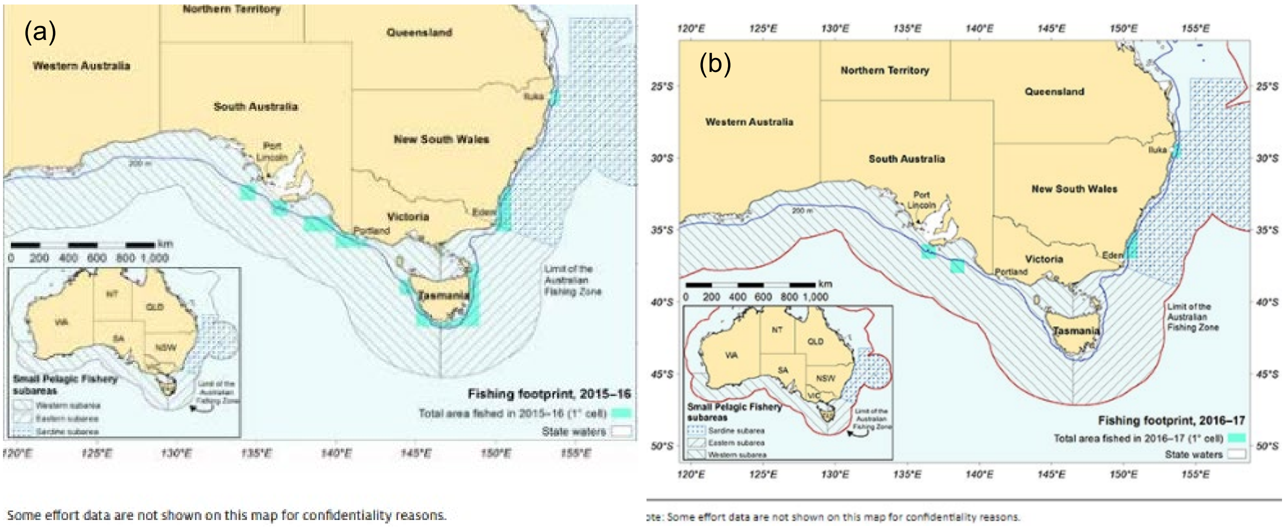

Figure E.16 Area fished in the Small Pelagic Fishery during (a) 2015–2016 and (b) 2016–2017

Southern Squid Jig Fishery

Jurisdiction of the Southern Squid Jig Fishery (SSJF) extends across AFZ waters adjacent to SA, TAS, NSW, VIC and southern QLD however most fishing occurs in continental shelf waters near Portland, VIC (Patterson et. al 2017). SSJF vessels typically operate at night in depths of 60 to 120 m using the jigging method. The fishery operates year round although fishing generally occurs from January to June. Squid are also caught in the CTS by demersal trawling (Patterson et. al 2017). The target species of the SSJF is Gould's squid, which occurs as a single biological stock throughout southern Australian water. Because of the fisheries highly variable stock and recruitment parameters, the SSJF harvest strategy relies on within-season monitoring against catch triggers for the jig and trawl sectors.

There were seven vessels actively fishing using squid jigs in both 2015 and 2016 (Patterson et. al 2017). The numbers of vessels in the fishery varies considerably but has shown a downward trend through time (Figure E.16). Annual catches have fluctuated between 1,569 t in 2005 and 2 t in 2014 (Figure E.17). In 2016, 384 and 597 t of squid were captured in the SSJF and combined trawl fisheries, respectively (Patterson et. al 2017). Recent data on fishing intensity demonstrate the broad area over which squid are caught, particularly by trawlers. Fishing effort within the Activity EMBA by the SSJF was low but higher by the CTS (Figure E.18). Nine different vessels fished in the Activity EMBA, landing 120 t over 96 days during 2008 – 2017 (SETFIA 2018).

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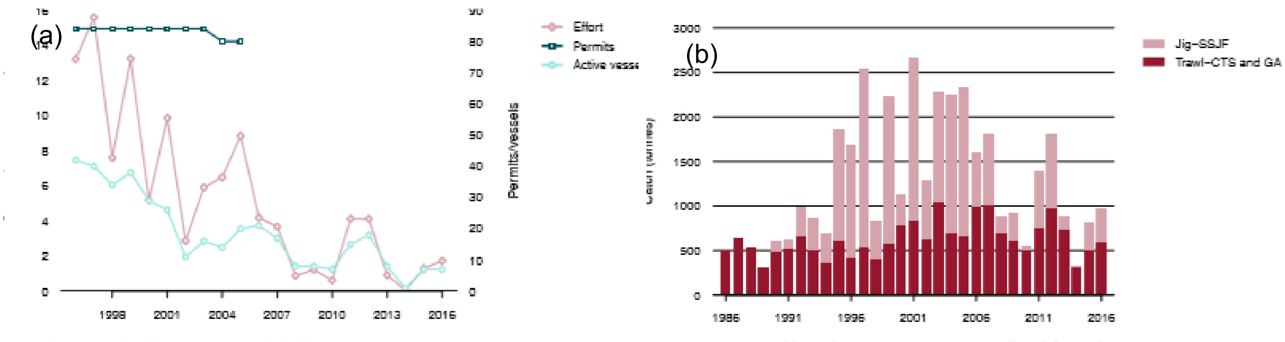

Figure E.17 (a) Effort, number of permits and number of active vessels in the SSJF, 1996 to 2016, and (b) squid catches in the SSJF, CTS and the GABTS, 1986 to 2016

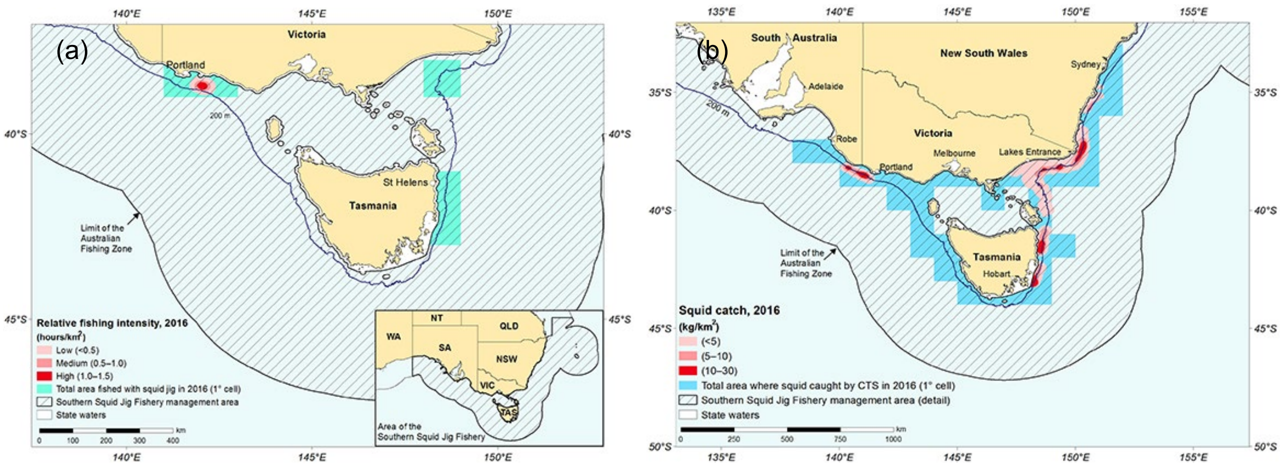

Figure E.18 (a) Relative fishing intensity in the Southern Squid Jig Fishery, 2016 and (b) Commonwealth Trawl Sector Squid Catch, 2016

State (Victorian) managed fisheries

The Victorian Fisheries Authority (VFA) manages VIC commercial fisheries and aquaculture under the under the *Fisheries Act 1995* (VIC). The gross value of production of VIC commercial fisheries was $48.2 M in 2016–17 (https://vfa.vic.gov.au/commercial-fishing/featured/commercial-fish-production accessed 13 Aug 2018).

Jurisdictional boundaries of nine Victorian commercial fisheries intersect with the Activity EMBA:

- Rock Lobster Fishery
- Trawl (Inshore) Fishery
- Scallop (Ocean) Fishery
- Wrasse (Ocean) Fishery
- Multi-Species Ocean fishery
- Purse seine (Ocean) Fishery
- Abalone Fishery
- Giant Crab Fishery
- Sea Urchin Fishery.

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Rock Lobster Fishery

The Rock Lobster Fishery (RLF) extends along the entire Victorian coastline and across Commonwealth waters under an OCS. It is Victoria's second most valuable fishery. Commercial vessels fish nearshore waters to depths around 150 m, with the majority of catches taken in depths less than 100 m (DEDJTR 2016). This area is divided into two separately managed zones: Western Zone and Eastern Zone, with jurisdiction of the latter overlapping the Activity EMBA. In the Eastern Zone, most catch is landed through Queenscliff, San Remo and Lakes Entrance (https://vfa.vic.gov.au/commercial-fishing/rock-lobster/fishery-overview#fishery accessed 13 Aug 2018).

The key target species is southern rock lobster, considered a single biological stock throughout southern Australian waters as the species occurs in a continuous distribution across this range and has extensive and protracted pelagic larval dispersal phase (DEDJTR 2016). Baited commercial pots are the fishing method used and the primary management method is individual transferable quota units and total allowable commercial catch (TACC). The maximum number of licenses in the Eastern Zone is 47. The fishery is closed from 1 June to 15 November (females) and 15 September to 15 November (males) (https://vfa.vic.gov.au/commercial-fishing/rock-lobster/fishery-overview accessed 13 Aug 2018).

Based on stock assessment results, the TACC have been reduced across south-eastern Australia over the past decade to reduce fishing mortality. The 2015/16 TACC was 59 t. The catch was 46 t during the fishing year (November to (September) and 58 t during the quota year (July – June; Figure E.19) (DEDJTR 2016). During 2016-17 a total of 53 t was landed in the Eastern Zone, compared to 209 t in the Western Zone (SETFIA 2018). Catch and effort during 2016/17 in the Eastern Zone were highest in August and December – January (Figure E.20; SETFIA 2018).

Historic fishing data for the RLF shows very little effort (< 5 vessels) in the area of the Activity EMBA (SETFIA 2018). The small number of operators did not allow the catch by the fishery to be reported separately, however anecdotal evidence suggests that < 10% of the Eastern Zone TACC is caught from within the Activity EMBA (SETFIA 2018).

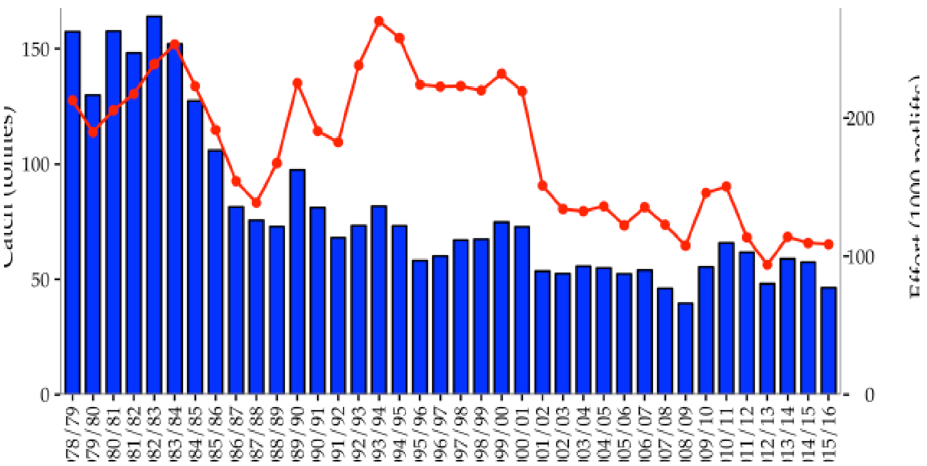


Figure E.19 Total commercial catch of southern rock lobster (blue bar; tonnes) and nominal effort (red line; ×1000 pot lifts) in the eastern zone from 1978–1979 to 2015–2016

RPS

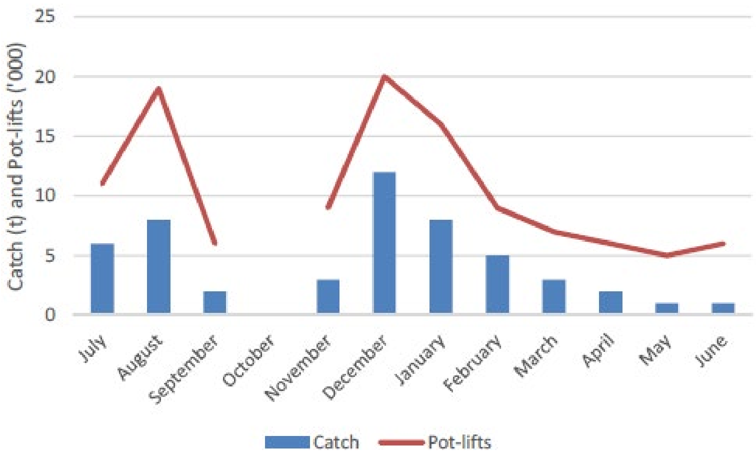


Figure E.20 Catch (t) and number of pot-lifts ('000) in the eastern zone of the Victorian Rock Lobster Fishery from 2016–2017 (VFA (2018) in SETFIA 2018)

Scallop (Ocean) Fishery

The Scallop (Ocean) Fishery (SOF) extends the length of the Victorian coastline from high tide mark to 20 nm offshore. Scallops are mostly fished from Lakes Entrance and Port Welshpool using the scallop dredge method. The target species is commercial scallop (VFA 2017). The fishery is characterised by highly variable catches (Figure E.21). It is open year-round although most fishing occurs from winter to early summer (SETFIA 2018). The fishery is managed via limited entry, gear restriction and a Total Allowable Commercial Catch (TACC). Temporary closures may also be enforced when stocks are low to allow scallop beds to recover. An abundance survey was undertaken for the eastern Victorian ocean scallop between December 2017 and January 2018 (Koopman et. al 2018). This survey included sites inshore of and just inside of the Operational Area, and of the nine potential scallop beds identified only one was considered worthy of further survey (Koopman et al. 2018). This was the first abundance survey to take place in the fishery since 2012 and the TACC was previously set at zero tonnes for the 2010/11, 2011/12 and 2013/14 years due to poor stock status. The TACC has since remained at a low level of 135 t since 2014/15 to allow for exploratory fishing. However, the recent 2017/18 survey confirmed a continued low level of abundance and recruitment throughout the fishery and the TACC has remained the same (https://vfa.vic.gov.au/commercial-fishing/scallop accessed 14 Aug 2018). It is possible that some scallop fishing will occur within the Activity EMBA in coming years, although the impact of the proposed MSS on the SOF is likely to be very low or nil (SETFIA 2018).

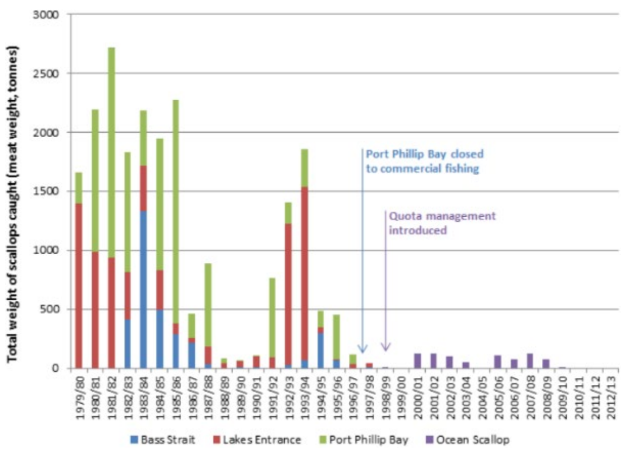


Figure E.21 Commercial catch of commercial scallop 1979 to 2014

Wrasse (Ocean) Fishery

The Wrasse (Ocean) Fishery (WOF) extends the length of the Victorian coastline from the high tide mark to 20 nm offshore (https://vfa.vic.gov.au/commercial-fishing/wrasse accessed 14 Aug 2018). The key species targeted by the fishery are bluethroat and purple wrasse. The fishery operates year round using handlines as the main fishing method. Annual catches of wrasse have been relatively stable over the past seven years at 20 – 30 t (Figure E.22). The fishery is primarily managed via limited entry, minimum size and gear restrictions. There are currently 22 WOF licenses but the majority of the wrasse harvest is taken by eight license holders. Spatial assessment of catch and effort (obtained from a Wrasse Workshop Presentation; https://vfa.vic.gov.au/commercial-fishing/wrasse accessed 14 Aug 2018) indicates that the fishery is not active in the Activity EMBA (Figure E.23).

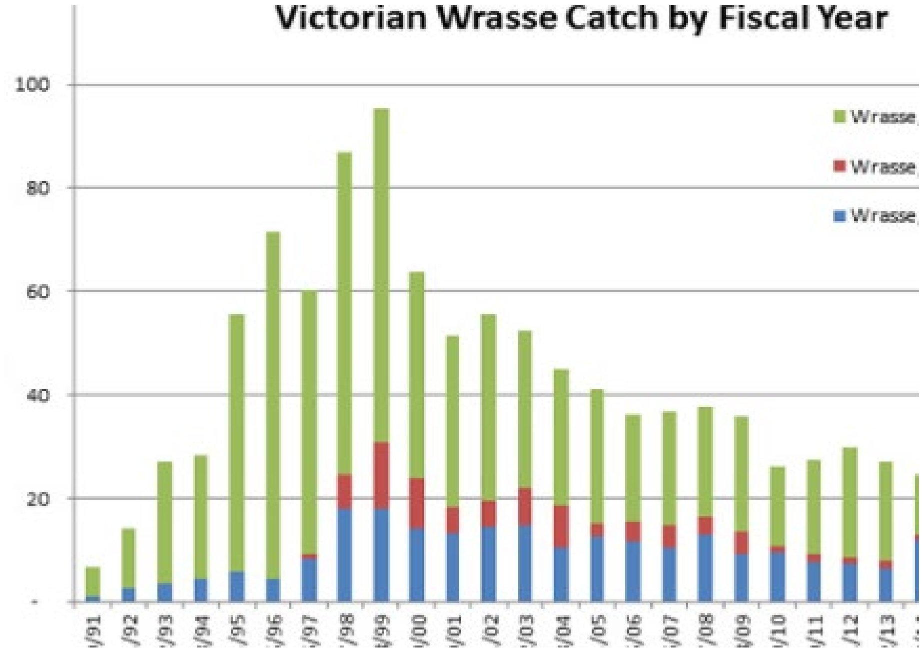


Figure E.22 Total catch for the Wrasse (Ocean) Fishery, 1990–2016

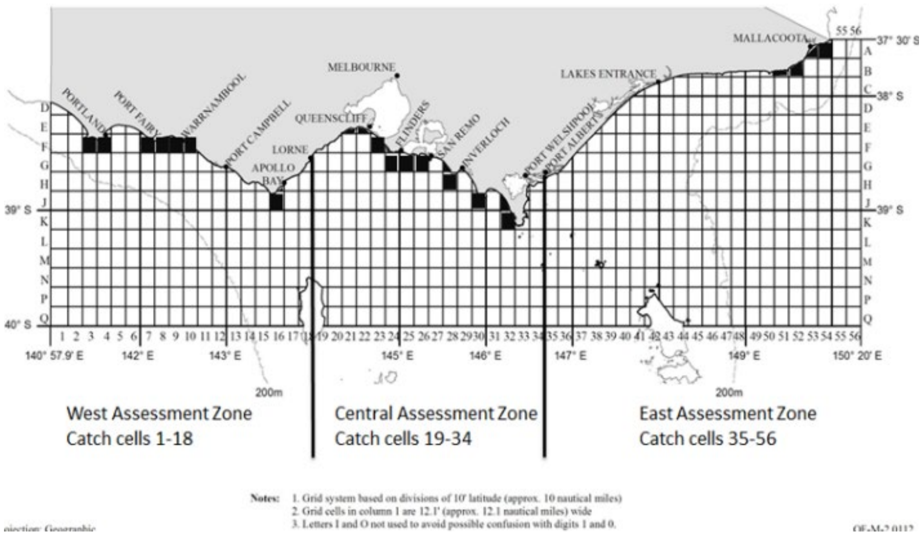


Figure E.23 Catch and effort reporting grid for the Wrasse (Ocean) Fishery

RPS

Ocean (General) Fishery

The Ocean (General) Fishery (OGF) extends the length of the Victorian coastline from the high tide mark to 20 nm offshore. The Ocean General Access License authorises the 171 license holders to undertake fishing activities using a variety of gear types in marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea (https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production#fp-molluscs accessed 14 Aug 2018). Fishing methods include line (dropline, longline, handline), dip net, bait traps, octopus traps, landing nets, gaffs, seine nets, mesh nets and bait pumps. Catches in the OGF mostly comprise snapper, octopus and gummy shark (catches of abalone, jellyfish, southern rock lobster, giant crab, commercial scallop and sea urchins are prohibited). Management measures for the fishery include limited access and gear restrictions. Operators in this fishery usually undertake day trips in small vessels (< 10 m), and may fish at anchor or underway. Most of the fishing effort by the OGF has historically occurred in western Victorian waters. A relatively small amount occurs off Lakes Entrance during April to July (SETFIA 2018).

Purse-seine (Ocean) Fishery

The Purse-seine (Ocean) Fishery (POF) extends the length of the Victorian coastline from the high tide mark to 20 nm offshore. Target species are Australian salmon, Australian sardine, sandy sprat and Australian anchovy (SETFIA 2018). There is only one POF license issued in Victoria, enabling the operator to fish marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea using a purse seine or lampara net (VFA 2017 in SETFIA 2018). This fisher is based in Lakes Entrance and typically does day trips. The fisher generally operates very close to shore and has limited if any overlap with the Activity EMBA (SETFIA 2018).

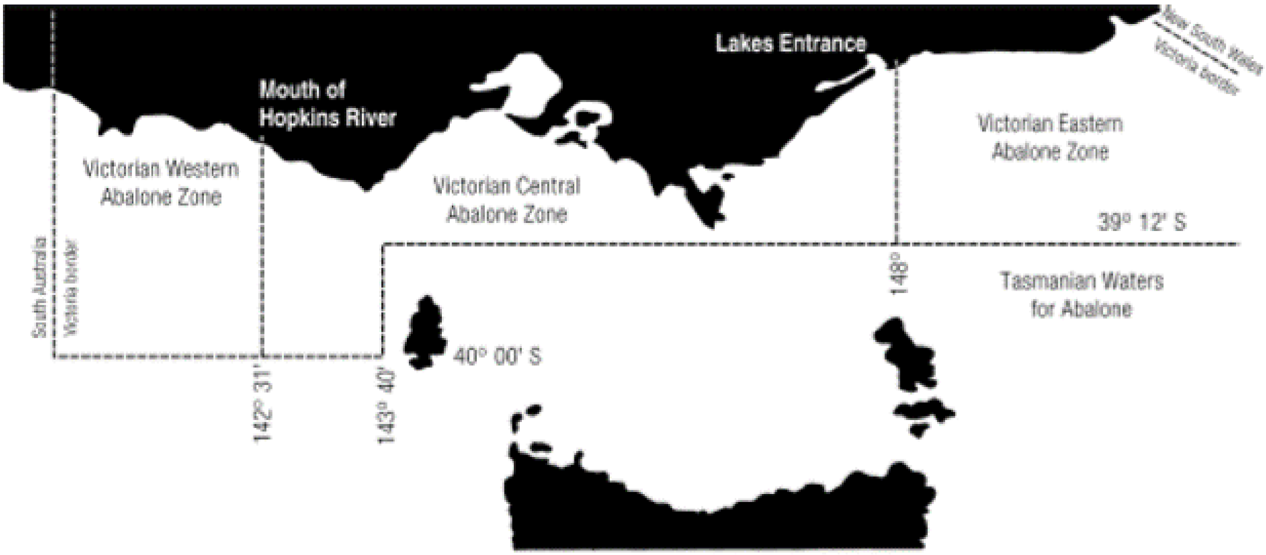
Inshore Trawl Fishery

There are 54 Inshore Trawl Licenses, however most of these are not active (VFA 2017 in SETFIA 2018). These licences allow the operators to fish the same waters as the Ocean (General) Fishery and the Ocean Purse Seine Fishery, using otter-board trawls (SETFIA 2018). The Inshore Trawl Fishery targets crustaceans (eastern king and school prawns), and to a lesser extent bugs, crabs and limited finfish (SETFIA 2018; http://www.afma.gov.au/static/annual-report-2010-11/fisheries/south-eastern-scalefish.html accessed 14 Aug 2018). Historically, effort by the Inshore Trawl Fishery has focussed on nearshore waters of eastern Victoria, particularly near Lakes Entrance (SETFIA 2018). However given the current lack of participation in this fishery it is not expected to be very active within the Activity EMBA.

Abalone Fishery

The Abalone Fishery is one of Victoria's most valuable commercial fisheries. It is a limited-entry fishery managed within three zones: Eastern, Central and Western (Figure E.24). Within each zone separate Total Allowable Commercial Catch and Individual Transferable Quotas are set based on outcomes of a regular stock assessment process. The key target species are blacklip abalone and greenlip abalone. Abalone are captured by divers to depths of 30 m using a chisel-like iron bar to prise individuals off rocks (DEDJTR 2015; https://vfa.vic.gov.au/commercial-fishing/abalone accessed 14 Aug 2018). There is negligible fishing for abalone in the vicinity of Lakes Entrance (Figure E.25) and there is not expected to be any overlap with the Activity EMBA.

RPS



Note areas closed to harvesting are not shown.

Figure E.24 Area of the Victorian Abalone Fishery, including the three commercial zones

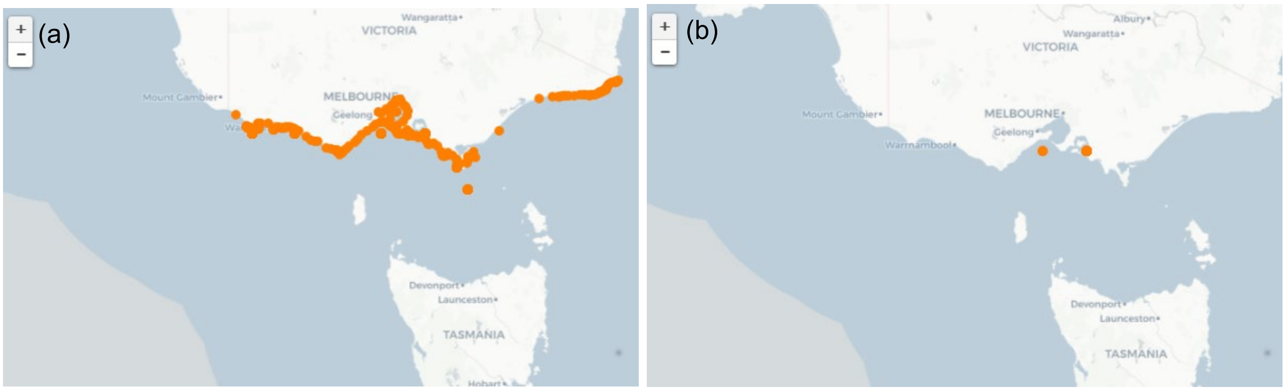


Figure E.25 Distribution of reported commercial catch of (a) blacklip abalone and (b) greenlip abalone (http://www.fish.gov.au/report accessed 14 Aug 2018)

Giant Crab Fishery

The Giant Crab Fishery (GCF) is a small, limited entry fishery that is closely linked to the Rock Lobster Fishery. Under an Offshore Constitutional Settlement Arrangement the Victorian government has jurisdiction over the GCF in Commonwealth waters adjacent Victoria (Fisheries Victoria 2010). The fishery has two management zones, with jurisdiction of the Eastern Zone overlapping the Activity EMBA (Figure E.26). Other management measures include limited entry (maximum 30 licenses), individual transferable quota and total allowable commercial catch. GCF licenses have only been issued for the Western Zone. Should there be an interest in exploratory fishing for giant crab in the Eastern Zone, eligible licence holders will need to apply for a general permit to fish (https://vfa.vic.gov.au/commercial-fishing/giant-crab/fishery-overview accessed 16 August 2018). The area of active fishing does not therefore overlap with the Activity EMBA.

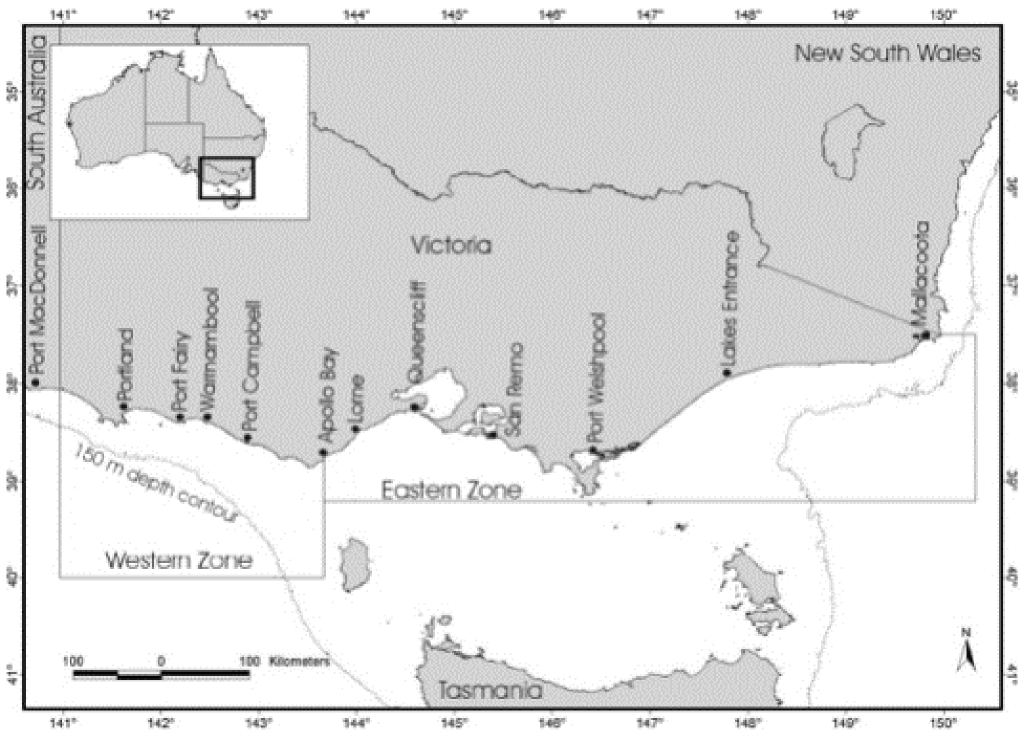


Figure E.26 Management zones of the Giant Crab Fishery

Sea Urchin Fishery

The Sea Urchin Fishery (SUF) was operating as a 'developing fishery' until new regulatory arrangements came into effect in 2014. Under these arrangements a SUF Access License is required to harvest sea urchin, with a Total Allowable Commercial Catch (TACC) set for four management zones (Figure E.27). Currently, TACCs are only set for the Port Phillip Bay and Eastern Zones (DEPI 2014). Target species are white sea urchin and black, long-spined sea urchin, which are hand-collected by divers. Catches in the Eastern Zone are primarily taken out of Mallacoota, near the NSW border. Sea urchins are mainly found on near-shore reefs dominated by macroalgae, and the area of active fishing does note overlap with the Activity EMBA.

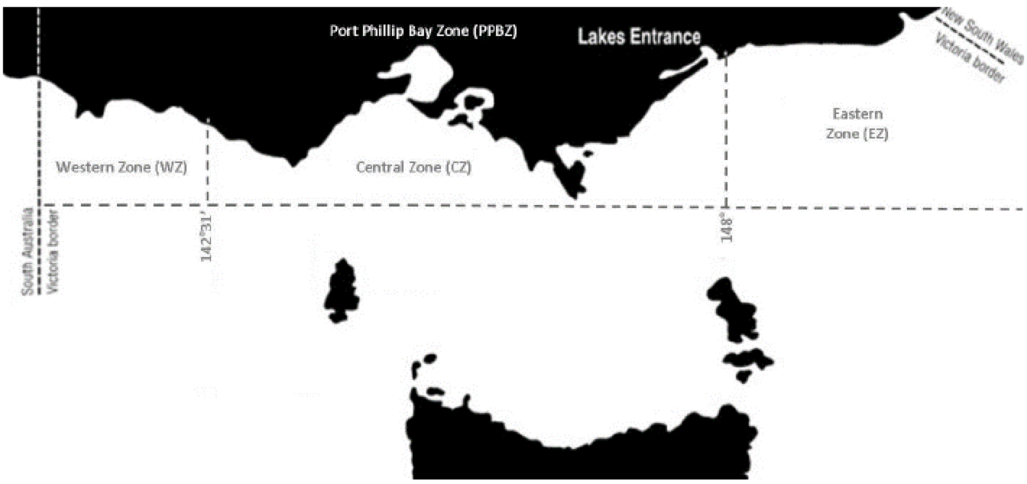


Figure E.27 Management zones of the Sea Urchin Fishery

Appendix F

QuietSea specifications

Appendix F QuietSea specifications

PAM operators will work closely with the visual observation team (MFOs) to verify marine mammals are within the shutdown or low-power zones and have direct communication access for immediate relay of marine mammal presence. Quiet Sea software will provide increased confidence in detections, classifications, and localisation of vocalising marine mammals in real time.

If a marine mammal is positioned within the shutdown, or low-power zones, the PAM operator, Lead MFO or SEA will immediately notify the seismic operators, who will immediately initiate the appropriate mitigation responses as defined in Table 6.14 (Environmental performance outcomes, standards and measurement criteria for underwater sound from seismic operations).

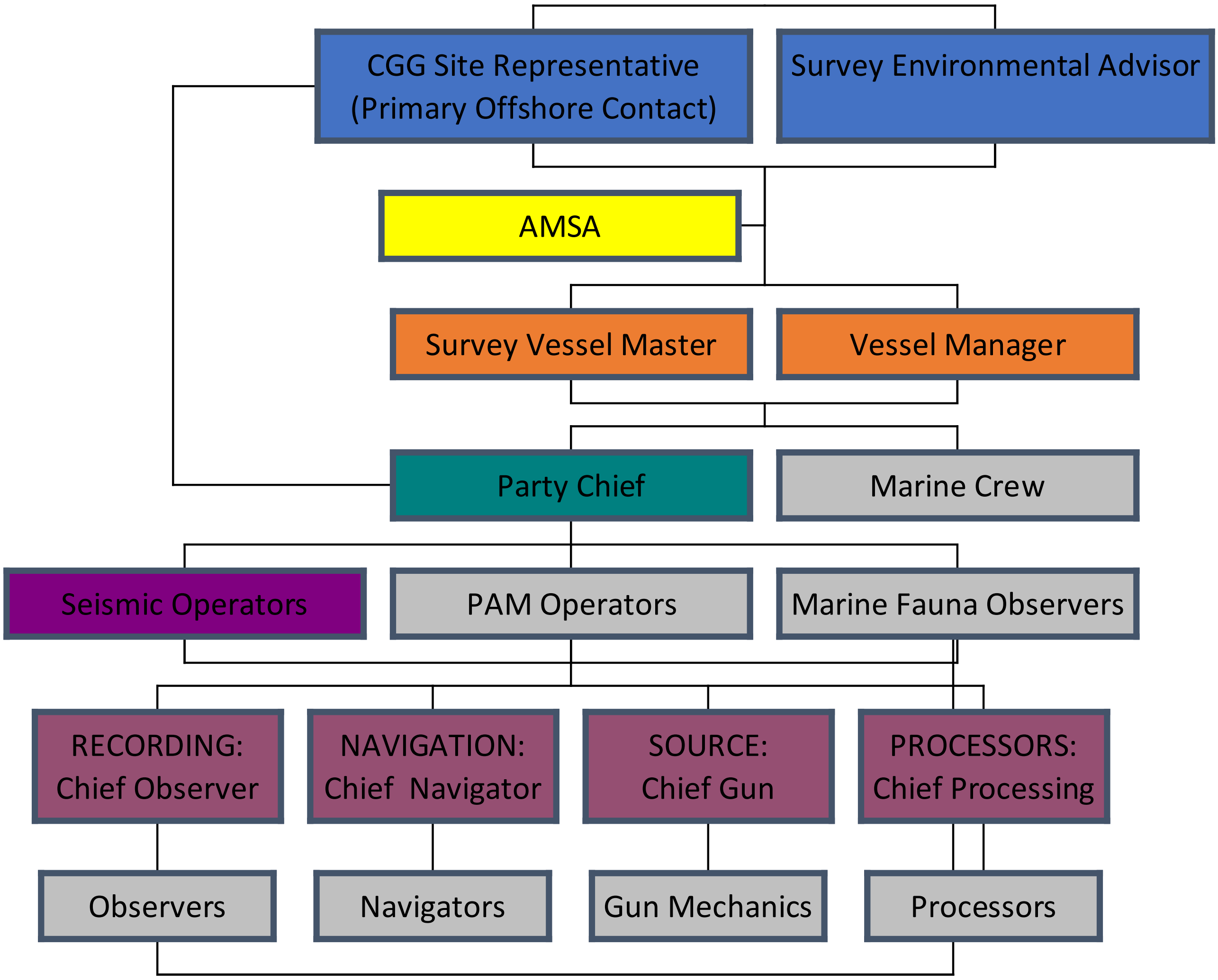


Figure F-1 Vessel communication structure

1.1 Passive acoustic monitoring system – QuietSeaTM

There have been discussions and publications regarding the limitations of passive acoustic monitoring. However, through further development, advancing technology, and empirical data collection, passive acoustic monitoring (PAM) has been accepted as the most effective way to detect baleen whales in many circumstances (Erbe 2013). PAM is used for monitoring the presence of marine animals when unable to detect them visually (Erbe 2013). In one study, PAM provided hundreds of acoustic minke whale detections from an acoustic line transect survey using a towed hydrophone array, when no minke whales were sighted (Norris et al., 2017). Also, humpback whale behaviour has been identified in Hawaii using only PAM to acoustically track their movements (Henderson et al, 2018). In Australia, passive acoustic monitoring revealed migration timing and pathways of pygmy blue whales down the west coast of Australia and across the GAB (McCauley et al. 2004). It is a proven technique accepted for use in detecting baleen whales.

QuietSeaTM is a new passive acoustic monitoring (PAM) system designed to detect the presence of marine mammals during seismic operations. Unlike other separate antenna PAM systems, QuietSeaTM is integrated within the seismic streamers allowing for greatly enhanced marine mammal detection capabilities in a wide frequency range that covers a large variety of vocalising cetacean species (i.e. (10 Hz to 96 kHz) (Figure 6.9). There are no external devices to entangle streamers and a reduction in false alarms. The higher frequency range (200 Hz to 96 kHz) is monitored via modules installed along the streamer and below the seismic sources for accurate crossline and inline detection/localisation.

The upper frequency limit of the QuietSea system is currently approximately 96 kHz, which allows the monitoring of most whale and dolphin species but not porpoises; however, there are plans to improve this to cover the full frequency range of marine mammal vocalisations in the future (Sercel, pers. comm., In: Verfus et al. 2018). There are no know areas of importance for high frequency cetaceans in the Gippsland MSS, therefore this frequency limitation does not affect the suitability of this system for cetacean monitoring during the Gippsland MSS. Specifications for the system are found in Appendix F.

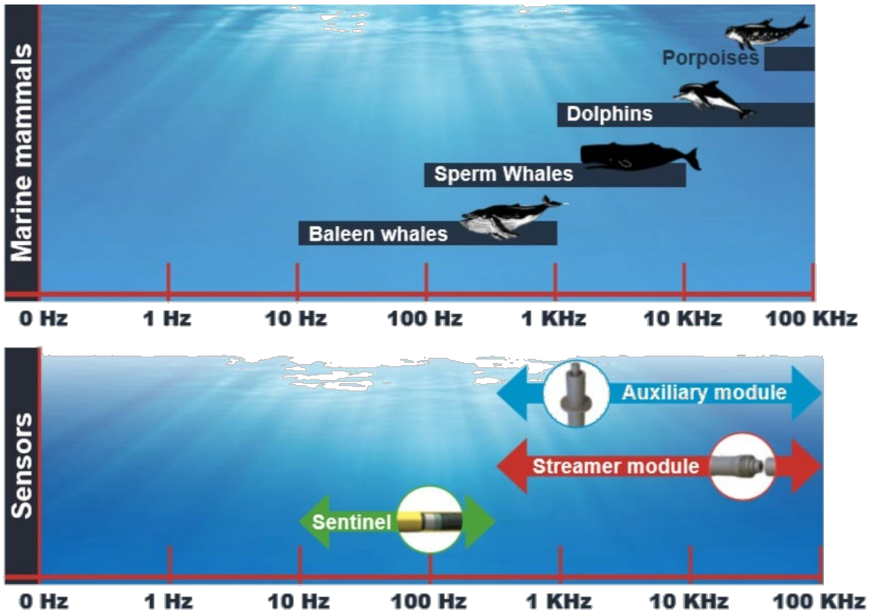
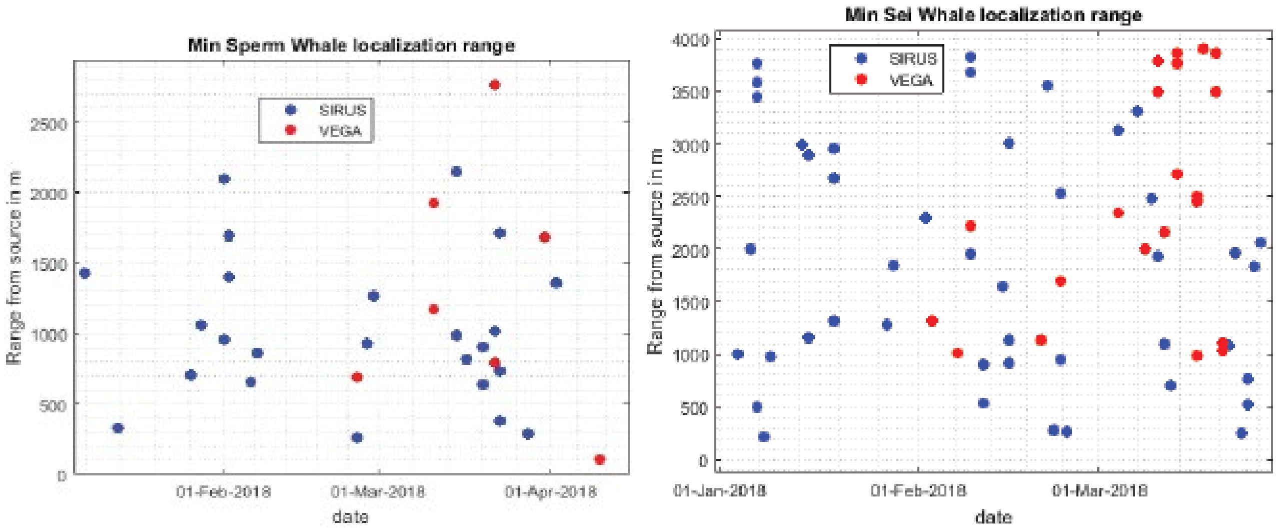


Figure F-2 Range of vocalisations monitored by QuietSeaTM

In-field validation and verification of the QuietSea system in detecting low frequency (sei whale) and mid frequency (sperm whale) cetaceans and accurate range estimation/localisation was carried out in 2018 (Le Her et al. 2018). The Quiet Sea PAM verification study verified the detection and localization performance during seismic surveys with the seismic source both active and inactive. Detection ranges for sei whales were up to 4 km and for sperm whales up to 3 km (Figure 6.9). The PAM validation exercise demonstrates effectiveness of detecting and localizing baleen whales during seismic acquisition by use of a baleen whale call simulator, deployed from a second vessel at a known distance, and within the amplitude, frequency, and call length ranges of baleen whales. The fake calls were detected by both the PAM operators and the automated detection algorithms, giving the verified direction to the sound source using time differential of signal reception by the hydrophones, and providing the baseline for determining distance to baleen whales with known source levels. The findings from the validation exercise were that the QuietSea system enables the automatic and precise monitoring of marine mammals with:

- wide bio-acoustic frequencies covered
- accurate crossline and inline detection/localisation
- no port/starboard ambiguity due to a multi-streamer configuration
- high redundancy due to the high plurality of sensors.



(L'Her et al. 2018)

Figure F-3 Sperm and sei whale detection ranges during QuietSea validation exercise

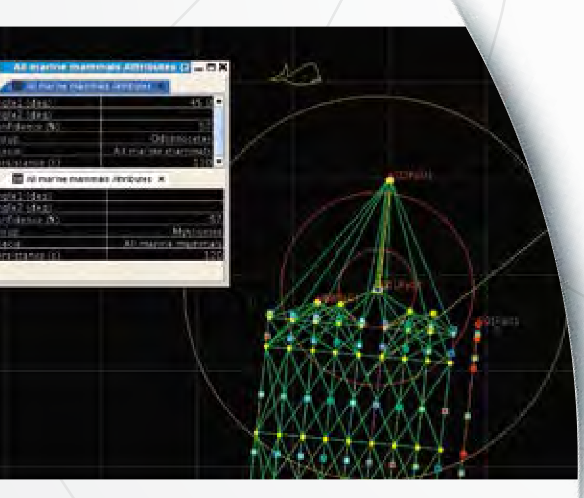
QuietSea™

Marine mammal monitoring system

Sercel

Ahead of the Curve℠

Features & Benefits



// **INTEGRATED ARCHITECTURE**

Sensors within Sentinel® streamers

Interfacing Seal 428 & SeaPro Nav

// **OPTIMIZED PRODUCTIVITY**

No external devices to entangle streamer

False alarm rate reduction

// **PRECISE MONITORING**

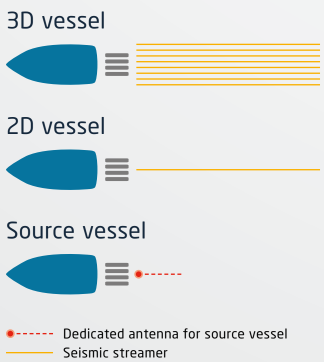
Automated detection & localization algorithms

Objective decision-making

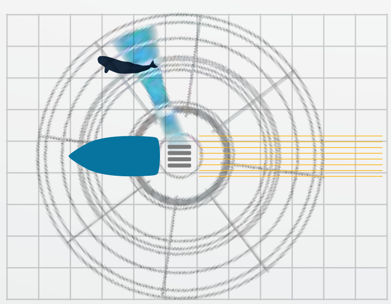
QuietSea™ is the new passive acoustic monitoring (PAM) system from Sercel designed to detect the presence of marine mammals during seismic operations.

Unlike other separate antenna PAM systems, QuietSea is seamlessly integrated within the Sercel Sentinel seismic streamer (Sentinel, Sentinel RD and Sentinel MS).

COMPATIBILITY

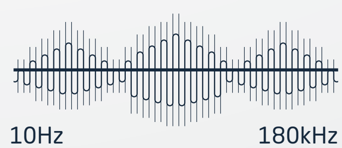


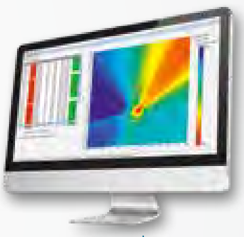
AUTOMATED LOCALIZATION



WIDE FREQUENCY RANGE

Whistles, moans and clicks





Onboard equipments

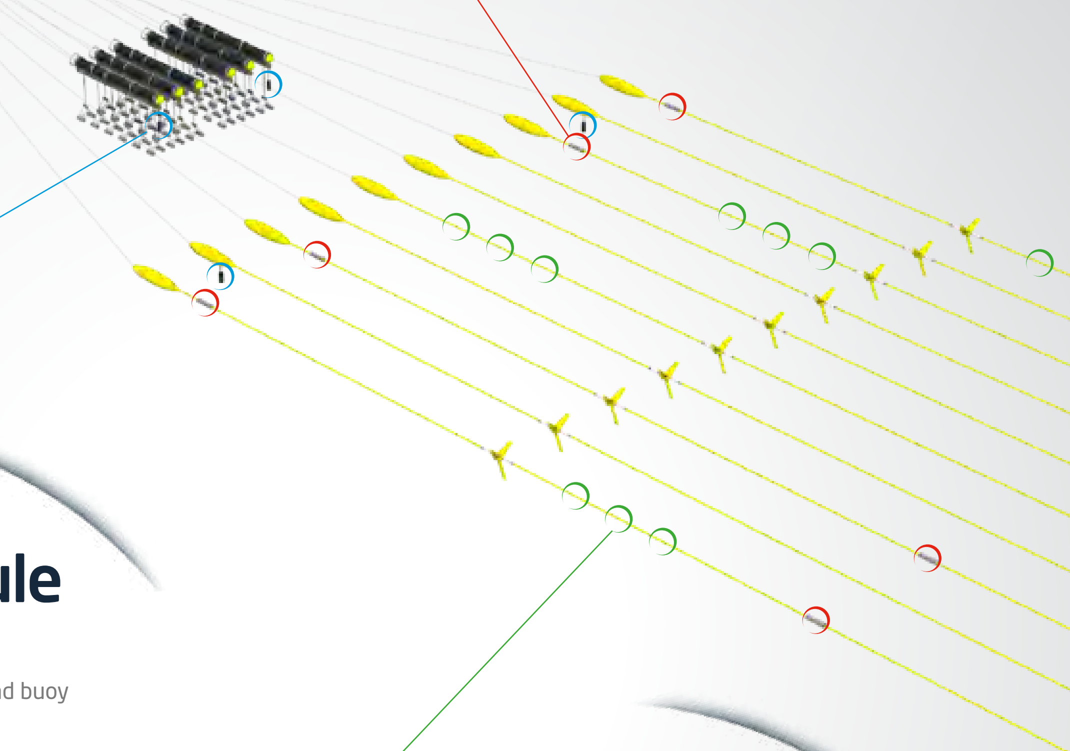
Localization and Low frequency detection

- QuietSea software
- Interface to Seal 428 and SeaPro Nav
- Acquisition & data processing (Streamer and Auxiliary modules)
- Data logging & localization display

Streamer module

High frequency detection

- Interfaced with positioning transducer
- A/D conversion
- Vocalization detection (200Hz to 96kHz) and timestamping
- Sensor test
- 50 or 70mm diameter
- Up to 4 modules per streamer



Auxiliary module

High frequency detection

- To be mounted on the vessel hull, head buoy or gun array
- A/D conversion
- Vocalization detection (200Hz to 180kHz) and timestamping
- Sensor test
- Up to 8 modules per system

Sentinel

Low frequency detection

- Both seismic data recording and mammal monitoring
- Vocalization detection (down to 10Hz)
- Up to 512 processed channels per spread
- Sensor test

QuietSea™

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16 rue de Bel Air
B.P. 30439 - 44474 CARQUEFOU Cedex
Téléphone: (33) 2 40 30 11 81
Fax: (33) 2 40 30 19 48
E-mail: sales.nantes@sercel.com
SAS au capital de 2 000 000 €
Siège Social: 16 rue de Bel Air - 44470 CARQUEFOU
378.040.497 R.C.S. Nantes Code APE 2651B

Sercel Inc. - U.S.A.
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Telephone: (1) 281 492 6688
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E-mail: sales.houston@sercel.com

www.sercel.com

Produced according to the Sercel environmental printing standard

Sercel
Ahead of the Curve℠

Appendix G

M/V *Geo Coral* SOPEP

SOPEP

SHIPBOARD OIL POLLUTION EMERGENCY PLAN

"GEO CORAL"
- LACA 8 -

IMO No: 9492579

IN ACCORDANCE WITH

MARPOL, Annex I, Reg. 37,

in compliance with amended IMO Res. MEPC.86(44)

OWNER:

CGGEidesvik Ship Management AS
Carl Konows gate 34
5162 Laksevåg
Bergen, Norway

APPROVED
MARPOL, Annex I, Reg. 37
SEE LETTER
Date: 2017-03-06

INTRODUCTION

GEO CORAL

IMPORTANT

ANY OIL SPILLAGE SHOULD BE TREATED AS AN EMERGENCY.

IT IS VITALLY IMPORTANT TO PREVENT ANY ESCAPE OF BUNKERS (FO, DO), LO, SLUDGE AND / OR ANY HARMFUL LIQUID SUCH AS PAINTS, THINNERS, LO AND CHEMICALS IN DRUMS, FROM FLOWING OVERBOARD.

EVERY CREW MEMBER HAS A RESPONSIBILITY TO PREVENT POLLUTION.

DRAWINGS

THIS PLAN IS LINKED WITH SEVERAL DRAWINGS, THE LIST OF WHICH IS GIVEN SECTION 8.

SECTION 1

Visas

PLAN APPROVED

DATE	APPROVED BY	OFFICIAL STAMP

CHANGE N°

DATE	APPROVED BY	OFFICIAL STAMP

CHANGE N°

DATE	APPROVED BY	OFFICIAL STAMP

CHANGE N°

DATE	APPROVED BY	OFFICIAL STAMP

CHANGE N°

DATE	APPROVED BY	OFFICIAL STAMP

Records of Reviews

DATE	SUBJECT	PARTICIPANT(S)

Records of Reviews (continue)

DATE	SUBJECT	PARTICIPANTS

Records of Changes

CHANGE N°	ABOUT SECTION		DATE	NAME	SIGNATURE
	Controlled (15 to 34)	Not controlled			

Records of Changes (continue)

CHANGE N°	ABOUT SECTION		DATE	NAME	SIGNATURE
	Controlled (15 to 34)	Not controlled			

SHIPS PARTICULARS

SHIP NAME	GEO CORAL
GROSS TONNAGE	12812 UMS
SHIP TYPE	Research SurveyVessel
CALL SIGN	LACA8
MMSI	257 080 000
VSAT	Telephone +47 23678540
IMO N°	9492579
FLAG	Norway
PORT of REGISTRY	Bergen
FORMER NAME(S)	N/A
BUILDER	Bergen Group BMV AS, Yard No. 162
BUILT / REBUILT	2010
LENGTH OVERALL	108.30 M
BREADTH MOULDED	24.00 M
EXTREME BREADTH	28.00 M
SUMMER DRAUGHT	7.50 M
BUNKER CAPACITY	796 M^3 DO
	1700 M^3 HFO

DETAILS of ANY MAJOR MODIFICATIONS OR REBUILDING	NONE
OTHER RELEVANT INFORMATION SPECIFIC to the SHIP	NONE

Registered Head Owners, ISM Manager, Operator,(Version 1)

REGISTERED HEAD OWNERS	**CGG GEO VESSELS AS** Lillearkerveien 6 0283 OSLO NORWAY
ISM MANAGER	**CGG EIDESVIK SHIP MANAGEMENT** CARL KONOWS GATE 34 5162 BERGEN – NORWAY PHONE OFFICE: +47 95076719 PHONE EMERGENCY: +47 97010359
OPERATOR	**CGG** 27 Avenue Carnot 91341 MASSY - FRANCE TEL 33 (0)1 64 47 30 00 FAX 33 (0)1 64 47 39 45 TLX 602 442 F

SECTION 2

2.1. SOPEP

2.1.1. Introduction

1. This plan is written in accordance with the requirements of regulation 37 of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).
This manual meets the new SOPEP requirements introduced by IMO Resolution MEPC.54(32) amended by Resolution MEPC 86(44).

2. Without interfering with shipowners' liability, some coastal States consider that it is their responsibility to define techniques and means to be taken against an oil pollution incident and approve such operations which might cause further pollution, i.e., lightening. States are in general entitled to do so under the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 (Intervention Convention)." The United States of America is the notable example of this.

3. The purpose of the plan is to provide guidance to the Master and Officers on board the ship with respect to the steps to be taken when a pollution incident has occurred or is likely to occur.

4. The plan contains all information and operational instructions required by the Guidelines for the development of the shipboard oil pollution emergency plans" (IMO Resolution MEPC.54(32) amended by MEPC.86(44)), adopted on March 6, 1992. The appendices contain names, telephone, telex numbers, etc., of all contacts referred to in the plan, as well as other reference material.

5. This plan has been approved by the Administration and, except as provided below, no alteration or revision shall be made to any part of it without the prior approval of the Administration.

6. Changes to § 6.3.and the annexes will not be required to be approved by the Administration. The annexes should be maintained up to date by the owners, operators and Managers.

7. This plan will be regularly reviewed and updated.
Revisions, other than those referred to in § 6.3. above will be submitted to the Flag State Authorities for approval.
Revision will be initiated by the Master, will involve at least himself and the Chief Engineer and will be carried out at intervals not exceeding 12 months. Refer to § 6.3.5

8. Following an incident in which the plan has been activated, there will be a thorough review of its effectiveness.

2.1.2. Preamble

1. This Shipboard Oil Pollution Emergency Plan is provided to assist personnel in dealing with an unexpected discharge of oil. Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge and to limit its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.

2. The plan makes use of flowcharts and checklists to guide the Master through the various actions and decisions which will be required in an incident response. The charts and checklists provide a visible form of information, thus reducing the chance of oversight or error during the early stages of dealing with an emergency situation.

3. For ready reference, tank plans, piping diagrams and capacity charts, with a general arrangement of the hull and upper deck are Section 8 of the plan.

4. The plan is designed to link into the Company's corporate plan for dealing with oil pollution emergencies ; and the Master will be backed up on-scene by management appointed personnel as the circumstances and the position of the vessel at the time of the incident, require.

5. For any plan to be effective it has to be:
   - familiar to those with key functions on board the ship,
   - reviewed and updated regularly,
   - tested for viability in regular practices.

6. Training and exercises in implementation of the shipboard contingency procedures must be held at regular intervals.

7. The Master and/or the Chief Engineer and/or the Duty Officer must be informed of any leakage of oil from any other vessel in the vicinity, AND MUST INFORM AUTHORITIES IMMEDIATELY.
   This point is very important to protect the ship and owners' interests. They should immediately proceed:
   a) to take photos and records (the outspread with landmarks, hours, monitoring of the slick, etc.),
   b) to inform Authorities,
   c) every effort must be made to obtain a written statement from independent and impartial witness to the event.

SECTION 3

3.1. REPORTING REQUIREMENTS

3.1.1. General

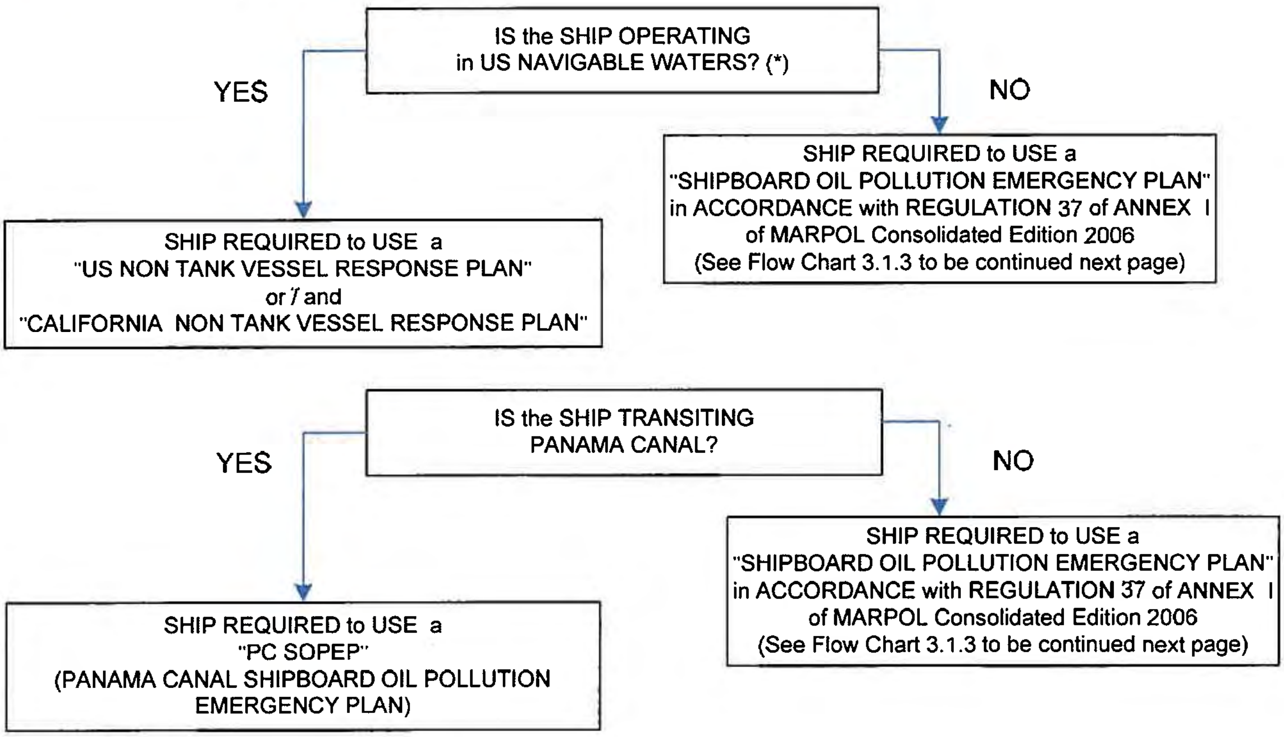
1. Article 8 and Protocol I of MARPOL 73/78 **require** that the nearest coastal state should be notified without delay of actual or probable discharges of oil to the sea. The intent of the requirement is to ensure that coastal states are informed without delay of any incident giving rise to pollution, or threat of pollution, of the marine environment, as well as the need for assistance and salvage measures, so that appropriate action may be taken.

2. The reporting procedure to be followed by the Master or other person in charge of the ship after an oil pollution incident is based on guidelines developed in the IMO Resolution A.851(20) as amended with MEPC.138(53)

3. If the ship is involved in a pollution incident, reports must be made both to coastal state or port contacts, as appropriate, and to contacts representing interest in the ship.

4. The following flow diagram should be used to ascertain whether the vessel has to be ready to put into effect the MARPOL "Shipboard Oil Pollution Emergency Plan" or the U.S. "Vessel Response Plan" as per OPA 90, or any other local oil pollution emergency plan according to the country (example: Panama Canal, SPRO agreement for China).

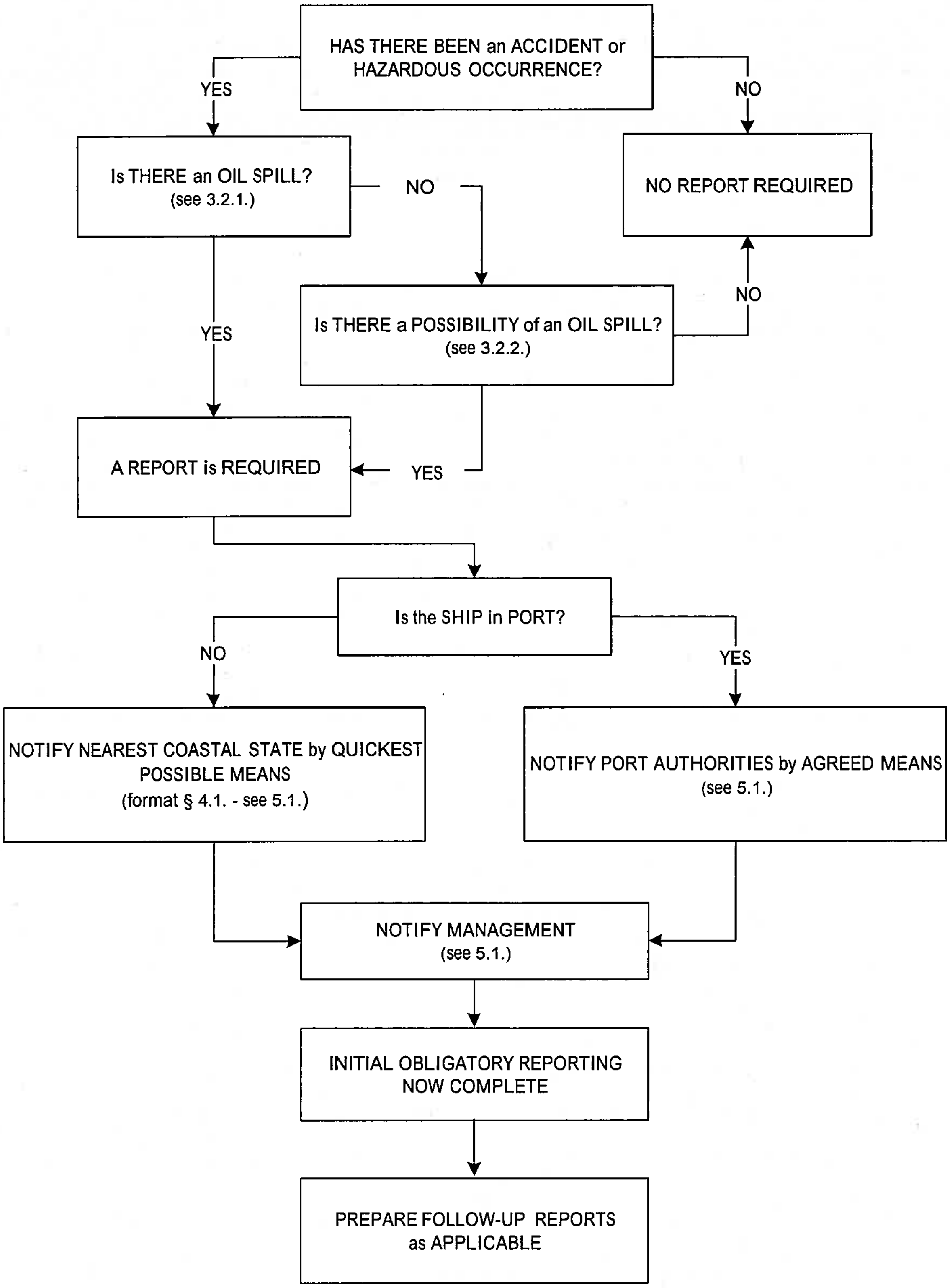
3.1.2. Flow Chart



(*) Clean Water Act, Section 502:
The term "navigable waters" means the waters of the United States, including the territorial seas.
The term "territorial seas" means the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending

seaward a distance of three miles.

3.1.3. Flow Chart (continue)



3.2. WHEN to REPORT

3.2.1. Actual Discharge

A report is required whenever there is:
- a human error,
- a discharge of oil resulting from damage to the ship or its equipment,
- an intentional discharge for the purpose of securing the safety of a ship or saving life at sea,
- during the operation of the ship a discharge of oil in excess of the quantity or instantaneous rate permitted under applicable marine pollution regulations.

Reports to coastal states should be in the style given in § 4.1.

3.2.2. Probable Discharge

Although an actual discharge may not have occurred, a report is required if there is the probability of a discharge.

In judging whether there is such a probability, and thus whether a report must be made, the following factors should be taken into account:
- the nature of damage sustained by the ship,
- failure or breakdown of machinery or equipment which may adversely affect the ability of the ship to manoeuvre, operate pumps, etc...,
- the location of the ship and its proximity to land or other navigational hazards,
- present weather, tide, current and sea state,
- expected weather conditions,
- traffic density,
- morale, health and ability of the crew on board to deal with the situation.

As a general guide the Master should make a report in cases of:

- Safety of the ship or other shipping hazards: collision, grounding, fire and/or explosion, structural failure, flooding, cargo shifting.

- Failure or breakdown of machinery or equipment which results in impairment of the safety of navigation: examples are breakdown of steering gear, propulsion, electrical generating system, essential ship borne navigational aids.

3.2.3. Follow up Reports

Once the vessel has transmitted an initial report, further reports should be sent at regular intervals to keep those concerned informed of developments.

Follow up reports to coastal states should always be in the style given in § 4.1., and should include information about every significant change in the vessel's condition, the rate of the release and spread of oil, weather conditions, and details of agencies notified and clean-up activities.

SECTION 4

4.1. INFORMATION REQUIRED

4.1.1. Content of Reports

The REPORT MUST CONTAIN the FOLLOWING INFORMATION
Ref is made to MEPC Res. A.851(20) as amended with MEPC.138(53)
This report is available in CGG Eidesvik SMS Safety Management System

AA. **Name of ship, call sign and flag.**

BB. **Date and time (GMT) of incident** : a 6-digit group giving :
day of month (first two digits), hours and minutes (last four digits).

CC. **Ship's position**, giving:
latitude: a 4-digit group in degrees and minutes suffixed with N (North) or S (South), and
longitude: a 5-digit group in degrees and minutes suffixed with E (East) or W (West),

or

DD. **Ship's position by true bearing** (first 3 digits)
and
distance (stated) from a clearly identified landmark.

EE. **True course** (as a 3-digit group).

FF. **Speed** (in knots and tenths as a 3-digit group).

LL. **Route information** - details of intended track.

MM. Full details of **radio stations and frequencies being guarded.**

NN. **Time of next report** (a 6-digit group as in BB).

OO. **Draught** (a 4-digit group giving draught in metres and centimetres).

PP. **Types and quantities of cargo** and **bunkers on board**.

QQ. **Brief details of defects, damage, deficiencies or other limitations.** These must include the condition of the ship and the ability to transfer cargo, ballast, or fuel.

RR. **Brief details of actual pollution**. This should include the type of oil, an estimate of the quantity discharged, whether the discharge is continuing, the cause of the discharge and, if possible, an estimate of the movement of the slick.

SS. **Weather and sea condition**, including wind force and direction and relevant tidal or current details, direction and height of swell.

TT. Name, address, telex, facsimile and telephone numbers of the **ISM Manager**.

UU. Details of length, breadth, tonnage, type of ship and draught.

WW. Total number of persons onboard.

XX. Miscellaneous - to include relevant details including, as appropriate:
- Brief details of incident,
- Need for outside assistance,
- Action taken with regard to the discharge and movement of the ship,
- Number of crew and details of any injuries,
- Details of P&I Club and local correspondent,
- Others:

If no outside assistance is required,
this should be clearly stated

Reports should be transmitted by the quickest available means to the responsible authorities of the nearest coastal state or the Rescue Coordination Centre (RCC) via the appropriate shore radio station. If the ship is within or near to an area for which a ship reporting system has been established, reports should be transmitted to the designated shore station of that system.

The following additional information should be sent to ISM Manager either at the same time as the initial report or as soon as possible thereafter:
- Further details of damage to ship and equipment,
- Whether damage is still being sustained,
- Assessment of fire risk and precautions taken,
- Disposition of cargo on board and quantities involved,
- Number of casualties,
- Damage to other ships or property,
- Time (GMT) assistance was requested and time (GMT) assistance expected to arrive on scene,
- Name of salver and type of salvage equipment,
- Whether further assistance is required,
- Priority requirements for spare parts and other materials,
- Details of outside parties advised or aware of the incident,
- Any other important information.

After transmission of the information in an initial report, as much as possible of the information essential for the safeguarding of life and the protection of the ship and the marine environment should be reported in a supplementary report to the coastal state and the ISM Manager, in order to keep them informed of the situation as the incident develops.
This information should include items P, Q, R, S and X, as appropriate.

SECTION 5

5.1. WHOM to CONTACT

WRITTEN EVIDENCE is VITAL WHEN DEALING with AUTHORITIES.

5.1.1. Coastal State Contacts

In order to expedite response and minimize damage from a pollution incident, it is essential that appropriate coastal states are notified without delay. This process is begun with the initial report. Guidelines for compiling reports are provided in § 4.1.

In his message of notification, the Captain will indicate the type of dispersal agent onboard and will ask authorization according to custom.

This plan includes as Annex 2 a list of agencies or officials of administrations responsible for receiving and processing reports. In the absence of a listed focal point, or where the responsible authority cannot be contacted by direct means without delay, the Master should contact the nearest coast radio station, designated ship movement reporting station or Rescue Coordination Centre (MRCC) with the GMDSS equipment.

5.1.2. Port Contacts

If an oil spill occurs when the vessel is in port, whatever the cause, it is the Master's duty immediately to activate the vessel's Oil Pollution Prevention Team and report the incident. Precise details of whom to notify locally should be obtained on arrival and used to systematically update the Annex 1.

The following is a guide:

- Terminal/loading Master,
- Local fire department (in case of explosion and/or fire),
- Agent,
- Port Authority
- The vessel's local P&I representative (P&I Club List of Correspondents is filed in your insurance file).
- Any other contact as required by local regulation (US, Panama, China as examples).

5.1.3. Ship Protective Interest Contacts

Annex 3 gives the basic role of the Captain.

Annex 10 refers to CGG Eidesvik SMS procedure

The Annex 11 of the present Oil Pollution Emergency Plan gives the Responsibilities relevant to that ship. All further reports and copies of messages sent to coastal states and/or port authorities should be sent to the Company.

5.1.4. Company's Emergency Staff Action

If required, the Company's office will be staffed as soon as possible after receipt of an initial report. Once initial reports have been made, the Company's corporate plan will ensure that other interests such as Flag State authorities, P&I Club and classification society are notified and kept up to date on the incident. **For further details, refer to the procedure** "7-01-004 CGG Eidesvik Emergency Contingency Plan, **which gives the procedure to gather the Shore Contingency Unit on a 24/24 hours basis.**

5.1.5. Flag State Authority

Sjøfartsdirektoratet
Postboks 2222, 5509 Haugesund
Telefon: 52 74 50 00
Telefaks: 52 74 50 01
E-post: post@sjofartsdir.no

SECTION 6

6.1. STEPS to CONTROL DISCHARGE

Notice

WHENEVER AN OIL SPILL OCCURS, IT IS THE DUTY OF THE PERSON FINDING THE SPILL TO IMMEDIATELY INFORM THE MASTER OR RESPONSIBLE OFFICER, WHO SHOULD CALL OUT THE VESSEL'S OIL POLLUTION PREVENTION TEAM

REMEMBER THAT AN OIL SPILL MAY CREATE A FIRE OR EXPLOSION HAZARD, REQUIRING SAFETY PRECAUTIONS TO BE OBSERVED.

6.1.1. Operational Oil Spills

IT MUST BE BORNE IN MIND THAT THE PLAN CONCERNS FO, DO, LO & SLUDGE TRANSFERS, AND RISKS DUE TO PAINTS, THINNERS, LO AND ALL CHEMICALS IN DRUMS

IMPORTANT

DURING THE CLEANING, DO NOT USE ANY OIL DISPERSANT INTO THE SEA OR WASH ANY OIL DISPERSANT INTO THE SEA WHETHER THE VESSEL IS IN PORT OR NOT.

MAKE EVERY EFFORT TO CONTAIN THE SPILL ON BOARD.

The most likely operational spills will result from:

A Pipeline leakages, including transfer hoses
B Bunker tank overflows
C Hull leakages
D Leakage from Stern Tube
E Leakage from deck hydraulic systems
F Operational Discharge during offshore bunkering

A - Pipeline Leakage during Discharging-Loading Bunkers

Measures to be implemented immediately

- Stop all cargo and bunkering operations, and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedures.
- Inform terminal/loading Master/bunkering personnel about the incident.

Further measures

- Consider whether to stop air intake into accommodation and non-essential air intake to engine room.
- Locate source of leakage, and begin clean-up procedures.
- Drain affected section of pipeline into an empty or slack tank (overflow tank).
- Prepare portable pumps (if any) where it is possible to transfer spilled oil into a slack or empty tank (by the sludge discharge pipe on the main deck).

If the spilled oil is contained on board and can be handled by the Oil Pollution Prevention Team

- Use absorbents and permissible solvents to clean up oil spills on board.
- **Ensure that any residues collected in the clean up operation are stored carefully prior to disposal.**

AFTER DEALING WITH THE CAUSE OF THE SPILL, it MAY be NECESSARY to OBTAIN PERMISSION FROM LOCAL AUTHORITIES or the TERMINAL (or BOTH) to RESUME NORMAL OPERATIONS.

B - Tank Overflow during Bunkering

Measures to be implemented immediately

- Stop all cargo and bunkering operations, and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedures.
- Inform terminal/loading Master/bunkering personnel about the incident.

Further measures

- Consider whether to stop air intake into accommodation and non-essential air intake to engine-room.
- Reduce the tank level by dropping bunkers into an empty or slack tank.
- Prepare pumps for transfer of bunkers to shore if necessary.
- Begin clean up
- Prepare portable procedures pumps (if any) if it is possible to transfer the overflowed oil into a slack or empty tank.

If the spilled oil is contained on board and can be handled by the Oil Pollution Prevention Team

- Use absorbents and permissible solvents to clean up oil spills on board.
- Ensure that any residues collected in the clean up operation are stored carefully prior to disposal.

AFTER DEALING WITH THE CAUSE OF THE SPILL, it MAY be NECESSARY to OBTAIN PERMISSION FROM LOCAL AUTHORITIES or the TERMINAL (or BOTH) to RESUME NORMAL OPERATIONS.

C - Hull Leakage

If oil is noticed on the water near the vessel during bunkering operations and cannot be accounted for, the possibility of hull leakage should be suspected.

Stability and Hull Resistance in Deteriorated Condition

Any damage of hull leads to a deterioration of the stability (reduction of the surface of hull and creation of additional free faces) and of the structure resistance. The SERS will bring to the ship the appropriate support according to the necessary information indicated in an onboard specific file.

Measures to be implemented immediately

- Stop all bunkering operations, and close manifold valves.
- Sound the emergency alarm, and initiate emergency response procedures.
- Inform terminal/loading Master/bunkering personnel about the incident.

Further measures

- Use the Oil Pollution Prevention Team in an attempt to locate the source of leakage.
- Consider whether to stop air intake into accommodation and non-essential air intake to engine-room.

When the source of leakage is Identified

- Reduce the head of bunker oil by dropping or pumping oil into an empty or slack tank.
- Consider possibility of pumping water into the leaking tank to create a water cushion to prevent further oil loss.
- If the leakage is located below the waterline, call in divers for further investigation.

If it is not possible specifically to identify the tank

- The level of oil in the tanks in the vicinity of the suspected area should be reduced.
- Remember to consider the effect on hull stress and stability of the vessel.

AFTER DEALING WITH THE CAUSE OF THE SPILL, it MAY be NECESSARY to OBTAIN PERMISSION FROM LOCAL AUTHORITIES or the TERMINAL (or BOTH) to RESUME NORMAL OPERATIONS.

D - Oil Leakage from Propeller Shaft Seal

An accurate record must be kept of any oil added to the stern tube system. Location of any losses should be quickly established. If the losses are from the aft seal, this should be reported at once.
The leakage may be controlled by establishing an hydraulic balance between the head of lubricating oil and the head of sea water acting on the outside of the seal. This may be achieved by substituting the fixed oil header tank by an oil drum connected to the system with a flexible hose. The head may be adjusted by suspending the oil drum from a chain block and raising or lowering it until a balance is achieved and the loss of oil stopped. Care must be taken to avoid any ingress of water through the seal.

E - Oil Leakage from Deck Hydraulic Systems

a) Preventative actions
It must be kept in mind that every slick of oil on the deck is an injury risk for the personnel and a possibility of pollution in case of rainy weather.
Chief Officers must be aware of such events and give appropriate orders.

b) In the event of a piping failure
Wherever it originates from, manoeuvring stand, main pipe, hatch jacks or motors, it is expected of the seaman in charge of the operation to become quickly aware that a problem exists, whether by actually seeing or hearing the leak or by the slowness of the response of the equipment.
He should immediately stop the hydraulic pumps.

c) Cleaning up the deck
Hydraulic oil is very fluid:
- stop pumps immediately, contain and mop up the oil remaining on deck with sawdust and cotton rags.
- sweep the deck with brooms.
- clean the deck with detergents, and avoid any action which could result in oily residues going overboard.
- ensure that residues collected in the clean up operation are stored carefully prior to disposal.

F - Operational Discharge during offshore bunkering

Below checklists are applicable for operating discharge occurences while conducted bunkering off-shore with Support Vessel, under-way (in-line / side to side)

EMERGENCY PLAN/CHECK LIST - LEAKAGE FROM PIPES AND HOSES

Measures to be Evaluated	Started	Responsible
IMMEDIATE MEASURES		
Evaluate setting off emergency alarm	Yes/No	Individual discovering incident
Commence vessel's emergency plan	Yes/No	Duty officer
PRELIMINARY MEASURES		
Stop all loading and/or refuelling activities and close manifold valves	Yes/No	Duty officer
Crew in stand-by positions	Yes/No	Everyone
Inform terminal/loading-responsible/ Refuelling personnel about incident	Yes/No	Captain/Duty officer
FURTHER MEASURES		
Evaluate necessity of closing air intake to accommodation and unnecessary air intake to engine room	Yes/No	Chief
Locate source of discharge, and undertake collection and cleaning plan:	Yes/No	Chief/Duty officer

Check if scupper plug is blocked:	Yes/No	Deckhand on duty
Drain affected part of pipe to an empty or loose tank	Yes/No	Chief
Evaluate fire/health hazard connected to the discharge	Yes/No	Captain
Prepare portable pumps if oil discharge can be transferred to loose or empty tank	Yes/No	Chief
Undertake measures to reduce pressure in the affected part of pipe	Yes/No	Chief
Seal potential discharge	Yes/No	Chief
Evaluate report to authorities:	Yes/No	Captain

If the oil discharge is limited to onboard the vessel, and can be handled by vessel's own crew, then further measures will be as follows:

1. Seal off area onboard so that oil spill is prevented to spread to non polluted areas of the vessel, possibly by changing the trim, or by making barriers of rags/cotton waste and sawdust. Use dredge pump or absorbent material and legal dissolvents to collect oil spill onboard.
2. Transfer oil and oily water from deck cleaning to slop tank or loose tank.
3. Make sure that the entire spill is cleaned up and stored safely until collection can be arranged.

After discharge is stopped and the damage is repaired, it may be necessary to obtain permission from local authorities and/or terminals in order to continue normal operation.

Special precautions when conducting bunkering offshore under way with support vessel (in-line / side to side):

- Break-away coupling to be installed on the in-line bunkering hose
- If possible, break-away coupling to be installed on the bublkering hose used for side to side bunkering
- If availabe, remote stop function of fuel delivery pump of support vessel to be handed over to siemsic vessel bunkering station/duty officer
- Maintain permanent contact between seismic vessel and support vessel bridge/duty officers

6.1.2. Spills Resulting from Casualties

In the event of a casualty the Master's first priority is to ensure the safety of the vessel's personnel and to initiate action to prevent the incident from getting worse.

When the safety of both the ship and personnel has been addressed, the master can initiate mitigating activities considering the following matters:

- Assessment and monitoring requirements;
- Personnel protection issues:
  Protective equipment; and
  Threats to health and safety
- Containment and other response techniques (e.g. dispersing, absorbing,);
- Isolation procedures;
- Decontamination of personnel; and
- Disposal of removed oil and clean-up materials.

If the casualty involves grounding, breaching of the outer hull, or other structural damage for which calculations of stability and damaged longitudinal strength are beyond the ship's resources, assistance must be sought from shore.

If the ship remains under command, the Master must assess the possibility and the necessity to manoeuvre upwind of spill, away from land and/or to sail to a more suitable location such as a gulf, outer roads, safe anchorage, to manage a rendezvous for a lightering operation or to undertake emergency repairs with or without assistance. When expecting to approach the coasts, **great care must be held to the coastal state authorisations & cooperation requirements.**

It may be necessary to transfer all or part of the bunkers to another ship. The ICS/OCIMF publication "Ship to Ship Transfer Guide (Petroleum)" describes procedures to be followed in such a case. A copy is held on board, and the Master should encourage Officers to familiarize themselves with its contents. When arranging a rendezvous, the Master must ensure that the lightering vessel will also follow the procedures in the guide.

The following casualty situations are dealt with:

A Grounding - Stranding
B Fire - Explosion
C Collision
D Hull failure - Containment system failure
E Excessive list
F Submergence – Foundering - Wreck
G Hazardous vapour release

If shore assistance is requested for further stress & stability calculations, the Master will use the Annex 5 and will contact the CGG Eidesvik office, Officer on duty, whose emergency number is given in the procedure 7-01-004 SMS Management System

A –Grounding - Stranding

<u>If the ship runs aground</u>

- Sound the emergency alarm and initiate emergency response procedures.
- Eliminate all avoidable sources of ignition and ban all smoking on board.
- Consider whether to stop air intake to accommodation and non-essential air intake to the engine room.
- Carry out a visual inspection of the vessel to determine the severity of the situation.
- Take soundings around the vessel to determine the nature and gradient of the seabed.
- Check difference in the tidal ranges at the grounding site.
- Evaluate tidal current in the grounding area.
- Take soundings of all bilges, ballast and bunker tanks and check all other compartments adjacent to the hull: **ullage plugs should not be opened indiscriminately as loss of buoyancy could result.**
- Compare present soundings against departure soundings.
- Evaluate the probability of additional release of oil.

Further information on the action to be taken when a ship is aground is contained in the publication:
ICS/OCIMF "Peril at Sea and Salvage - A Guide for Masters".

Having assessed the damage that the vessel has sustained, and taking into account the effects of hull stress and stability, the Master should decide whether or not any action can be taken to avoid further spillage, such as:

- Transfer of bunkers internally. If the damage is limited, for example to one or two tanks, consideration should be given to transfer of oil from damaged to intact tanks.
- Isolate bunker tanks to reduce further loss due to hydrostatic pressure during tidal changes.
- Evaluate the possibility of transferring bunkers to barges or other ships, and request such assistance accordingly.
- Trimming or lightening the vessel sufficiently to avoid damage to intact tanks, thereby avoiding additional pollution from oil spillage.

If the risk of additional damage to the vessel by attempting to refloat it by its own means is assessed to be greater than by remaining aground until assistance has been obtained, the Master should try to prevent the vessel from moving from its present position by:

- Using anchors,
- Taking in ballast in empty tanks (if possible),
- Reducing longitudinal stress on the hull by transferring bunkers internally.

If shore assistance is requested for further stress & stability calculations, the Master will use the Annex 5 and will contact the CGG Eidesvik SMS' Officer on duty, whose emergency number is given in the procedure 7-01-004 in QA Contingency Plan

B - Fire-Explosion

<u>If an explosion or a fire occurs on board</u>

- Sound the emergency alarm, deploy the vessel's fire emergency team(s) and follow the emergency procedures.
- Determine the extent of the damage, and decide what damage control measures can be taken.
- Determine whether there are casualties.
- Request assistance as deemed necessary.
- Assess the possibility of pollution from oil leakage.
- If there is a spill of oil in connection with the fire or explosion, inform appropriate parties in accordance with Section 5 of this plan.

C – Collision

If a collision occurs

- Sound the emergency alarm and initiate emergency procedures
- Determine whether there are casualties.

The Master should assess the situation for pollution purposes as follows, taking action where appropriate:

- Decide whether separation of the vessels may cause or increase the spillage of oil.
- If any oil tanks are penetrated, reduce the risk of further spillage by isolating penetrated tanks or transferring oil to slack or empty tanks.
- If there is a spill of oil in connection with the collision, inform the appropriate parties in accordance with Section 5 of this plan.

D - / Hull Failure - Containment System Failure

If the vessel suffers severe structural hull failure

- Sound the emergency alarm and muster the crew.
- Reduce speed or stop to minimise stress on the hull
- Assess the immediate danger of sinking or capsize.
- Initiate damage control measures.

The Master should then assess the situation for pollution purposes as follows:

- If oil has spilled, or it is necessary to jettison oil in order to maintain stability, inform the appropriate parties in accordance with Section 5 of this plan.
- Consider the forecast weather conditions and the effect they may have on the situation.

If shore assistance is requested for further stress & stability calculations, the Master will use the Annex 5 and will contact the CGG Eidesvik office, Officer on duty, whose emergency number is given in the procedure 7-01-004 in QA Contingency Plan

E - Excessive List

If an excessive list occurs rapidly and unexpectedly it may be due to

- Failure of the hull plating.
- Failure of an internal bulkhead between compartments.
- Shift of cargo.
- Flooding of the engine room, where free surface can cause a list.
- Damage through grounding or collision.
- Incorrect operational procedures.
- Insufficient Gm.

Measures to be taken immediately

- Stop any cargo, bunkering or ballast operations in progress.
- Sound the emergency alarm and muster the crew.
- If under way, reduce speed or stop.
- Establish reason for list.

Further measures

- Sound all tanks and compare soundings with departure soundings.
- If oil has spilled, or it is necessary to jettison oil in order to maintain stability, inform the appropriate parties in accordance with Section 3 of this Plan.

- If possible, take corrective action to rectify the situation.

F - Submergence- Foundering - Wreck

If the ship is wrecked to the extent that it is in imminent danger of foundering or being completely or partially submerged, safety of the lives of the crew will take priority over preventing pollution. It is likely that the event which caused the sinking will have led to some surface pollution already. However, if time allows, it may be possible to take some measures which will limit subsequent spillage.

Actions to consider

- Prepare for evacuation,
- Inform the appropriate parties in accordance with Section 3 of this plan,
- Close all fuel pipeline valves,
- Alert other ships and navigational authorities for assistance and of the presence of pollutants.

G –Hazardous Vapour Release

For cargo ships at sea, it is unlikely that a significant marine pollution hazard will be created solely by vapour release. In port the main problem with such an event is safety of the crew and nearby shore personnel in a flammable atmosphere.

Measures to be taken immediately

- Stop any cargo, bunkering or ballasting operations in progress, and close all tank valves and pipeline master valves,
- Eliminate possible sources of ignition,
- If under way, consider altering course to create the best wind flow, or reducing speed or stopping,
- If in port, consider evacuation of non-essential personnel,
- If in port, alert shore and terminal personnel, and the crew of craft alongside.

Further measures

- Identify the reason for the hazardous vapour release,
- Close unnecessary air intake of accommodations and engine room,
- If possible, take corrective action to rectify the situation.

6.1.3. Mitigating Activities

When the safety of both the ship and personnel has been addressed, the Master can initiate mitigating activities considering the following matters :

1. assessment and monitoring requirements;
2. personnel protection issues
   - 2.1 protective equipment; and
   - 2.2 threats to health and safety
3. containment and other response techniques (e.g. dispersing, absorbing);
4. isolation procedures;
5. decontamination of personnel; and
6. disposal of removed oil and clean-up materials.

6.1.4. Stability and strength considerations

See annex 5

Great care in casualty response must be taken to consider stability and stress when taking actions to mitigate the spillage of oil or to free the ship if aground.
Great care in casualty should only be undertaken with a full appreciation of the likely impact on the ships overall stress and stability.

When the damage sustained is extensive, the impact of internal transfer on stress and stability may be impossible for the ship to assess. Contact should be made with the Technical Manager for the necessary calculations to be carried out.

Information requires by the Technical Manager will include:

1. Intact ship's condition
    - Cargo/Ballast - amount and disposition
    - Fuel oil -amount and disposition
    - Draft - when free floating

2. Damage
    - Location and extent

3. Condition of ship
    - Extent to which aground (soundings around ship)
    - Draft - forward, amidships (port and starboard), and aft
    - Cargo fuel loss or change in amount and disposition
    - Action already taken

4. Local conditions -
    - Tide - range and whether rising or falling
    - Wind - strength and direction
    - Sea state - height and direction of sea and swell
    - Weather forecast
    - Air and sea temperatures
    - Nature of bottom
    - Other locally significant features

Details of current bunker and ballast tank information, including quantities and specification, are held in the ships Office.

6.1.5 Transfer of Bunker/ Lightening

If the ship has sustained extensive structural damage, it may be necessary to transfer all or part of the cargo/ bunker to another ship; however, this section refers to bunker transfer procedures only.
In Ship-to-Ship-transfer operations involving a specialized service ship, the Master of that ship will normally be in overall charge.
In the case of non-specialized ships the Master or other person in overall charge of the operation should be mutually agreed and clearly established by the Masters concerned prior to the start of operations.
The actual bunker transfer should be carried out in accordance with the requirements of the receiving ship.
In all cases each Master remains responsible for the safety of his own ship, its crew, cargo/ bunker and equipment and should not permit their safety to be jeopardized by the action of the other Master, his owner, regulatory officials or others.

The Ship-to-Ship-transfer operations should be coordinated with the appropriate responsible local Authority.

When selecting the area of operation the Master(s) should consider the following points

- The need to notify and obtain the agreement of any responsible authority

- The destinations of the ships concerned
- The shelter provided, particularly from sea and swell
- The sea area and depth of water, which should be sufficient for manoeuvring during mooring, unmooring and transfer operations and allow a safe anchorage if operations have to be undertaken at anchor
- The traffic density
- The weather conditions and the weather forecasts

Further, before commencing Ship-to-Ship transfer operations each ship should carry out, as far as possible, appropriate preparations like

- Pre-mooring preparations of the ships
- Positioning of fenders if such equipment is available on board
- Mooring equipment arrangements
- Checking the communication channels between the two ships

In additions to the general principles of Ship-to-Ship operations as aforementioned the Master should take note of supplemented instructions issued by the company.

Those supplemented information is located in UNISEA QA.

6.2. NATIONAL and LOCAL COORDINATION

Quick, efficient coordination between the ship and coastal state or other involved parties becomes vital in limiting the effects of a pollution incident.
In most countries it is accepted that an oil spill can be tackled most effectively from the shore and there is normally no requirement on the part of the shipowner / ISM Manager or the ship's crew to organise the
clean-up response in respect of oil lost overboard. Operational spills usually occur in port at an oil or bunkering facility and tend to be cleaned up by the facility operator. In case of casualties, the responsibility to organise and control the clean-up response is usually assumed by an agency of government.
In both cases the spiller would be expected to cooperate fully.

<u>IN CASE OF LACK OF MEANS OR TOO LONG DELAY FROM SHORE</u>

- Report to shore Authorities (refer to Annex 2),
- Assess the possibility of limiting the spread of oil at sea by using the ship's facilities,
- Contact the coastal state for authorization to undertake mitigating actions,
- Ask whether the ship's dispersant or absorbent can be used or not,
- Lower a lifeboat at sea,
- On deck, link the length needed or available of fire hoses (or use ropes),
- Plug one side,
- Blow up the hoses at half pressure, to assure the buoyancy without getting them rigid,
- Complete by or use ropes instead of hoses,
- Use the lifeboat to set the spill boom around the slick,
- Pump the oil spill with a portable or floating pump,
- Send the oily water into a small capacity, preferably normally dedicated to water ballast,
- Block-up (padlock or other system) all the valves in relation with this capacity,
- Ask for confirmation to the authorities and treat the spill remaining with the ship's dispersants,
- Report to Authorities and to the ISM Manager of the current action and the end of the operation. If necessary, the ISM Manager will arrange for assistance from a cleanup contractor,
- At the first opportunity, put ashore the oily water by the sludge pump if possible,

- Wash carefully the capacity and send the washing residues ashore,
- Check the cleanliness of the capacity,
- Release the ballast piping valves dedicated to this capacity.

6.3. ADDITIONAL INFORMATION

6.3.1. Company Policy

It is the CGG Eidesvik SMS' policy to operate and maintain the ships at standards which demonstrate its responsibility towards employees, owners, charterers and the public at large.

The Master and the Chief Engineer must ensure that under no circumstances will oil or contaminated water be discharged or allowed to escape from vessels tanks or lines except when this is in full compliance with statutory regulations.

All vessels have been supplied with copies of internationally approved regulations and, where applicable, those issued by local authorities where special requirements may apply.

Strict compliance must be observed with the instructions for maintenance of the Oil Record Book.
Certificate of Financial Responsibility (COFR only for ships trading in US ports and COFR Ca only for ships trading in Californian ports) and Bunker Convention Certificate (Certificate of Insurance or other financial security in respect of civil liability for bunker oil pollution damage) must always be kept available for inspection when required.

6.3.2. Diagrams and Drawings

Please refer to Section 8.

6.3.3. Response Equipment

A minimum equipment to be immediately available during the bunkers operations

6.3.4. Records

Masters are required to act in respect of the guidelines of the:
"MARINER'S ROLE in COLLECTING EVIDENCE".

6.3.5. Plan Review

Masters and Chief Engineers will review this Oil Pollution Emergency Plan at least once a year and will record it in the Section 1, page 7.
A review will also be conducted after each pollution incident.
This review consists in reading the documents (and the drawings), in order to verify that:
- it is complete,
- it is updated,
- the amendments have been correctly made and recorded,
- the obsolete documents have been removed,
- the full set of the attached drawings (if any, otherwise it is copies put in the Section 8) are still with the plan itself,
- it remains applicable, or if on board instructions have adapted the proposals contained in the SOPEP in order to match with the shipboard organization,
- if your SERS file is onboard and contents understood (process, information to give...), it is the opportunity to check the shortest time necessary –in case of emergency- to get from the Chief Engineer the exact situation of the distribution of FO/DO/LO on board.
- the bunkering procedure is conform, and if the adaptation to the bunkering at sea is applicable (seismic vessels),
- the controlled copies of the procedure are of the last version,

This list is only a frame. The first review may take time, but becomes quickly a routine. Once the external documents like the bunkering procedures or the oil spill team are fixed and checked conform, the review is just a check of the updating.

6.3.6. Exercices / Drills

We consider that the minimum equipment to be placed on site at each bunkering operation will keep the crew familiar with it and aware of the precautions to be undertaken.

The Oil Pollution Prevention drills may be in the form of Officers meetings, the subjects of which should be the emergency transfers, the possibilities to use a wing tank for the waste oil, the actions in case of serious damage to the hull, etc.

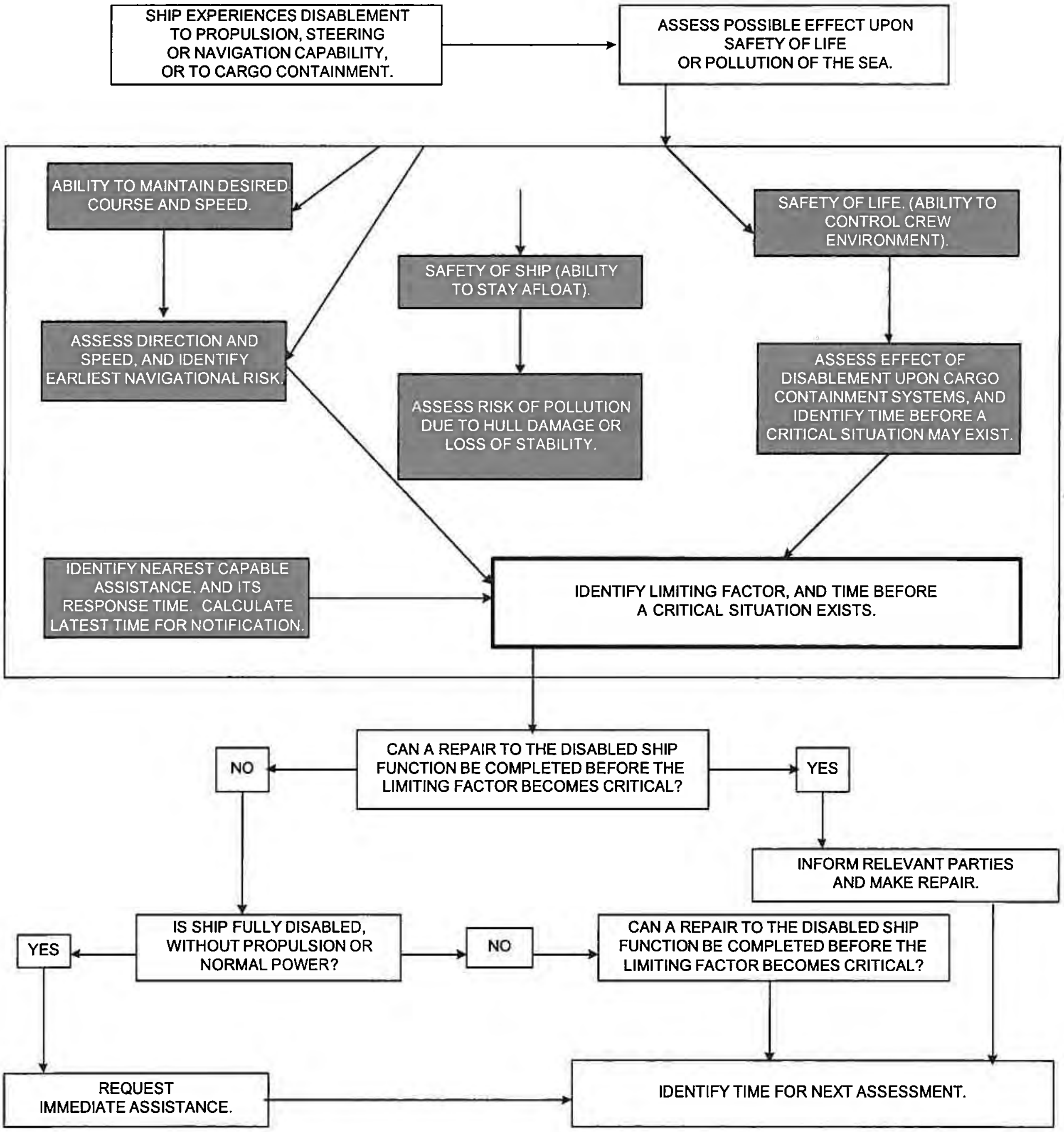
One of the pre-identified emergency situation drills requested by the ISM Code may be fully dedicated to a pollution. Or any of these drills may encompass a pollution aspect which, if dealt with sufficient details, may be considered as a drill in the scope of the SOPEP requirement.

These drills are recorded in the matrix, in CGG Eidesvik SMS
Management System

6.3.7. Salvage

When a casualty occurs to a ship under way that reduces its manoeuvrability, the master needs to determine his window of opportunity considering the response time of assistance, regardless of the estimated time of repair. It would not be prudent to hesitate in calling for assistance when the time needed to repair something goes beyond the window of opportunity. The following flow chart will aid the master or to shore management in assessing the need and urgency of calling for salvage assistance when a casualty occurs.

FLOW CHART TO ASSIST MASTER
TO DETERMINE WHEN SALVAGE ASSISTANCE SHOULD BE OBTAINED.



SECTION 7

ANNEXES

ANNEX 1

Port Contacts

PORT	PERSON / INSTITUTION / ADDRESS	TEL.	FAX

ANNEX 2

Coastal States Contacts

Please refer to Company circular letters or IMO

ANNEX 3

Oil Pollution Prevention Team

The purpose of the Oil Pollution Prevention Team is to initiate recovery and clean-up operations immediately if an incident occurs during bunkers transfers.

Composition of the OPPT

MASTER

Chief Officer
Duty Deck Officer

Chief Engineer
Duty Engineer Officer

Deck and Engine Ratings on duty

In the event of an oil spill, the team is called out immediately.

The team is given the necessary training in the place and the use of equipment and/or oil absorbents that the vessel carries. All members of the oil pollution prevention team are aware of their duties should an oil spill occurs.

The WILLINGNESS of the CREW WILL BE NOTED by the AUTHORITIES

Instructions to Oil Pollution Prevention Team

When Refueling at Sea

- Refer to CGG Eidesvik SMS Management System for bunkering at sea procedure

Master

In overall charge.
Inform Terminal authorities of incident.
Inform local agent and request agent to inform the local P&I representative.
Advise the Company's head office of the situation. Keep everyone updated at regular intervals and advise any changes in status of emergency.
Request assistance as deemed necessary.

Chief Officer

In charge of deck operation.
Keep Master informed and updated on the situation and on the results of steps taken to limit outflow.

Chief Engineer

In charge of bunker operations.
Inform the Master immediately.
Organize the distribution of oil spill cleaner.

Engineer Officer on Duty

a) <u>Bunkering from barge / shore to ship</u>
Alert "shore" staff immediately.
Close all valves and inform the Chief Engineer and the Chief Officer.
Mobilise deck hands to contain spillage.
Fire-fighting team on stand-by if necessary.

b) <u>Discharging sludges / bunkers</u>
Stop pumps immediately.
Close all valves and inform the Chief Engineer and the Chief Officer.
Alert "shore" staff.
Mobilise deck hands to contain spillage.
Fire-fighting team on stand-by if necessary.

Ratings on Duty

If an oil leakage is detected, alert the Duty Officer immediately

ANNEX 4

Check Lists for Use in Emergencies

A - OPERATIONAL OIL SPILL RESPONSE CHECK LIST

This checklist is only a response guidance when dealing with an oil spill during bunkering operations. A selection of the actions will be conducted according to the circumstances.

When Refueling at Sea

Refer to CGG Eidesvik SMS Safety Management System's bunkering procedures.

ACTIONS to be CONSIDERED	ACTION taken YES	ACTION taken NO	RESPONSIBLE PERSON
Immediate action			
Sound emergency alarm	O	O	Person discovering incident
Initiate vessel emergency procedures	O	O	Duty Officer
Initial response			
Cease all bunkering operations	O	O	Duty Officer
Close manifold valves	O	O	Engineer on Duty
Stop air intake to accommodation	O	O	
Stop non-essential air intake to E/R	O	O	
Locate source of leakage	O	O	
Stop-reduce cargo operations	O	O	Duty Officer
Commence clean-up procedures using absorbents and permited solvents	O	O	Chief Officer
Comply with reporting procedures	O	O	Master
Secondary response			
Assess the risk from release of flammable substances	O	O	Chief Officer
Reduce oil level in relevant tank by dropping oil into an empty or slack tank	O	O	Chief Engineer
Reduce level of oil in tanks in suspect area	O	O	
Drain affected line to empty or slack tank	O	O	
Prepare portable pumps if any to transfer spilt oil to empty tank (sludge tank)	O	O	
Further response			
Consider mitigating activities to reduce effect of spill liquid	O	O	Master
Pump water into leaking tank to create water cushion and prevent further oil spill	O	O	Chief Engineer & Chief Officer
If leakage in below waterline, arrange divers for further investigation	O	O	Master
Calculate stress and stability requesting shore assistance if necessary	O	O	Master & Chief Officer
Transfer bunkers to alleviate high stresses	O	O	Chief Officer Chief
Designate stowage for residues from cleanup carefully prior to disposal	O	O	Officer

B - CASUALTY OIL SPILL RESPONSE CHECK LIST

This check list is only a guidance when dealing with an oil spill following a casualty.

ACTIONS to be CONSIDERED	ACTION taken YES	ACTION taken NO	RESPONSIBLE PERSON
Action immédiate / Immediate action			
Sound emergency alarm	O	O	Person discovering incident
Initiate vessel emergency response	O	O	Duty Officer
Initial response			
Assess the risk of fire & explosion and alter course immediately	O	O	Duty Officer
Stop air intake to accommodation	O	O	Engineer on duty
Stop non-essential air intake to E/R	O	O	
Assess further danger to ship or personnel by such as capsize or immediate sinking	O	O	
Cease all non essential operations	O	O	Master
Assess whether oil has actually been spilt	O	O	Chief Officer
Or there is a probability that it will be spilt	O	O	
Comply with reporting procedure	O	O	Master Chief
Sound all compartments	O	O	Officer Chief
Sound around vessel if aground	O	O	Officer
Request outside assistance	O	O	Master
Stop or reduce flow of oil	O	O	Chief Engineer
Counter excessive list	O	O	Chief Officer & Chief Engineer
Contain spilt oil	O	O	Duty Officer
Commence cleanup using absorbents and permitted solvents	O	O	
Secondary response			Chief Officer
"Assess the risk from release of flammable substances	O	O	
Consider evacuation of non-essential crew	O	O	Master
Assess likelihood of further damage to vessel	O	O	
Calculate stress-stability requesting shore assistance if necessary	O	O	Master & Chief Officer
"r Transfer bunkers to alleviate high stresses	O	O	Master & Chief Engineer
"r Request assistance or escort to place of refuge	O	O	Master
"r Manoeuvre upwind of spill, away from land	O	O	
"r Assess effect of tide and current on ship and spill liquid	O	O	
"r Obtain weather forecast and assess effect	O	O	
"r Prepare pumps for transfer of liquid to other tanks or to shore or lighter	O	O	Chief Engineer
"r Reduce liquid level in tanks in suspect area	O	O	Chief Engineer
"r Designate stowage for residues from clean-up prior to disposal	O	O	Chief Engineer

ANNEX 5

Damaged Stress and Stability Calculations

The copies attached hereafter give the minimum information expected from the vessel if any assistance about damage stress and stability calculations is required from shore.

Master is to gather all this information before initiating such assistance.

The Master should contact with owner/Manager given in “Annex 10” in order to gain damage stability and damage longitudinal strength assessments, if necessary.

Section A: Communication Details

Ship Name	IMO/LRS N°
Phone Number (Inmarsat)	
Telex Number	
Fax Number	

ISM Manager
Phone Number
Telex Number
Fax Number

Owner's Representative Concerned with Casualty
Phone Number (if different from above)
Telex Number
Fax Number

Section B: Voyage Particulars

Departure Port	
Destination	Via
Departure Date	Time (GMT)

Section C: Ship Condition Immediately Before Casualty

Mean Draughts Fwd Meters Aft Meters

KG (Solid) / KG (Fluid) of Ship (if known) Meters

LCG of Ship (if known) Meters from Midships or AP

ID	Compartment	SG	Tonnes

Section C: Ship Condition Immediately Before Casualty (continued)

ID	Compartment	SG	Tonnes

Section D: Data Relating to Vessel After Casualty

Nature of Casualty: Collision / Grounding (Fixed/Free) / Fire / Explosion / Heavy Weather / Other

Casualty Date Report Time (GMT)

Geographical Location at Casualty LAT

LONG

Conditions at Site at Time of Casualty Report

Weather

Sea State

Tidal State

Tidal Range

Forecast

SG of Surrounding Water

	Port / Starboard	
Draughts at Fwd Marks / FP		Meters Measured / Best Estimate
Draughts at Aft Marks / AP		Meters Measured / Best Estimate
Draughts at Midships		Meters Measured / Best Estimate
Angle of Heel		Degrees Port / Starboard

Best Estimate of Depth of Water on Deck:

Location	Meters

Best Estimate of Depth of Water (for Grounding)

Location	Port (Meters)	Starboard (Meters)

Section E: Reported Damage

Details of each damaged compartment known to be open to the sea, including those damaged above the present waterline.

Compartment	Estimated Cargo Weight (tonnes)	Permeability of Cargo (%)	Comments

Extent and location of structural damage in way of the above compartments. (Attach sketch)

Extent of additional damage to pipes, valves, hatches, doors etc... and list of compartments which may be subject to progressive flooding as a result

Soundings from or estimates of amounts of flood water in spaces not directly open to sea

Section F: Proposed Action and Requirements

Any other relevant information, details of action being undertaken or proposed course of action, salvage operations, etc...

ANNEX 6

Oil Spill Response Equipment Carried on Board

Oil spill response equipment is able to deal with 7 barrels (1100 litres) spill.

Oil Spill Response Equipment available on board is in accordance with OPA 90 requirements.

This equipment is, fully and only dedicated to oil pollution cleanup operation.

IMPORTANT

No bunkering or sludge discharge operation will be started without the following minimum equipment being in place at the site of operations:

- Sawdust 20 Kg
- Buckets 3
- Non-Spark Shovels 3
- Brooms 3
- 200 L Drum 1

ANNEX 7

Example Report

When Refueling at Sea

- Refer to CGG Eidesvik SMS Management System)

The following is an example of an initial report sent to the government of the coastal State and to ISM Manager

AA	(YOUR SHIP, CALL SIGN & FLAG)
BB	291150
CC	2230N 06000E
EE	137
FF	120
LL	BOUND SINGAPORE FROM RAS TANURA
MM	BAHRAIN RADIO 500 KHZ, VHF 16, INMARSAT NO. 888888
NN	AS REQUIRED
OO	1700
PP	CRUDE OIL ARAB LIGHT 85742 TONNES. QATAR 36764 TONNES
QQ	COLLISION WITH CARGO SHIP WHITE SKY. TANK 6 PORT BREACHED SUBSEQUENT FIRE MAIN DECK AND ENGINE ROOM THUS UNABLE TO MANOEUVRE. FIRE NOW EXTINGUISHED. UNABLE TRANSFER CARGO DUE FULL TANKS. BALLAST AND FUEL SYSTEM INOPERATIVE.
RR	ESTIMATE LOSS 2000 TONNES ARAB LIGHT CRUDE OIL FROM 6 PORT. OUTFLOW NOW STOPPED APART FROM SEA ACTION. ESTIMATE OF SLICK MOVEMENT AND AREA NOT POSSIBLE.
SS	WEATHER FINE. WIND SE FORCE 3. SEA SLIGHT.
TT	SHIP OPERATOR BLACK GOLD SHIPPING CO., HIGH TOWERS, NEW YORK TELEPHONE : + ... FAX : + ...
UU	LENGTH 223M. BREADTH 42M. TONNAGE 127506 SDWT. TYPE OIL TANKER.
WW	25
XX	TUG ABC 2 CONTRACTED TO ASSIST ETA 291600 DO NOT ANTICIPATE FURTHER ASSISTANCE REQUIRED.

The following is an example of **additional information for the ISM Manager :**

QQ	TANK 6 PORT BREACHED FROM DECK TO 1 METRE ABOVE WATER. SHIP LISTED 5 DEGREES STARBOARD. BOILER OUT OF SERVICE HOWEVER ANTICIPATE WILL RESTORE TO SERVICE APPROX. 8 HOURS. GENERATORS OK. NO FURTHER DAMAGE. FIRE RISK UNCERTAIN. ALL INTACT TANKS INERT.
RR	CARGO DISPOSITION ARAB LIGHT ALL WINGS PLUS ONE/FOUR CENTRE QATAR TWO THREE FIVE CENTRE. ALL TANKS FULL.
XX	ONE MISSING (NAME). THREE NON SERIOUS INJURIES (NAMES). DAMAGE TO COASTER WHITE SKY UNKNOWN HOWEVER SHE ADVISES NOT IN DANGER OF SINKING. TUG ABC 2 ETA REMAINS 1600 GMT. LOF 95 WITH SCOPIC CLAUSE AGREED. DO NOT ANTICIPATE FURTHER ASSISTANCE REQUIRED. WILL REVERT WITH SPARES/MATERIALS REQUIREMENTS. SELF AND WHITE SKY BROADCAST VHF PAN MESSAGE, COASTAL STATE ADVISED. UNDERSTAND LOCAL COAST GUARD ARRANGING AERIAL SPRAYING. NO OTHER INFORMATION.

Ref: FO-ALL-MGT055E

AA	Name: GEO CORAL Call Sign: Flag: FRENCH	
BB	Date, Time (UTC) D D H H M M	
CC	Position OR LAT: d d m m N/S LONG: d d d m m E/W	**DD** BEARING d d d DISTANCE N miles FROM
EE	d d d True Course	**FF** Speed kn kn 1/10
LL	Route	
MM	Radio	
NN	Next report D D H H M M	
OO	Draught m m cm cm	
PP	Cargo Bunkers	
QQ	Defects	
RR	Pollution	
SS	WIND DIRECTION FORCE (Beaufort)	SWELL DIRECTION HEIGHT (m)
TT	CGG Eidesvik Ship Management – Carl Konows Gate 34 - 5162 BERGEN – NORWAY Phone Office +47 950 76 719 – Duty Watch +47 97 01 03 59	
UU	LENGTH (m) BREADTH (m) TONNAGE (UMS) TYPE	
WW	TOTAL on board including of crew	
XX	MISCELLANEOUS	

ANNEX 8

Bunkering Procedure

FO, LO, DO
SLUDGE DISCHARGE

Please refer to Company Bunkering Procedure in UniSea QA

The Chief Engineer is in charge of the Bunkering operations, assisted by an engineer Officer.
He is "at the site of the transfer operation and immediately available to the transfer personnel", and "in possession of a copy of the transfer procedures"

Tanks soundings / ullages are to be taken regularly at short intervals and to be recorded. Expected final figures must be calculated prior to the operation.
Sounding pipes will be plugged after each measure.

Before commencing bunkers

1. Ensure that receiving tanks are isolated from other tanks in the system.
2. Ensure that there are no internal bunker transfer operations taking place.
3. Ensure that all "deck scuppers" are plugged and cemented.
4. Ensure that all "save all" plugs are secured in place
5. Check visually that the bunkering hose is in good condition, and properly supported.
6. Ensure that a good gasket is fitted between the hose and the manifold, and that a "4 bolts" or "secure clamp connection" is used.
7. Each end of hose and/or manifold not connected must be blanked off.
8. Check the bunker barge or shore tanks for contents and water test.
9. Discuss and agree emergency "shut down" procedure.
10. Agree "communication and stop" procedures.
11. Agree identity of the product, sequence, quantity, pressure and pumping rate.
12. Lay out oil spill equipment.

Deck Department

When Refueling at Sea
Refer to CGG Eidesvik SMS Management System

Duty Officer: Officer on watch at sea, Duty Officer at port.
Deck rating: duty watchman.

1. Ensure that all moorings are in good equal tension, and check regularly during the bunker operation.
2. Ensure adequate illumination of the bunker station.
3. Ensure that correct signals are displayed throughout the operation (day and night).
4. If bunkering from a barge, ensure that barge moorings are in good condition and tension to avoid strain of bunker hose or connections.

Communications

1. All internal communications to be tested prior to commencement of bunkering operation.
2. Communication system to be set up between vessel and barge or shore installation.

Emergency procedure

1. In the event of a tank overflow or hose rupture, the order "STOP PUMPING" will be given, and the barge or shore facility should at once cease pumping and close down all relevant valves under his control.
2. Bunkering will only recommence on the instruction of the Chief Engineer.
3. If the vessel is discharging to a reception facility, the sludge pump or bilge pump remote stop will be activated, and the discharge valve on deck closed. Recommencement of discharge will only start on the instructions of the Chief Engineer.

Topping off

1. When "topping off", the pumping rate is to be reduced to a minimum and carried out in the slackest tank.
2. Company's policy is to limit a "full tank" at 92 % of the total and individual bunker capacity. The "blowing through" should not be carried out on a capacity accidentally filled over 95 %.

Completion of bunkering operation

1. Bunker lines to be closed.
2. Bunker hose to be disconnected, and any residue in the hose to be drained.
3. Hose blank to be put back in place and secured (gasket).
4. Bunker manifold flange blank to be put back in place and secured (gasket).
5. Manifold "save all" to be cleaned out.
6. Remove plugs.

General

"NO SMOKING" and/or "NO NAKED LIGHT" are to be laid out during the bunkering operation.

All previous instructions together with a line diagram of the bunkering system, showing the position of all the valves, etc., is to be posted adjacent to the bunker station, in a prominent and well lit position, together with the "Oil Spill Contingency Plan" which must have all the relevant information with regard to notification procedures entered up before commencing the taking of bunkers.

Reporting an oil spill

- Refer to the present "Oil spill contingency plan".
- In case of pollution, keep in mind the importance of the records of times and delays, photographs, films, samples... (see the check lists in "The Mariner's role in collecting evidence").
- All bunkering or sludge disposal to shore should be done according to USCG requirements.

ANNEX 9

CGG Eidesvik Ship Management Emergency Contingency Plan

Please refer to UniSea QA "CONTINGENCY PLAN CONTINGENCY SYSTEM (Vessels & Office)"

Procedure number 7-01-004 Reporting and Notification

Emergency Telephone:

CGG Eidesvik Duty Watch (**+47 97 01 03 59**)

DNV-GL Emergency Response Service:

+47 91 84 97 15,

Backup number:

+49 40 36 149 199 (code word OPA90)

ANNEX 10

Bibliography (Version 1)

"IMDG CODE SUPPLEMENT - REPORTING PROCEDURES"

"PERIL at SEA and SALVAGE - A GUIDE for MASTERS" (ICS)

"The MARINER's ROLE in COLLECTING EVIDENCE" (Nautical Institute)

"SHIP to SHIP TRANSFER (PETROLEUM)" (ICS)

"CODE of FEDERAL RULES" (USCG)

SECTION 8

PLANS AND DRAWINGS

GENERAL ARRANGEMENT,

- PIPING DIAGRAMS limited to:
  FO/DO transfer,
  LO Diagram
  Bilge and Ballast plan,

- CAPACITY and FO/DO/LO TANKS PLAN,

- STABILITY FILE.

The drawings mentioned above are immediately available with the SOPEP.

Deck drawings are available in the deck office

Engine drawings are available in the control room and in the Chief Engineer's room

Ballast and bunker situations are kept updated after each transfer and displayed on blackboards, situated in the deck office or in the pump room and in the control room.

RPS

Appendix H

Relevant stakeholders report

RPS

Appendix H Relevant stakeholders consultation report

Regulatory requirements

Table H.1 Demonstration that the OPGGS(E) Regulations have been met

Sub-regulation	Regulatory requirement	Notes
10A(g)	**Criteria for acceptance of an environment plan** For regulation 10, the criteria for acceptance of an environment plan are that the plan: (g) demonstrates that: (i) the titleholder has carried out the consultations required by Division 2.2A; and (i) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate.	The process by which consultation was carried out is described in Section 9.0 of this EP. The outcomes of the process are documented in this Appendix. Together, these demonstrate that the requirements of Division 2.2A have been met.
11A(1)	**Consultation with relevant authorities, persons and organisations, etc** In the course of preparing an environment plan, or a revision of an environment plan, a titleholder must consult each of the following (a relevant person): (a) each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant; (b) each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant; (c) the Department of the responsible State Minister, or the responsible Northern Territory Minister; (d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan; (e) any other person or organisation that the titleholder considers relevant.	Section 9.0 of this EP summarises the process CGG used to identify and consult with relevant stakeholders. Table H-2 provides the current list of relevant stakeholders for the Gippsland MSS. Other key stakeholders that were potentially relevant, but either advised they were not, or CGG deemed they were not are in Table H-3.
11A(2)	**Consultation with relevant authorities, persons and organisations, etc** For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.	The approach undertaken to provide sufficient information is described in Section 9.0 of this EP. Table H-4 lists all information provided to each relevant stakeholder. Appendix I contains records of the information provided to stakeholders.
11A(3)	**Consultation with relevant authorities, persons and organisations, etc** The titleholder must allow a relevant person a reasonable period for the consultation.	The approach undertaken to provide a reasonable period for the consultation is described in Section 9.0 of this EP. Table H-4 lists the timeframes that have been provided for each relevant stakeholder. Appendix I contains records of the information provided to stakeholders.

RPS

Sub-regulation	Regulatory requirement	Notes
14(9)	**Implementation strategy for the environment plan** The implementation strategy must provide for appropriate consultation with: (a) Relevant authorities of the Commonwealth, a State or Territory; and (b) Other relevant interested persons or organisations.	The process for ongoing consultation is described in Section 9.0 of this EP. A schedule of notifications to stakeholders is provided in the Implementation Strategy (Section 8.0 of this EP).
16(b)	**Other information in the environment plan** (b) a report on all consultations between the titleholder and any relevant person, for regulation 11A, that contains: (i) a summary of each response made by a relevant person; and (ii) an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and (iii) a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and a copy of the full text of any response by a relevant person.	Table H-4 and Appendix I

List of relevant stakeholders

Table H-2 provides the current list of relevant stakeholders for the Gippsland MSS. Other key stakeholders that were potentially relevant, but either advised they were not, or CGG deemed they were not are in Table H-3.

Relevant stakeholders were grouped according to their common functions, interests and activities as follows:

- Government agencies, authorities and representatives – general
- Government agencies – fisheries
- Fisheries associations
- Fishing companies and fishers
- Tourism and recreation
- Research
- Industry operators.

Table H.2 Relevant stakeholders consulted for the Gippsland MSS

Stakeholder organisation or individual	Reason identified as relevant
Government agencies, authorities and representatives – general	
Aboriginal Victoria	Commonwealth government agency responsible for cultural heritage management and protection.
Australian Maritime Safety Authority	Commonwealth authority responsible for maritime safety, protection of the marine environment including marine pollution and maritime aviation search and rescue.
Commonwealth Department of Agriculture and Water Resources	Commonwealth government agency that develops policy to promote the sustainability of Australian fisheries and leads the implementation of Australia's marine pest and biosecurity management requirements.

RPS

Stakeholder organisation or individual	Reason identified as relevant
Commonwealth Department of Defence – Australian Hydrographic Office	Commonwealth government agency responsible for the publication and distribution of nautical charts and other navigation information, including Notice to Mariners.
Victorian Department of Economic Development, Jobs, Transport and Resources	Victorian government agency responsible for marine pollution, marine transport and mining and resources. Note that the CarbonNet Project is covered under the stakeholder group ‘Research’.
Victorian East Gippsland Shire Council	Local government council for East Gippsland, responsible for managing community needs like waste collection, public recreation facilities and town planning.
Victorian Environmental Protection Authority	Victorian government agency responsible for regulating pollution and waste.
Victorian Office of the Hon Daniel O’Brien – Member for Gippsland South	Member of parliament responsible for representing the views and interests of Gippsland South constituents.
Victorian Office of the Hon Darren Chester – Member for Gippsland	Member of parliament responsible for representing the views and interests of Gippsland constituents.
Victorian Office of the Hon Tim Bull – Member for Gippsland East	Member of parliament responsible for representing the views and interests of Gippsland East constituents.
Victorian South Gippsland Shire Council	Local government council for South Gippsland, responsible for managing community needs like waste collection, public recreation facilities and town planning.
Victorian Wellington Shire Council	Local government council for Wellington, responsible for managing community needs like waste collection, public recreation facilities and town planning.
Government agencies – fisheries	
Australian Fisheries Management Authority	Commonwealth government agency responsible for the management and sustainable use of Commonwealth fish resources.
Victorian Fisheries Authority	Victorian government authority established to manage Victoria’s commercial and recreational fisheries resources.
Fishing associations	
Abalone Council Australia Ltd	Industry body that represents the wild-harvest abalone industry (for Victoria and other states in Australia).
Abalone Victoria Limited (Central Zone)	Industry body that represents the views and interests of Abalone Central Zone licence holders.
Commonwealth Fisheries Association	Industry body that represents the rights, responsibilities and interests of Commonwealth commercial fisheries.
Eastern Zone Abalone Industry Association	Industry body that represents the views and interests of Abalone Eastern Zone licence holders.
EastRock	Industry body that represents the views and interests of the Victorian eastern zone rock lobster fishers.
Lakes Entrance Fisherman's Co-operative Ltd	Industry body that represents the views and interests of Lakes Entrance fishers.
Scallop Fishermen's Association of Tasmania	Industry body that represent the views and interests of Tasmanian scallop licence holders, some of who may have interests, activities or functions within the survey area.
Scuba Divers Federation of Victoria	Industry body that represent the views and interests of recreational scuba divers of Victoria.
Seafood Industry Victoria	Industry body that represents the views and interests of the Victorian seafood industry (fishers, wholesale, processors and retail).

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Stakeholder organisation or individual	Reason identified as relevant
South East Trawl Fishing Industry Association	Industry body that represents the views and interests of licence holders, fishers and businesses with a commercial interest in the Southern and Eastern Scalefish and Shark Fishery, specifically the Commonwealth Trawl Fishery, Shark Gillnet Hook and Trap and Scalefish Hook sectors.
Southern Rocklobster Limited	Industry body that represents the views and interests of the Australian southern rock lobster fishery. Victorian Rock Lobster Association (see below) is a member.
Southern Shark Industry Alliance	Industry body that represents the views and interests of Commonwealth-licenced shark gillnet and shark hook members in the Gillnet Hook and Trap Fishery.
Sustainable Shark Fishing Association	Industry body that represents the views and interests of Commonwealth-licenced shark gillnet and shark hook members in the Gillnet Hook and Trap Fishery.
Victorian Abalone Council	Industry body that represents the views and interests of abalone licence holders in Victoria.
Victorian Abalone Divers Association	Industry body that represents the views and interests of abalone divers in Victoria.
Victorian Rock Lobster Association	Industry body that represents the views and interests of rock lobster licence holders in Victoria. Member of Southern Rocklobster Limited (see above).
Victorian Scallop Fisherman's Association	Industry body that represents the views and interests of scallop licence holders in Victoria.
VRFish	Industry body that represents the views and interests of recreational fishers of Victoria.
Fishing companies and fishers	
Stakeholder ID 763	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Small Pelagic Fishery (not relevant) *Commonwealth Southern Squid Jig Fishery *Victorian Scallop (Ocean) Fishery
Stakeholder ID 2193	Fishing licence holder active within the survey area. *Commonwealth Trawl Fishery
Stakeholder ID 1735	Fishing licence holder potentially active within the survey area. * Victorian Scallop (Ocean) Fishery
Stakeholder ID 2396	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 2514	Consulting group that advise on fisheries investment, management, research, science and trade.
Stakeholder ID 2132	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2497	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2755	Fishing licence holder active within the survey area. *Commonwealth Trawl Sector

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Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2212	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2142	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2143	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2133	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 1819	Fishing licence holder active within the survey area. *Commonwealth Trawl Fishery
Stakeholder ID 2433	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 868, Stakeholder ID 2273	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 2145	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2398	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2294	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2496	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2214	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Hook Sector
Stakeholder ID 2502	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Victorian Ocean (General) Fishery
Stakeholder ID 2146	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2295	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery

RPS

Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2156	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Trawl Sector *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector *Commonwealth Small Pelagic Fishery (not relevant) *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2202	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2134	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2135	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2335	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2530	Fishing licence holder potentially active within the survey area. *Commonwealth Trawl Sector
Stakeholder ID 2297	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 2798	Fishing licence holder potentially active within the survey area. *Victorian Ocean (General) Fishery
Stakeholder ID 2339	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2129	Fishing licence holder potentially active within the survey area. *Commonwealth Trawl Sector
Stakeholder ID 2147	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2400	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2434	Consultant representing Relevant Stakeholder ID 2153, Cull Fisheries Pty Ltd, Cull Fisheries Management Pty Ltd and Relevant Stakeholder ID 2399.
Stakeholder ID 2495	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2195	Fishing licence holder potentially active within the survey area. *Commonwealth Trawl Sector *Commonwealth Southern Squid Jig Fishery

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Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2527	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2498	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 1748	Fishing licence holder active within the survey area. *Commonwealth Bass Strait Central Zone Scallop Fishery *In process of purchasing licence for the Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2200	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2447	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2522	Fishing licence holder active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2401	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2157	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2402	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2565	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector *Commonwealth Trawl Fishery
Stakeholder ID 766, Stakeholder ID 2510	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Victorian Ocean (General) Fishery
Stakeholder ID 2718	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Victorian Scallop (Ocean) Fishery
Stakeholder ID 2491	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Trawl Sector
Stakeholder ID 2138	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2739	Company involved in the wholesale and distribution of fish and seafood.

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Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2403	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery *Victorian Scallop (Ocean) Fishery
Stakeholder ID 698, Stakeholder ID 760, Stakeholder ID 596, Stakeholder ID 2523	Fishing licence holder active within the survey area. *Victorian Ocean (General) Fishery *Victorian Purse Seine (Ocean) Fishery *Victorian Inshore Trawl Fishery
Stakeholder ID 1743	Fishing licence holder potentially active within the survey area. (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 870	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Trawl Fishery
Stakeholder ID 710	Fishing licence holder active within the survey area. *Commonwealth Trawl Fishery
Stakeholder ID 5262	Contractor responsible for transporting fresh fish from LEFCOL at Lakes Entrance to the Melbourne Fish Relevant Stakeholder ID 2491ets (and transports freight back to Lakes Entrance).
Stakeholder ID 2404	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Trawl Fishery
Stakeholder ID 2203	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2397	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2405	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2566	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Trawl Fishery
Stakeholder ID 2439	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 1744, Stakeholder ID 1774	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector - Scalefish Hook Sector
Stakeholder ID 2435, Stakeholder ID 2353	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery

Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2333	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2198	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2501	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Victorian Ocean (General) Fishery
Stakeholder ID 2139	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2140	Fishing licence holder potentially active within the survey area. *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector
Stakeholder ID 2494	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector
Stakeholder ID 2277	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2151	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2493	Fishing licence holder potentially active within the survey area. *Commonwealth Trawl Sector
Stakeholder ID 2281	Fishing licence holder potentially active within the survey area. *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2152	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 764	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector *Commonwealth Southern Squid Jig Fishery
Stakeholder ID 2506	Fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector *Commonwealth Bass Strait Central Zone Scallop Fishery

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Stakeholder organisation or individual	Reason identified as relevant
Stakeholder ID 2563	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Potentially (never responded) fishing licence holder active within the survey area (identified in the SETFIA report (SETFIA 2018))
Stakeholder ID 2215	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Hook Sector
Stakeholder ID 2529	Fishing licence holder active within the survey area. *Commonwealth Trawl Fishery
Stakeholder ID 1745	Fishing licence holder potentially active within the survey area (identified in the SETFIA report (SETFIA 2018)). *Commonwealth Trawl Fishery *Commonwealth Small Pelagic Fishery (not relevant)
Stakeholder ID 2153	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery *Commonwealth Bass Strait Central Zone Scallop Fishery
Stakeholder ID 2492	Fishing licence holder potentially active within the survey area. *Commonwealth Trawl Sector
Stakeholder ID 2316	Fishing licence holder active within the survey area. *Commonwealth Southern Squid Jig Fishery
Tourism and recreation	
Stakeholder ID 2535	Diving operator active out of Lakes Entrance.
Stakeholder ID 2571	Fishing charter operator potentially active out of Lakes Entrance.
Stakeholder ID 2572	Fishing charter operator potentially active out of Lakes Entrance.
Stakeholder ID 2573	Fishing charter operator potentially active out of Lakes Entrance.
Stakeholder ID 2569	Fishing charter operator potentially active out of Lakes Entrance.
Stakeholder ID 2567	Fishing charter operator active out of Lakes Entrance.
Research	
Blue Whale Study	Research project activities within or near the survey area.
CO2CRC	Research project activities within or near the survey area.
CSIRO	Research project activities within or near the survey area.
CarbonNet (Victorian Department of Economic Development, Jobs, Transport and Resources)	Research project activities within or near the survey area.
University of Melbourne	Research project activities within or near the survey area.
Industry Operators	
3D Oil	Petroleum titleholder with an active offshore Exploration Permit that overlaps with the survey area.
Basslink	Operator of the Basslink Interconnector that runs through the survey area.
Cooper Energy	Offshore titleholder, currently undertaking Sole pipeline installation activity that will cross the survey area. Pipeline installation commenced in September 2018 and is planned to finish Q1 2019.

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Stakeholder organisation or individual	Reason identified as relevant
Emperor Energy	Petroleum titleholder with an active offshore Exploration Permit that overlaps with the survey area. Drilling program planned for 2021.
ExxonMobil (Esso Australia Pty Ltd)	Esso Australia have Exploration Permits that overlap with the survey area and existing pipelines installed within the survey area.
GB Energy	GB Energy have an active Retention Lease that is located within the survey area and planning geophysical surveys for Q2 2019.
Hibiscus Petroleum	Hibiscus Petroleum have an active Exploration Permit that overlaps with the survey area (a collaboration with 3D Oil) that is located within the survey area.
Llanberis Energy	Llanberis Energy is lease and operator of active Exploration Permit that overlaps with the survey area but no activities currently planned that CGG is aware of.
SGH Energy	SGH Energy have an active Exploration Permit that overlaps with the survey area, but no activities planned for at least six months.

Table H.3 Other stakeholders engaged by CGG for the Gippsland MSS

Stakeholder organisation or individual	Reason not considered relevant
Stakeholder ID 1746	Fisherman in the Victorian Giant Crab and Rock Lobster Fishery. Stated via phone that they do not operate near the survey area and will not be affected.
Stakeholder ID 2270	Fisherman in the Commonwealth Southern Squid Jig Fishery. Stated via email they do not fish in the area.
Stakeholder ID 2210	Fisherman in the Commonwealth South East Scalefish and Shark Fishery – SFR holder. Stated via phone they do not fish in the area and will not be affected.
Australian Southern Bluefin Tuna Industry Association	Industry body for the Commonwealth Southern Bluefin Tuna Fishery. Stated via email they will not be affected.
Stakeholder ID 2204	Fisherman in the Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector. Stated they do not fish in or near the survey area and will not be affected.
Stakeholder ID 2155	Fisherman in the Commonwealth Southern Squid Jig Fishery. Stated they have sold their licences and will not be affected.
Stakeholder ID 2197	Fishermen in the Commonwealth Trawl Fishery. Stated via phone that they do not fish in the Gippsland Basin.
Stakeholder ID 1730	Fisherman in the Commonwealth Trawl Fishery – stated via phone that they do not operate near the survey area and will not be affected
Stakeholder ID 2148	Fishermen in the Commonwealth Southern Squid Jig Fishery. Stated via phone they do not fish in the area.
Stakeholder ID 1796	Fisherman in Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector. Stated via phone that they do not fish in the survey area and will not be affected
Stakeholder ID 2141	Fisherman in the Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Hook Sector. Stated via phone they do not fish in the area and will not be affected.
Stakeholder ID 2490	Fisherman in the Commonwealth Trawl Fishery and raised as relevant in the SETFIA report (SETFIA 2018). Stated via phone that they are retired and no longer fishing.
Stakeholder ID 2356	Fisherman in the Commonwealth Southern Squid Jig Fishery. Stated via phone they do not fish in the area.

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Stakeholder organisation or individual	Reason not considered relevant
Stakeholder ID 2377	Fisherman in Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Scalefish Hook Sector. Stated via phone that they do not fish in the survey area and will not be affected.
Stakeholder ID 2334	Fisherman in the Commonwealth South East Scalefish and Shark Fishery – Gillnet Hook and Trap Subsector – Shark Gillnet Sector and raised as relevant in the SETFIA report (SETFIA 2018). Stated that they do not fish in the area and will not be affected.
Stakeholder ID 2149	Fisherman in the Commonwealth Southern Squid Jig Fishery. Stated via phone they do not fish in the area.
Stakeholder ID 2528	Fisherman in the Commonwealth Small Pelagic Fishery. Advised by SETFIA that this fishery will not be affected.
Small Pelagic Fishery Industry Association	Representative industry body for the Commonwealth Small Pelagic Fishery. Advised by SETFIA that this fishery will not be affected.
Tuna Australia	Industry body for Commonwealth Eastern Tuna and Billfish Fishery. Stated via email they will not be affected.
Victorian Abalone Growers Association	Industry body for abalone fishers in Victoria. Stated they don't believe there to be any impact on them.
Stakeholder ID 2154	Fisherman in the Commonwealth Southern Squid Jig Fishery. Stated via phone they do not fish in the area.

Relevant stakeholder feedback, assessment of merit and CGG response

This section summarises relevant stakeholder feedback, CGG's assessment of merit of that feedback and response. For each relevant stakeholder the following information is provided in Table H-4:

- dates and methods of all consultation events with that stakeholder
- a summary of the feedback received from relevant that stakeholders for each event
- an assessment of the merits of any objections or claims raised for each event
- a statement of CGG's response, or proposed response, as a result of the consultation (where appropriate)
- a summary of the arrangement for ongoing consultation with that stakeholder.

CGG has used the NOPSEMA definition for "objections or claims" to identify and respond to them. An 'objection or claim' is taken to mean:

- to express opposition, protest, concern or complaint about the proposed activities; a request or demand that certain action be taken by the titleholder to address adverse impacts; and
- an assertion that there will be an adverse impact; or allegation to cast doubt about the manner in which the activities will be managed.

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Table H.4 Summary of relevant stakeholder feedback, assessment of merit and CGG responses

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Government agencies, authorities and representatives – general					
Aboriginal Victoria Key contact: Aboriginalaffairs @dpc.vic.gov.au	12/06/18 06/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the first, second or third stakeholder consultation letters.	NA	NA
Australian Maritime Safety Authority (AMSA)	28/05/18 13/06/18 05/09/18	1st formal notification Rev 0 Email incoming Email outgoing	Via email incoming13/06/18: In response to the first stakeholder consultation letter, AMSA provided a vessel traffic plot showing the Area to be Avoided (ATBA) and vessel traffic in relation to the proposed activities. They noted the following: • that heavy vessel traffic will be encountered entering and exiting both Traffic Separation Schemes (TSS) throughout the survey activities • most of the operational area will also encounter local and support vessels for the offshore petroleum industry activities • CGG can expect to encounter approximately 12 vessels per day using the Gippsland TSS, with over 90% comprised of cargo vessels, such as container ships and bulk carriers, or tankers • any related avoiding action by commercial shipping, should it be necessary, should not increase and/or compound the navigational risk to other shipping in the vicinity • it is recommended that survey lines are planned to minimise interaction with commercial shipping • the seismic vessel must display appropriate day shapes, lights and streamers, reflective tail buoys, to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre • visual and radar watches must be maintained on the bridge at all times • the survey vessel and any support vessels will need to be active in maintaining exceptional communications with any nearby commercial shipping. AMSA requested the vessel notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC would require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end. AMSA also stated that the Australian Hydrographic Office must be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners.	AMSA's functions are related to maritime safety, protection of the marine environment including marine pollution and maritime aviation search and rescue. AMSA raised the following objections or claims relevant to their functions, associated with potential maritime safety risks (vessel interactions with other marine users): • heavy traffic area entering and existing the TSS • interactions with local vessels and other petroleum support vessels • indicated that most vessels encountered would be container ships and bulk carriers or tankers. AMSA stated the increased traffic posed by CGG's should not increase the navigational risk to shipping in the area however recommended the following actions for CGG's to consider: • planning survey lines to minimise interaction with commercial shipping • displaying appropriate Relevant Stakeholder ID 2491ers, etc. to indicate the vessel is towing and is therefore restricted in her ability to manoeuvre • maintaining visual and radar watches • all vessels associated with the activity to maintain exceptional communications with other commercial ships • notifications to be sent to the JRCC and the AHO. **Action:** CGG to consider the control measures recommended by AMSA to mitigate potential navigational risks and determine those to be included in the EP.	Via email outgoing 05/09/18: CGG responded to AMSA and noted that the survey vessels will need to work extensively within the ATBA and that CGG is in the process of negotiating SIMOPS arrangements with petroleum facility operators in the area to ensure safe operations. CGG stated the following commitments would be adopted to mitigate conflict and disruption to other vessels and shipping traffic: • survey activities will be conducted in accordance with CGG Safe Navigation Area (doc. MAR_SEO_PRC_004A), which defines the vessel operation area within which all navigation dangers, restricted zones and precautionary areas (including shipping lanes) are highlighted, and managed in accordance with other CGG procedures specifically developed for seismic survey activities • the seismic vessel will comply with all relevant COLREG requirements, including displaying appropriate day shapes, lights and streamers, reflective tail buoys, to indicate the vessel is towing and is therefore restricted in its ability to manoeuvre. Visual and radar watches are maintained on the bridge at all times. This is further complimented by the seismic navigation crew who also constantly monitor the positioning of all seismic in water equipment, support and chase vessels • both the maritime crew on the bridge and the seismic navigation crew have displays of AIS broadcasts integrated with ships radar of all nearby shipping • the Australian Maritime Union crew, who will be onboard the vessel throughout the survey, are well acquainted with Australian shipping operations • the survey vessel and support vessels will maintain communications with any nearby commercial shipping by broadcasting twice daily all ships bulletins outlining vessel's location and planned movements over next 24 hours. This is affected by radio, AIS, and email (to all known stakeholders in the area of operation) • when the operation is within 4 hours of crossing the shipping lane, the broadcasts will be increased to an appropriate interval, and broadcasting made to all shipping within radio contact. Direct 2-way communication will be affected to any shipping that is calculated to be within the vicinity of the crossing at the same time or within an appropriate period as the Seismic Operation crossing the lane • known stakeholders include, but is not limited to, all oil field operators, their support contractors, regular shipping line companies through the area, fishing operators and recreational boating/shipping companies will be contacted • there will always be a forward and aft escort/support vessel accompanying the survey vessel which will manage on-water interactions with other vessels; a complement of vessels will be maintained to ensure this is effective. Operation of these vessels will be managed in accordance with CGG Escort & Support Vessel Operations Manual (doc. MAR_MSS_MNL_001E) to ensure appropriate levels of recognised good practise and safety regulations are met • as indicated above, CGG has a suite of internal procedures for managing interactions with other marine users which have been highly

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					effective in other extremely busy shipping lanes/port entries/areas and will be implemented for this survey • there would be no refuelling or maintenance within shipping channels • CGG will notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. CGG will provide the following information: vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels • CGG will notify JRCC when operations start and end • CGG will contact the Australian Hydrographic Office through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners. CGG requested that AMSA consider the following additional measure: • Temporarily widening and/or shifting of the traffic separation scheme, such that through traffic vessels did not have to go any closer to existing platforms to the north when deviating around CGG's seismic vessel. This measure was implemented prior to the 2002 HGP2002 MSS which overlay the TSS and is reported to have worked well. Following AMSA's advice additional control measures have been included in this EP, however, note that this is covered further below in this table as a result of further consultation with AMSA.

	06/09/18
	11/09/18
	30/10/18
		2nd formal notification general
		
		Email incoming
		Email outgoing
			No response was received in response to the second consultation letter sent to AMSA on 6th September 2018.
			Via email incoming 11/09/18:
			AMSA responded to CGGs email dated 05/09/18 stating they were comfortable CGG would take all necessary provisions for conducting operations safely at sea by undertaking the measures outlined.
			AMSA stated that adjusting the TSS was not warranted for seismic operations given the long lead times, domestic and international implications and IMO submissions required to implement the change.
				AMSA advised widening and/or shifting the TSS was not warranted. CGG have not pursued this option further.	Via email outgoing 30/10/18:
					CGG contacted AMSA and explained they were currently responding to NOPSEMA comments on the Environment Plan and wished to consult further on shipping lane issues.
					CGG noted the following in their email they wished to discuss the following issues with AMSA:
					• scenarios of ships heading towards a seismic acquisition zone/shipping lane interface – indicated they were generating plots using the likely shipping traffic density and asked for clarification that the density is 12 vessels per day (total incoming and outgoing)
					• highlight the standard communication protocols of our seismic vessel (and expectations of other ships)
					• illustrate an example action of ships involved in an adjustment of heading procedure
					• illustrate which direction the vessels could move to avoid the seismic operation whilst avoiding the platform zone
					• indicate the adjustment of the seismic survey design around the TSS.
					CGG proposed a communication plan on these issues as follows:
					• initial phone call to briefly discuss the project, ensure CGG is aligned on AMSA concerns. Stated they would then update the plots and prepare summary of items for discussion for AMSA review
					• second more formal phone call after AMSA have reviewed the plot and the draft text provided by CGG. Suggested this teleconference could be used to discuss the subject with reference to a real example on the plots and formulate the following:
					  ◦ set of assumptions,
					  ◦ guidelines
					  ◦ amendments to the survey design
					  ◦ Notices to Mariners guidelines
					  ◦ other suggestions.
					CGG asked if AMSA were available for this call later in the week.

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					• that a short summary of the above discussions would need to be agreed and would be provide to NOPSEMA. CGG noted they were happy to have a further call if AMSA require. Apologised for the short notice, noted the CGG employee was sick which delayed contact for a week.
	31/10/18 31/10/18 31/10/18 01/11/18 02/11/18 05/11/18	Email incoming Email outgoing Email incoming Email incoming Phone call outgoing Email outgoing	Via email incoming 31/10/18: In response to CGG's email on 30/10/18 AMSA sought confirmation that CGG wanted to understand if the number of vessels traversing the Gippsland MSS area had changed from 12 per day as quoted previously. They stated they could analyse recent AIS data for the area and provide the indicative number of vessels using the traffic lanes in the survey area.	NA	Via email outgoing 31/10/18: CGG confirmed they wanted to understand the density at various times of the day – is there a busy time, a quiet time, etc. They asked when the ships head in and out of port and then pass by the Gippsland MSS area, do they steam with 1 hour or 2 hours between (roughly)? CGG again asked if they could discuss with someone over the phone.
			Via email incoming 31/10/18: AMSA replied they would do some further analysis and provide CGG with updated information around the Class A and Class B vessels, and the timings/direction of traffic. They noted the timings are likely to be sporadic as they will have a range of different destinations and arrival/departure times. AMSA provided contact details and said that CGG could speak to point of contact, but that there would not be much more they could offer other than the traffic analysis. Via email incoming 01/11/18: In response to CGGs request for information on shipping density, AMSA advised that in any given calendar month they could expect ~192 vessels to travel north through the Gippsland MSS area, and ~187 vessels to travel south, which equates to about 1 vessel every 2 hours. The noted that the distribution of vessels appears to be fairly uniform across a 24-hour period, although there may be some diurnal variation in that distribution; but that it is hard to determine. AMSA also stated they could not tell if certain days of the week are busier than others. A vessel's traversal of the area can take several hours, and it is hard to pick a "point in time" against which to measure their voyages. This is also based on a limited historical data set. The behaviour of future vessel traffic may not reflect what has happened in the past.	No objections or claims. AMSA provided additional data on vessel density and movements for CGG to consider in developing control measures for the activity.	Via phone call outgoing 02/11/18: CGG phoned AMSA to discuss the activity and potential maritime safety issues. Via email outgoing 05/11/18: CGG provided AMSA with a copy of the NOPSEMA comments relevant to discussions with AMSA with the following notes and queries: • **RE: NOPSEMA letter comment 3.1 (Consulting with relevant persons):** Is there a list of regular shipping companies transiting the survey area? • **RE: NOPSEMA table comment #5 (Addressing all control measures with suitable EPS):** CGG asked AMSA what the best forms of communication were with shipping companies. • **RE: NOPSEMA table comment #16 (Managing interactions with commercial shipping):** shortening the time before crossing the shipping lane increases the accuracy of predictions when will be crossing, however this is changing the way CGG acquire the data not the physical design. CGG stated they could not change the physical design of the survey but would appreciate AMSA's feedback on what would be beneficial to them in regard to this comment. • **RE: NOPSEMA table comment #19 (Ongoing consultation):** CGG stated they would liaise with the AHO on this and asked who was the best contact.
	07/11/18 07/11/18	Email incoming Phone call outgoing	Via email incoming 07/11/18: AMSA provided the following additional comments in response to CGG's email on 5th November 2018 – for further discussion during conference call: • **RE: providing a list of regular shipping companies transiting the survey area:** AMSA stated this was not a standard service that they provide and CGG had the following options: 1. engage the services of an AIS data provider. 2. AMSA may be able to provide a more in-depth analysis of vessel names etc, for a specific period and area. This request will need to be submitted through the AMSA spatial portal: https://www.operations.amsa.gov.au/Spatial/ and they charge a fee for this service. • **RE: the best forms of communication with shipping companies:** AMSA stated they are best discussing over the phone. • **RE: providing further information on the design of the survey and how it minimises interactions with commercial shipping:** AMSA stated they would need to discuss this as it is CGGs responsibility to manage and mitigate the risks associated with the survey and the potential interaction with other vessels.	AMSA raised a concern about minimising interactions with commercial shipping. CGG was asking to discuss the survey design with AMSA in relation to potential risks to shipping activities via a conference call. AMSA restated their previous recommendation to notify the AHO. Notification to the AHO has already been addressed by CGG (see above). No action required other than to proceed with a conference call and further resolve concerns via subsequent consultation.	Via phone call outgoing 07/11/18: CGG phoned AMSA to discuss the activity, potential issues and proposed conference call.

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			• **RE: Notifications to AHO:** AMSA restated arrangements for AHO notifications (which were consistent with what CGG agreed to on 5th September 2018).		
	07/11/18 07/11/18 07/11/18 09/11/18 09/11/18 09/11/18 09/11/18	Email incoming Email outgoing Email outgoing Phone call outgoing Email outgoing Email outgoing Email outgoing	Via email incoming 07/11/18: In response to CGG's phone call (see column to the right), AMSA apologised for missed calls and stated they were available most of the day.	NA	Via email outgoing 07/11/18: CGG replied to AMSA's email and requested conference call. Proposed the agenda include (1) operations planning and management, and (2) risk evaluation and reduction. CGG also noted the following drivers for the formal conference call: • to formalise discussions with AMSA on the planning, the risk factors and risk levels of operations • to mitigate or at least communicate the risk – so that the vessel management can work up an operational plan covering these factors • to ensure that both CGG and AMSA are fully aware of the operations, the risks and the expectations for a safe maritime operation • the need to demonstrate to NOPSEMA that adequate consultation and planning has occurred. CGG attached a draft presentation and stated they would add survey crossing zones, density and timing. Via email outgoing 07/11/18: CGG followed up stating that email to AMSA had bounced back due to size and propose solution (e.g. FTP site) for delivering the material prior to the conference call. Via phone call outgoing 09/11/18: CGG phoned AMSA to confirm arrangements for conference call later that day. Via emails outgoing (x3) 09/11/18: CGG provided AMSA with details for the conference call that day and said they would provide a presentation via drop box before the call. CGG confirmed presentation had been sent to the dropbox and said they were setting up for the call now. CGG sent AMSA another presentation and said they were calling in now.

	09/11/18	Conference call	Via conference call 09/11/18 (AMSA attendees).
			The following items were discussed during the call:
			• **Activity information:**
			  ◦ Gippsland seismic project planned to start early January up until June with seismic vessel GEO CORAL with support vessel Bourbon Gannet and 1-2 chase vessels
			  ◦ the program is estimated at 5 months. Presentation of vessel GEO CORAL, sister vessel of GEO CASPIAN which operated previously in Australia.
			• **Presentation of project focusing on interactions within traffic lanes:**
			  ◦ from AMSA information it is expected that 12 vessels per day will transit the area through the traffic lanes, 1 vessel every 2 hours either going up or down
			  ◦ the seismic vessel will cross traffic lane in 3-4 hours then will keep on its track (about 8 hrs) then turn back. This means that in a 24-hr period the seismic vessel will be 4 hours within the traffic lanes and 20 hours outside
			  ◦ the seismic vessel may then encounter 1-2 vessels during one day within the traffic lanes
			  ◦ scenarios were presented, and control measures highlighted.
			Action: AMSA stated they would revert with contact names and details for Navigation Warnings / Rescue Coordination Centre/ Notice to Mariners.
			• **Presentation of Virtual AIS as control measure:** the Virtual AIS system computes AIS Relevant Stakeholder ID 2491ers from the position of the streamers and issues these Relevant Stakeholder ID
				The issues raised and discussed during the conference call were CGG vessel interactions within/crossing shipping lanes, the appropriate notifications required to ensure safe maritime operations and control measures to reduce risks associated with vessel interactions.
				It was agreed in the conference call that AMSA would send formal advice via email detailing the arrangements and recommendations discussed.
				Action: CGG to review and address the content of the formal advice and respond to AMSA with final outcomes and arrangements in place. This is covered in detail in the rows below.
					CGG's response to the issues discussed during the conference call is covered in detail in the row below (in response to the formal email advice from AMSA).
					Note that a second conference call was not required.

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			2491ers on the AIS system which allows traffic to see the seismic gear on their AIS. This helps outside traffic to see the seismic gear especially the evolution in turns. AMSA welcomed the usage of Virtual AIS to warn outside traffic. **Action:** CGG to send description of Virtual AIS system. **Action:** AMSA will review previous email to CGG and will send updated message with other considerations including: • advice and contacts for notifications • propose that CGG contacts shipping companies regularly using traffic lanes and calling Melbourne/Geelong for information of seismic operations • contacting AIS Data Provider to perform analysis of shipping and identify vessels and companies typically sailing in the area. • information to harbour masters to forward to outgoing vessels, commercial or fishing. AMSA recommended CGG explain to NOPSEMA the control measures and actions taken on CGG side to reassure them that CGG has all necessary procedures and experience to operate safely in the area. AMSA also recommended contacting Transport Safety in Victoria. AMSA and CGG agreed to meet next week if needed.		
	14/11/18 14/11/18	Email incoming Email outgoing	Via email incoming 14/11/18: AMSA emailed CGG with email advice for CGG's review – summary of meeting discussions.	NA. The final email sent was assessed for merit (see row below). **Action:** CGG to review and confirm they are satisfied AMSA's advice reflects discussions on the issues.	Via email outgoing 14/11/18: CGG reviewed the advice provided and confirmed it was clear and represented the spirit of the discussions on 09/11/18. CGG also outlined their proposed response to NOPSEMA on the issues that NOPSEMA raised – and made the following additional notes: • confusion of terminology with the AMSA and NOPSEMA (respectfully) wording of "Survey lines are Planned", "Design of the survey", etc. To CGG, "Survey design is the location, extents, density, orientation of the seismic lines" and "survey planning is the intended acquisition pattern, timing and perhaps configuration". From our discussions, AMSA and CGG are aligned in the definitions. • review of feedback from AMSA would be circulated and discussed within CGG • requested a call to review CGG's findings • confirmed CGG had requested a proposal for the shipping lines report.

	15/11/18	Email incoming	Via email incoming 15/11/18:
			AMSA finalised their advice and sent to CGG, which included the following:
			• **Maritime safety information:** CGG needs to ensure that Maritime Safety Information is promulgated specific to the area and nature of operations for your activity. To promulgate MSI, they should:
			  ◦ contact the Australian Hydrographic Office at datacentre@hydro.gov.au no less than four working weeks before operations with the details related to the seismic survey operations. The AHO will promulgate the appropriate Notice to Mariners (NTM), which will ensure other vessels are informed of your activities.
			  ◦ the Master should also notify AMSA's Joint Rescue Coordination Centre (JRCC) through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.
				The objections and claims raised in AMSA's feedback are associated with the following nine topics:
				1. maritime safety information
				2. VHF communications
				3. exhibit appropriate lights and shapes to reflect the nature of operations
				4. monitor and warn traffic
				5. planning of survey lines including direction and speed
				6. means of Relevant Stakeholder ID 2491ing the streamers
				7. contact shipping companies:
				8. escort vessels
				9. Harbour Masters.
				Each topic is relevant to the functions, interests and activities of AMSA and each item requires actioning by CGG and a response from CGG on how the items were closed out.
					In response to AMSA's advice provided on 15/11/18, CGG have addressed 7 of the 9 items raised and are in the process of addressing the remaining two items (#7 and #9 below). Each of these items has already been discussed with AMSA however CGG will respond in writing to AMSA when these items have been closed out and/or arrangements have been finalised, stating how each objection or claim has been addressed. CGG's proposed response to AMSA is summarised as follows:
					1. **Maritime safety information:** CGG confirmed with AMSA the recommended notifications would be made and have ensured that each one is committed to in the EP.
					2. **VHF communications:** CGG's internal procedures require the escort vessel and the main survey vessel to issue a Security Broadcast (securite message/safety alert) at regular intervals via VHF radio, including when crossing the TSS.
					3. **Exhibit appropriate lights and shapes to reflect the nature of operations**: CGG confirmed they will adhere to the requirements of the International Rules for Preventing Collisions at Sea (IRPCS) (including the use of appropriate lights and shapes).
					CGG will also ensure their AIS navigation status is utilised to warn mariners of the nature of operations.
					4. **Monitor and warn traffic:** CGG will identify shipping companies regularly using the shipping lane, to notify them of the activity, potential risks and adopted control measures (refer to Item 7 below). During the

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			• CGG should plan to provide updates to both the Australian Hydrographic Office and RCC Australia on progress and changes to and promulgated MSI and NTM. • **VHF communications:** The Master should consider the use of an all ships 'securite' message at regular intervals on VHF radio, especially when crossing the TSS, in order to warn other mariners of CGG's intentions. • **Exhibit appropriate lights and shapes to reflect the nature of operations**: in conformance with the International Rules for Preventing Collisions at Sea (IRPCS), it is recommended that CGG consider the use of appropriate lights and shapes to reflect the nature of your operations in accordance with the IRPCS. CGG should also ensure their AIS navigation status is utilised to warn mariners of the nature of your operations. • **Monitor and warn traffic**: It is advised that CGG should take measures to identify vessels early using all available means and implement procedures to ensure they are warned in good time of the work of your vessel and the extent of the dangers. • **Planning of survey lines, including direction and speed:** AMSA notes that the traffic density in this area is generally light with expected encounters of approx. 12 vessels per day. AMSA recommends that CGG should consider the interaction with other vessels based on the AIS traffic data provided. The direction of survey lines should, where possible, seek to minimise interaction with other vessels, and crossing of the traffic separation scheme and separation zone should be planned in compliance with the IRPCS. • **Means of Relevant Stakeholder ID 2491ing the streamers:** CGG should consider a means of Relevant Stakeholder ID 2491ing the extent of the survey streamers. In doing so, AIS, Buoys, floats or lights may provide a solution. • **Contact Shipping companies:** AMSA, or a commercial AIS provider may be able to provide CGG information regarding ships that frequently operate in the Bass Strait TSS area. They may wish to take steps to contact the shipping companies directly to inform them of CGG's work. Should CGG wish to request further data analysis for the purposes of contacting shipping companies, they will need to submit a request for spatial information through AMSA's Spatial Portal. The form is quick and easy to complete and can be found at; https://www.operations.amsa.gov.au/Spatial/DataServices/AssistedRequest • **Escort vessels**: CGG should consider the use of chase boat(s), and or safety vessel(s) to assist in de-conflicting encounters with other ships. CGG should deem what is appropriate based on the risks they identify. • **Harbour Masters**: It is recommended that CGG liaise with local harbourmasters through Transport Safety Victoria to ensure Harbour Masters and local maritime industry operators are aware of the survey and associated hazards. AMSA has informally spoken with Transport Safety Victoria, who is well aware of your intended operations. AMSA stated they consider it is the responsibility of the Owner and Master to ensure an appropriate risk assessment is conducted, and that the associated risks are appropriately addressed. Should they wish to discuss this further, please contact AMSA by phone or email.	**Action:** CGG to review and address each objection and claim raised in AMSA's feedback. **Action:** CGG to close-out the objections and claims by responding to AMSA stating how each one has been or will be addressed, including control measures adopted in response to their feedback.	survey CGG have multiple means of notifying other marine users of the location of the survey vessels, including those in Items 1, 2, 3, 6 and 8 (above and below). The control measures adopted to manage vessel interactions have been discussed with AMSA and are documented in Section 6.0 of this EP. **5. Planning of survey lines including direction and speed:** CGG have demonstrated that the current survey design is designed in a manner that minimises the impacts on shipping operations to ALARP. Line turns have been avoided over the shipping lane; AMSA have been shown that the operations can continue across the shipping lane with the current design; changing the orientation of the survey lines provides only a slightly lower benefit than current survey design (<30 minutes difference); and the shipping density (12 vessels per day) is low compared to what the vessel crew and management are experienced operating in (e.g. overseas). The zoning scheme CGG has adopted for the survey area has been designed considering the location of the TSS and minimising the crossing time in that location. **6. Means of Relevant Stakeholder ID 2491ing the streamers**: CGG will Relevant Stakeholder ID 2491 the extent of the survey streamers by using tail buoys (each equipped with a flash), the virtual AIS system which emits AIS Relevant Stakeholder ID 2491ers to all surrounding traffic (showing the seismic streamers on other vessels radar and charts), and the escort vessel will be located at the end of the streamers. **7. Contact shipping companies:** CGG has submitted a request to AMSA for information on shipping companies and contact details, (online on the 20th November 2018). Evidence of this request is provided in Appendix I. CGG have engaged a shipping agent (Monson) to consult with shipping companies and with Transport Safety Victoria (refer to Item #9 below). Engagement with the shipping companies will involve making them aware of the proposed activity, proposed communication arrangements and other control measures CGG has adopted to minimise impacts to shipping operations and the risk of a vessel collision to ALARP. **8. Escort vessels:** CGG will use the chase vessel to assist in managing vessel interactions with other ships. In response to AMSA's recommendation to "deem what is appropriate based on the risks CGG identifies", the risks associated with vessel interactions have been assessed and control measures adopted to reduce the risk to ALARP and to an acceptable level (Section 6.0). Any further issues that arise during ongoing consultation will be addressed in the same manner as during preparation of this EP. **9. Harbour Masters:** CGG have engaged a shipping agent (Monson) to liaise with Transport Safety Victoria to ensure Harbour Masters and local maritime industry operators are aware of the survey and associated hazards.
	22/11/18	3rd formal notification Rev 0	No response received in response to the third stakeholder consultation letter.	NA	NA

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	Ongoing consultation: CGG is in the process of ensuring they have fully addressed each of AMSA's objections and claims that were documented in email on 15th September 2018. This includes engaging with Transport Safety Victoria and the shipping companies identified in the information request to AMSA. A response will be provided to AMSA clarifying the final arrangements when they have all been closed out. AMSA will continue to receive updates on the proposed activity on an ongoing basis.				
Commonwealth Department of Agriculture and Water Resources	12/06/18 22/11/18	1st formal notification Rev 0 3rd formal notification Rev 0	No feedback received in response to the first or third stakeholder consultation letters.	DAWR has not provided feedback despite their functions (biosecurity, marine pest and fisheries management) being directly relevant to the survey. **Action:** CGG to contact DAWR and clarify the correct person(s) have been receiving the letters provided and identify if they have any objections or claims associated with the survey.	The outcomes of further consultation with DAWR is summarised below.
	23/11/18 23/11/18 23/11/18 23/11/18	Phone call outgoing Email outgoing Email outgoing Email outgoing	Via phone call outgoing 23/11/18: Phoned point of contact, as DAWR had not responded to previous information provided by CGG (sent to the 'seaports' inbox). Spoke to colleague who explained point of contact has changed roles and was not in the office today. Stated we would follow up with DAWR via email. Via email outgoing 23/11/18: Emailed point of contact direct to ask if DAWR had been receiving project updates and if DAWR could confirm that we were sending information to the most appropriate person(s) in the department going forward. Via email outgoing 23/11/18: Emailed the 'seaports' mailbox to confirm that the project updates had been received since no response had been received. Asked for confirmation that the team has been receiving the updates and if they could advise who the best person is to liaise directly with going forward. Via email outgoing 23/11/18: Emailed the 'petroleum and fisheries' mailbox to ask if they have been receiving project updates since no response had been received from the department. Asked for confirmation that the team has been receiving the updates and if they could advise who the best person is to liaise directly with going forward.	NA	NA
	26/11/18 26/11/18 26/11/18	Email incoming Email outgoing Email incoming	**Consultation with Biosecurity Team.** Via email incoming 26/11/18: In response to email sent by CGG 23/11/18, key contact had received email from DAWR and was following up. DAWR biosecurity team requested a teleconference the following day to discuss the project and the biosecurity arrangements. Via email incoming 26/11/18: DAWR confirmed teleconference arrangements.	Project information sent to the 'seaports' mailbox had not been forwarded on to the correct persons. DAWR biosecurity team requested teleconference to get further information on the proposed activity. **Action:** CGG to provide DAWR biosecurity team with further information on the project via teleconference.	Via email outgoing 26/11/18: CGG confirmed teleconference arrangements.
	27/11/18 03/12/18	Conference call Email outgoing	**Consultation with Biosecurity Team.** Via conference call 27/11/18: The following items were discussed during the teleconference: • DAWR provided an overview of the department, recent changes and the main groups within which CGG would need to be consulting with, namely the Biosecurity Team (topsides management), Marine Pests Team (ballast water management) and the Petroleum and Fisheries Team (fisheries related issues) • DAWR stated they administer the Biosecurity Act 2015 and their jurisdiction is within the territorial sea (12 NM) • CGG gave high level overview of location and timing of the survey referring to most recent map of the project available • CGG summarised consultation with DAWR to date and mailboxes/contact person that had been contacted	DAWR have requested further information on the activity so they can advise on biosecurity control measures. **Action:** CGG to provide information to DAWR covering activity overview, vessel origin and movements before and during the survey. CGG will also provide DAWR with the current control measures adopted to mitigate biosecurity risks.	Via email outgoing 03/12/18: CGG followed up with DAWR, summarising the conference call discussion and asked DAWR for confirmation that the summary was accurate. CGG stated they would provide the requested information as soon as possible.

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			• DAWR referred to the DIIS (2016) guideline for a breakdown of Australian government relevant stakeholders, which CGG replied they had reviewed and considered during consultation
			• confirmed the seaports mailbox was the best point of contact, but that going forward CGG could contact them directly and cc the mailbox in
			• DAWR advised that for the purposes of further consultation they would require information on:
			  ◦ clear location of survey area (showing territorial sea boundary and state waters)
			  ◦ the origin of the proposed vessels (survey and support vessels) (e.g. overseas, within Australia)
			  ◦ vessel movements (e.g. will they be coming into Australian and/or state waters direct to the offshore location or via port)
			  ◦ ongoing vessel movements (e.g. which vessels will be operating out of a port and which port, as different ports pose a different biosecurity risk)
			  ◦ if within Australia, the current biosecurity status of the vessels under the Biosecurity Act 2015
			  ◦ advised that the simplest solution would be if CGG vessels had or could obtain 'release status' (released from biosecurity control) but that it depends on the information provided (above).
			• DAWR noted they would introduce CGG to the key contact in the Melbourne office for consultation on operational matters and logistics associated with biosecurity (and that DAWR would require the vessel information listed above)
			• DAWR noted they would introduce CGG to the key contact based in Perth for consultation on ballast water management requirements (and that DAWR would require information on ballast water origin and ongoing management)
			• Noted that reporting of incidents occurs via the Melbourne team.
			DAWR stated they would provide contact details for two other key contacts.
			CGG stated they would provide the information DAWR requested as soon as possible to continue the consultation process.		

	26/11/18 03/12/18	Email incoming Email outgoing	**Consultation with Petroleum and Fisheries Team.** Via email incoming 26/11/18: In response to email sent by CGG 23/11/18, DAWR confirmed that CGG should continue to send project updates to the 'petroleum and fisheries' mailbox.	DAWR petroleum and fisheries representative confirmed correct mailbox and provided link to online guidance on consultation with DAWR under the OPGGS(E) Act. **Action:** CGG to review guidance and continue consultation process via the 'petroleum and fisheries' mailbox.	Via email outgoing 03/12/18: CGG reviewed the online guidance provided and replied to DAWR stating: • consultation to date had not occurred via that mailbox and only via the 'seaports mailbox' • CGG reviewed the guidance and noted their requirement for titleholders to send requests for consultation and that general notifications will not be considered as consultation requests • information and a consultation request would be sent to the petroleum and fisheries mailbox as soon as possible • DAWR stakeholders that were also being consulted (biosecurity team) and a summary list of stakeholders consulted on fisheries-related issues. CGG intends to submit a request as soon as possible, providing the following information to the DAWR petroleum and fisheries team: (a) the proposed activity (including location and timing) (b) summary of consultation that has already occurred with fisheries-related stakeholders and the issues raised (c) summary of the impacts and risks to fisheries that have been identified (including habitat or ecosystems on which fisheries resources depend) (d) changes that have been made and control measures that have been adopted in response to stakeholders.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: CGG will follow up with the Biosecurity Team and the Petroleum and Fisheries Team, provide them sufficient information on the project and reasonable period to review and respond with any objections or claims. Any objections or claims raised will be addressed and responded to in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Commonwealth Department of Defence – Australian Hydrographic Office	28/05/18 28/05/18 28/05/18 12/06/18 30/08/18	1st formal notification Rev 0 Email incoming Email incoming 1st formal notification Rev 0 Email outgoing	Via email incoming 28/05/18: In response to the first stakeholder consultation letter, the DoD–AHO acknowledge it had been received. Via email incoming 28/05/18: The DoD – AHO replied asking for notification of the start date approximately 3 weeks before the survey to allow Notice to Mariners.	The AHO is responsible for the publication and distribution of nautical charts and other navigation information, including Notice to Mariners. This request is directly relevant to their functions. **Action:** CGG to confirm notice will be provided and include commitment in the EP for this.	Via email outgoing 30/08/18: CGG replied confirming they would ensure notification is provided three weeks prior to commencement of the survey as they requested. This requirement is included in the notification schedule for the survey, which is included in the Implementation Strategy of this EP.
	06/09/18	2nd formal notification general	No feedback received in response to the second stakeholder consultation letter.	NA	NA
	29/10/18 29/10/18	Email incoming Email outgoing	Via email incoming 29/10/18: DoD asked if there were any updates on the survey. Stated that the AHO was publishing the next notice to mariners on 1 November and would like to include any further information.	No objections or claims. The DoD requested an update on the commencement date for the survey. **Action:** CGG to provide update to DoD.	Via email outgoing 29/10/18: CGG replied notifying that the survey was postponed to January 2019 and they would contact the AHO once a date is finalised for a notice to mariners to be sent out. No response received.
	22/11/18 22/11/18 22/11/18	3rd formal notification Email incoming Email outgoing	Via email incoming 22/11/18: In response to the third stakeholder consultation letter, the AHO replied advised their notices are only published every fortnight, therefore the dates for January are going to be 11 and 25 January 2019. Asked if either of those dates suited CGG's operations and noted that if the survey is going to start earlier than January then the next Notice to Mariners is 14 December in which they could publish a forecast survey.	No objections or claims. The DoD requested an update on the commencement date for the survey. **Action:** CGG to provide update to DoD.	Via email outgoing 22/11/18: CGG replied stating the email had been forwarded to CGG Project Manager for a response. No response provided yet to AHO's email.
	Ongoing consultation: CGG will continue to provide project updates to the AHO and will respond to their email dated 22/11/18 confirming the approximate start date to allow for Notice to Mariners. In accordance with their email dated 28/05/18 CGG will notify them approximately three weeks prior to commencement as stated in this EP.				
Victorian Department of Economic Development, Jobs, Transport and Resources	12/06/18 10/08/18 06/09/18	1st formal notification Rev 0 1st formal notification Rev 1 2nd formal notification general	No feedback received in response to the first and second stakeholder consultation letters.	NA	NA
	22/11/18 23/11/18 26/11/18	3rd formal notification Email incoming Email outgoing	Via email incoming 23/11/18: In response to the third stakeholder consultation letter, DEDJTR responded and asked for boundary coordinates for the survey area.	No objections or claims. DEDJTR requested boundary coordinates for the survey. **Action:** CGG to provide coordinates to DEDJTR.	Via email outgoing 23/11/18: CGG replied they would chase the coordinates up for DEDJTR. Via email outgoing 26/11/18: CGG provided DEDJTR with shapefiles for the survey area. No further response received.
	Ongoing consultation: CGG will continue to provide project updates to the DEDJTR and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian East Gippsland Shire Council	12/06/18	1st formal notification Rev 0	No feedback received in response to the first stakeholder consultation letter.	NA	NA
	04/09/18 06/09/18 17/10/08 26/10/18 29/10/18	2nd formal notification fishers and fisheries 2nd formal notification general Email incoming Email incoming Email outgoing	Via email incoming 17/10/18: In response to the second stakeholder consultation letters, the East Gippsland Shire Council replied and asked if the survey was still going ahead. Via email incoming 26/10/18: The East Gippsland Shire Council followed up on their email dated 17/10/18 and asked for a status update on the project.		Via email outgoing 29/10/18: CGG confirmed the survey was still planned to go ahead and that details of the proposed survey have changed and are requiring further assessment by NOPSEMA. Advised that the next update would be distributed in the coming weeks. No response received.
	22/11/18	3rd formal notification Rev 0	No feedback received in response to the third stakeholder consultation letter.	NA	NA
	Ongoing consultation: CGG will continue to provide project updates to the East Gippsland Shire Council and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian Environmental Protection Authority	28/05/18 29/05/18 12/06/18 16/06/18	1st formal notification Rev 0 Email incoming 1st formal notification Rev 0 Email incoming	Via email incoming 29/05/18: The EPA acknowledged receipt of the first notification letter and stated that it had been forwarded on to the appropriate person. Via email incoming 16/06/18:	NA	NA

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			The EPA acknowledged receipt of the first notification letter (sent again) and stated that it had been forwarded for response. No response received.		
	06/09/18 22/11/18	2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to provide project updates to the Victorian EPA and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian Office of the Hon Daniel O'Brien – Member for Gippsland South	12/06/18 06/09/18 22/11/18	1st formal notification Rev0 2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the first, second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to provide project updates to the Office of the Hon Daniel O'Brien and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian Office of the Hon Darren Chester – Member for Gippsland	30/08/18	Email incoming	Via email incoming 30/08/18: In response to an email to LEFCOL that the Member for Gippsland was cc'd in on dated 30/08/18 (refer to event summarised under LEFCOL), Electorate Officer acknowledged the email had been received, that they would ensure that the Member for Gippsland sees the email and if he has any concerns requiring action, he will respond to CGG directly.	NA	NA
	06/09/18	2nd formal notification general	No feedback received in response to the second stakeholder consultation letter.	NA	NA
	22/11/18 23/11/18 30/11/18	3rd formal notification Rev 0 Email incoming Email outgoing	Via email incoming 21/11/18: Electorate Officer acknowledged the email had been received, that they would ensure that the Member for Gippsland sees the email and if he has any concerns requiring action, he will respond to CGG directly.	NA	Email outgoing 30/11/18: CGG acknowledge the reply and asked if the Member for Gippsland had an opportunity to review the consultation package and if he had any questions about the survey. No response received.
	Ongoing consultation: CGG will continue to provide project updates to the Office of the Hon Darren Chester and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian Office of the Hon Tim Bull – Member for Gippsland East	12/06/18 13/06/18 18/06/18 17/07/18 17/07/18	1st formal notification Rev 0 Email incoming Email outgoing Phone call outgoing Phone call outgoing	Via email incoming 13/06/18: In response to the first stakeholder consultation letter and notification that CGG would be available to meet, the Member for Gippsland's office replied the Member for Gippsland would like to meet with them and to let them know when date in July for Lakes Entrance is decided.	No objections or claims. **Action:** CGG to arrange to meet with the Member for Gippsland when they are in Lakes Entrance.	Via email outgoing 18/06/18: CGG replied they would be in touch when the dates were agreed. Via phone calls (x2) outgoing 17/07/18: CGG spoke to representatives from the Member for Gippsland's office who said that the Member for Gippsland would be in Melbourne during the week of the proposed meetings but that CGG could meet with (electorate officer). Meeting held on 26 July (see row below).
	26/07/18	Meeting	The following issues and queries were raised and discussed with the electorate officer at the meeting: • the electorate officer asked for an update on the meeting with LEFCOL and fishers. CGG said the meeting was a listening exercise and that there was genuine concern expressed by fishers. The issues raised are being evaluated and potential control measures considered to reduce impacts. Flow on effects to the Lakes Entrance community was also raised at the fishers meeting • the electorate officer confirmed their office had received the project information that was sent and noted that the Member for Gippsland had a close relationship with LEFCOL • the electorate officer commented that he thought the area had already been extensively surveyed. CGG described the proposed survey, the limitations with existing data and further drivers for the survey the electorate officer asked if the data was to be on sold and CGG answered yes and that initial reprocessing had given visibility of strata previously masked by coal layers and this was creating interest • the electorate officer asked who had oversight of the survey and CGG explained that NOPSEMA (an independent Statutory Authority) was the regulator. CGG also explained the role of NOPTA	No objections or claims were raised by the electorate officer. He asked questions that provided context for the activity, the consultation process and the environmental approvals process.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• CGG noted that NOPSEMA's consultation requirements compelled proponents to consult with stakeholders • asked if environmental issues including human and social were examined. CGG responded yes and explained that stakeholder issues are usually the biggest encountered • asked if the EP was going to be released and CGG responded that proponents must release EP summaries which in more recent times often exceed 500 pages and that full EP's are often 3000 pages. CGG explained that if the EP was rejected the survey would not go ahead • the electorate officer indicated that his office may need to ask more questions as the EP and consultation run their course.		
	06/09/18 07/09/18	2nd formal notification fishers and fisheries Email incoming	Via email incoming 07/09/18: In response to the second stakeholder consultation letter, the electorate officer responded on behalf of the Member for Gippsland with the following concerns: • **scale of the survey:** stated the proposed 17 000-square kilometre survey makes it one of the largest surveys undertaken in Australia. The area proposed for survey is eight times the size of Port Phillip Bay. Given there can be no guarantees that the survey will not adversely affect marine life, its scale represents inordinate risk for the fishing industry. To manage this risk, the survey area should be reduced or broken into smaller sections and the survey of those areas conducted over an extended period of two to three years so that its effects on fishing operations can be progressively assessed and modified as necessary. • **justification for the survey:** the electorate officer stated they understand that CGG has no current authority to extract oil or gas in Australia and intends to undertake the survey with the intention of on selling the results. They stated they do not believe a speculative venture that has potential for a significant impact on an existing industry, should proceed as outlined. • **impacts on fisheries species (e.g. scallops, crayfish, zooplankton, fish eggs, larvae and fish):** the electorate officer noted recent research off Tasmania that has shown after four seismic passes, 20% of scallops died and that after exposure to a seismic survey, crayfish lost the ability to extend their tails and right themselves if turned upside down. Noted other research showed that a seismic survey produced a 2 km dead zone where two-thirds of zooplankton died and that this raised concerns about the effects on fish eggs and larvae. Stated that International research shows that fish swim away from large seismic soundwaves and that fishermen across the world report that following a seismic survey, marine habitats become unproductive and catch rates drop for a year or longer. • **overlap of survey area with fishing grounds:** noted that in certain cases seismic testing must occur, but the scale and location of this proposal over vital fishing grounds is of great concern. • **impacts on the fishing industry:** the electorate officer stated the fishing industry is very concerned about CGG's plans, which will impact on rural communities. They stated that the fishing industry is being asked to accept disturbance to its operations for five months and then accept the risk of lowered catch rates for a year or more following. the electorate officer stated they understand that CGG has completed a study into the financial effect the survey will have on the fishing industry but has not released this information and requested a copy.	The Member for Gippsland represents the views and interests of Gippsland East constituents. Seven objections or claims have been raised by the Member for Gippsland's office and all are relevant to his functions as the Member for Gippsland East. The objections or claims are: 1. the survey area is too large and should be reduced or broken into smaller sections, with survey of those sections conducted over 2-3 years 2. do not believe there is adequate justification for the survey to go ahead 3. concern about the potential impacts on scallops, crayfish, zooplankton, fish eggs and fish larvae 4. concern that international reports that marine habitats become unproductive and catch rates drop for a year or longer following seismic surveys 5. concern about impacts on rural communities 6. concern about disturbing fishing operations during the survey 7. the financial effects on the fishing industry from drop in catch rates for a year or more. **Action:** CGG to address each objection or claim and respond to the Member's office explaining how they had been addressed including any changes or additional control measures adopted in response to their feedback.	CGG has provided the following responses to the objections and claims raised by The Member for Gippsland's Office (provided via letter outgoing on 21/11/18 – summarised here but see event below): 1. **the survey area is too large and should be reduced or broken into smaller sections, with survey of those sections conducted over 2-3 years:** CGG explained that the survey area has been reduced in response to stakeholder feedback and two zones removed. CGG noted that this update would be communicated to stakeholders in the next stakeholder consultation letter (which was subsequently sent out on 22/11/18). CGG explained the zoning system shows the vessel will only be transiting in the one zone at a time to reduce interactions with other marine users. In terms of the timing, CGG explained that the EP has allowed for a second year as a contingency but that CGG plans to acquire the survey in the first year as it is not economically feasible to bring the boat back a second time. They noted that the timing of the survey has considered potential impacts to cetaceans, commercial fish species (e.g. spawning times) and fishing operations, and CGG is continuing to work with fishers regarding the operating time in each zone to minimise impacts further 2. **do not believe there is adequate justification for the survey to go ahead:** CGG explained that the proposed survey is a multi-client data survey (data is acquired by a geophysical company covering a large area of interest) and the benefits of this is that a single survey will fulfil the requirements of a large number of titleholders rather than each company acquiring separate surveys. They stated the main purpose of the survey is to render the most accurate possible graphic representation of specific portions of the Earth's subsurface geologic structure. Noted that since hydrocarbon production began in the 70's acquisition and processing technologies have advance dramatically, and new acquisition is required to better image rocks beneath the coals which might contain new oil and gas deposits. 3. **concern about the potential impacts on scallops, crayfish, zooplankton, fish eggs and larvae:** Scallops and lobsters – CGG are aware on the research that has been conducted on Tasmanian scallops and lobsters and has taken this into account in the impact assessment for the survey. Please advise if you have concerns regarding specific locations of importance to scallops and lobsters (crayfish) in the survey area. Plankton, eggs and larvae – CGG is aware on the research conducted by the CMST on the effects of seismic sound on plankton and has taken this into account in the impact assessment, including assessing the potential impact on planktonic fish eggs and larvae. Please advise if you have specific concerns regarding plankton and fish spawning locations within the survey area.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			They stated they believe the project must be massively modified before it is given any further consideration and that they had advised NOPSEMA of this view.		4. **fishermen across the world report that following a seismic survey, marine habitats become unproductive and catch rates drop for a year or longer**: CGG acknowledged that stakeholders in the Gippsland area have noted drops in catch rates but to date have not provided evidence to support this claim. Stated there are no documented accounts of drops in catch rates from fishers across the world and therefore no scientific evidence to support the claim above. CGG noted there has been some research conducted by CSIRO and Geoscience Australia in the Gippsland Basin showing seismic did not have an adverse effect on catches of most commercial fish species (Bruce et al. 2018). CGG explained that available literature has been considered in the impact assessment and subsequently in determining the control measures adopted for the survey. 5. **impacts on rural communities:** CGG stated they had consulted with fishers operating within the survey area, fishers with jurisdictional rights within the survey area, fishing associations and peak bodies for both Commonwealth and State based fisheries such as SETFIA, LEFCOL and SSFA (groups that represent most of the fishers that could be affected by the survey). CGG explained they were currently convening a Scientific Advisory Committee consisting of scientists and fishing industry representatives to provide a forum to continue to proactively work together to minimise the potential impacts of the survey. Noted that more information on the Committee would be provided in the next stakeholder consultation letter (which was sent out on 22/11/18). 6. **disturbing fishing operations for five months during the survey:** CGG noted as per Item #1, that interactions with fishing operations are being managed using the zoning system and that the time in each zone would be about a month, during which time the other areas within the survey area will be open to fishing activity. CGG noted they had adopted control measures, which are documented in the EP and therefore legally binding, to notify fishers of their forward activities so that fishers may plan their operations to suit. The Scientific Advisory Committee will also explore options for resolving fisheries-related issues including impacts to target species and catches. 7. **financial effects on the fishing industry**: CGG stated they had not completed a study on the financial effect the survey will have on the fishing industry. They had conducted an impact assessment that supports the view that there will not be any medium to long-term impacts on fishing catches. CGG explained that SETFIA was contracted by CGG to produce a report encompassing catch and effort data of the Commonwealth fisheries operating within the survey area. SETFIA included in the report the value of some of the fisheries, however this report did not include a comprehensive assessment of potential financial effects. CGG explained the survey is being continually refined as CGG consults with stakeholders and finalises the survey design, to minimise impacts on the environment and fishing industry whilst maintaining the commercial viability of the survey and welcomed further feedback from The Member for Gippsland's Office.
	29/10/18	Email incoming	Via email incoming 29/10/18: The Member for Gippsland stated that if successful in the upcoming election, he intends to meet with CGG to discuss the industry's legitimate concerns.	No objections or claims.	NA
	21/11/18 22/11/18	Letter outgoing Email incoming	Via letter outgoing 21/11/18: CGG responded in writing to the issues raised by The Member for Gippsland's Office on 07/09/18. A summary of the response is in the row above (against the event dated 07/09/18). Via email incoming 22/11/18:	No objections or claims, however The Member for Gippsland confirmed he wants to meet with fishing industry representatives and CGG to further discuss the project.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			The Member for Gippsland replied to CGG's letter noting that there remain some points for discussion and he looks forward to sitting down with representatives of the fishing industry and CGG to discuss these matters further.		
	22/11/18 22/11/18	3rd formal notification Email outgoing	Via email outgoing 22/11/18: CGG replied they had forwarded The Member for Gippsland's email onto the Project Manager's, so they were aware of The Member's intention to meet. Also noted that the most recent stakeholder update was sent to stakeholders. Stated that it has more information on the changes CGG has made to the survey area and timing in response to stakeholder feedback and information on the Scientific Advisory Committee that has been formed for the project. CGG noted that the Committee was meeting for the first time tomorrow, 23 November 2018.	NA	NA
	29/11/18	Email outgoing	Via email outgoing 29/11/18: CGG Project Manager congratulated the Member for Gippsland on his re-election as Member for Gippsland East. Confirmed they were update him on the plans for our proposed Gippsland 3D Seismic Survey, the reasons behind the survey and recent developments with respect to the concerns raised by the fishing industry. Noted he had spoken to the electoral officer and understand the Member might be travelling to Melbourne next week. CGG asked if the Member had time to meet. No response received at time of EP submission.	NA	NA
	11/01/18 15/01/19	Meeting Email outgoing	Via Meeting: CGG met with the Member for Gippsland to discuss the project and the following claims were raised: The Member for Gippsland raised concerns among the fishing industry, about the possible effects of the survey. CGG informed the Member for Gippsland of the three stakeholder meetings at Lakes Entrance where the fishing community have voiced feedback and opinions on the survey. as a result CGG have introduced a number of practical design changes to the survey. The Member for Gippsland further raised concern over the potential for displacement of stocks resulting in a negative consequence for Lakes Entrance fishers The Member for Gippsland raised concern over the potential impact of sound on scallops, with direct reference to the 2010 die off.	The Member for Gippsland raised the following objections and claims: 1. Concerns among the fishing industry over the survey 2. Potential displacement of fish stocks 3. Impacts on scallops **Action:** CGG consider each of these items to have merit therefore CGG to review and respond to each one stating how they are being addressed, including any changes or control measures adopted in response to his feedback.	CGG has provided the following responses to the objections and claims raised by the Member for Gippsland via email outgoing. **In response to the concerns raised among the fishing industry, CGG informed the Member for Gippsland that as a result of the stakeholder meetings the following changes have been made to the survey.** 1. Excluded the most contentious shallow water areas from our survey including a developing Scallop bed. 2. Excluded the November December time frame from our operations. While it can be pointed out that we do not have permission yet, if the survey was to go-ahead next year, we will retain our commitment as we understand that the pre-Christmas period is a key time for commercial fishing to supply the festive season Relevant Stakeholder ID 2491et. 3. Excluded the South East Reef from the survey area as this has been identified by some fishers as a key breeding habitat. We have had other advice from SEFTIA that it is not that important, nevertheless we will keep our commitment. 4. We have reduced the overall size of the survey. **In response to the Member for Gippsland concerns over potential displacement of stocks, CGG stated:** The impact from the survey will largely result in the temporary displacement of fish stocks. Experience in the North Sea, where there is a much more substantial oil and gas industry and fishing industry where both have coexisted for decades, in similar water depths and no long term effects evident. There have been numerous seismic surveys conducted in Gippsland over the years, and a study by CSIRO in 2014 could find no negative effects from previous seismic surveys on fisheries caches and catch rates. A more recent paper by Hadden et al. 2018 did find temporary effect associated with a seismic survey but stated in its conclusion: "It would thus appear that the significant drop in the observed CPUE from the fishery independent survey of the fishery in the GAB, conducted in 2015, was very likely negatively influenced by it being run coincidently with the seismic survey. Fortunately, the seismic survey does not appear to

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					have had a lasting impact on Deepwater Flathead CPUE, which returned to typical values in the first month following the seismic survey.” **Impacts on scallops;** The potential impact from the survey on scallops has been raised before by fishers throughout the consultation period with many drawing a link to the 2010 collapse of the fishery and seismic surveys in operations at that time. Informed the Member for Gippsland of the FRDC paper, indicating there was a direct effect of scallop mortality linked to continuous exposure of a sound source, however research conducted in 2015, which involved insitu monitoring of scallops associated with a commercial scale seismic showed no detrimental effects on scallops and concluded that it was likely that a hot water plume may have caused the die-off in 2010. CGG is currently looking at two research projects to answer what effect seismic activities have on site attached organisms such as octopus as well as free swimming organisms such as finfish. These studies are designed to look at before, during and after effects of the survey. they therefore cannot be completed without a seismic survey. CGG have budgeted hundreds of thousands of dollars for these projects. CGG will continue to keep the Member for Gippsland up to date with the survey progress as well as the development of these research initiatives..
	Ongoing consultation: CGG will continue to consult with the Member for Gippsland and keep him updated on the activity. In particular CGG will arrange to meet again with the Member for Gippsland and fishing industry representatives (as he has requested).				
Victorian South Gippsland Shire Council	12/06/18 06/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the first, second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to provide project updates to the South Gippsland Shire Council and respond to any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Victorian Wellington Shire Council	12/06/18	1st formal notification Rev 0	No feedback received in response to the first stakeholder consultation letter.	NA	NA
	06/09/18 06/09/18 07/11/18	2nd formal notification general Email incoming Email outgoing	Via email incoming 06/09/18: In response to the second stakeholder consultation letter, the Manager for Business Development contacted CGG and asked how they intend to engage with the 90 Mile Beach community. Stated that Councillors are keen to understand how the community will be engaged.	The Wellington Shire Council is the local government council for Wellington, responsible for managing community needs like waste collection, public recreation facilities and town planning. Relevant Stakeholder ID 2567 raised one concern about CGG’s engagement with the 90 Mile Beach community. **Action:** CGG to respond to the Shire Council concern regarding consultation with the 90 Mile Beach community, summarising consultation undertaken to date and ongoing consultation planned.	Via email outgoing 07/11/18: CGG replied to the Manager for Business Development email and apologised for the delayed response. Noted his concern raised regarding how the community will be engaged on the potential impacts of the seismic survey on the people using the marine environment from the 90 Mile Beach community. CGG stated they assumed he was referring to recreational users of the marine environment, recreational fishers, and tourism operators and asked if that understanding was correct. CGG explained they have already engaged with recreational marine users, recreational fishing, and tourism. This has been done through VRFish, the recreational body for recreational fishing in Victoria, several fishing charter businesses operating out of Lakes Entrance and in the Gippsland area in general, diving operators in the Gippsland area and the councils along the Gippsland coastline. CGG noted they had provided these groups with a description of the survey, potential impacts related to their activities and control measures that CGG has adopted to avoid or reduce impacts. They explained the consultation process is ongoing and they continue to engage with relevant stakeholders to ensure that their concerns are addressed, and potential impacts are minimised for the duration of the survey. Nor feedback has been received from the Wellington Shire Council in response to the email.
	22/11/18	3rd formal notification Rev 0	No feedback received in response to the first stakeholder consultation letter.	NA	NA
	Ongoing consultation: CGG will continue to provide project updates to the Wellington Shire Council and respond to any further concerns they may raise in response to the email CGG sent on 07/11/18, in accordance with the ongoing consultation process described in Section 9.0 of this EP.				

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Government agencies and authorities – fisheries					
Australian Fisheries Management Authority	02/05/18 02/05/18 02/05/18	Email outgoing Email incoming Email outgoing	Via email outgoing 02/05/18: CGG notified AFMA of the proposed survey and provided a figure showing the locations and proposed area. They noted the various other areas for manoeuvring and buffer area. Provided a list of the petroleum titles overlapped by the survey area and buffer. CGG stated the timing. They explained that they had commissioned underwater noise and oil spill modelling and noted that the results won't be available for at least 4-8 weeks. Stated the areas potentially affected by underwater noise or oil spills is unknown at this time, however, is likely to be larger than the area shown in the attached figure. CGG stated they recognise AFMA as a relevant person for consultation and would like to receive any advice that AFMA can provide. CGG noted they will be contacting relevant fisheries associations and would also like to contact individual fishers potentially affected. Via email incoming 02/05/18: AFMA replied and asked CGG to ensure they consult with the Commonwealth Fisheries Association (CFA) on the survey. Via email outgoing 02/05/18: CGG replied that they would.	No objections or claims, however AFMA directed CGG to consult with the CFA. **Action:** CGG to consult with the CFA.	CGG added the CFA as a relevant stakeholder and have consulted them (refer to rows below under 'Fishing Associations' which summarise consultation with the CFA).
	28/05/18	1st formal notification Rev 0	No feedback received in response to the first stakeholder consultation letter.	NA	NA
	15/06/18 25/06/18	Email outgoing Email incoming	Via email outgoing 15/06/18: CGG contacted AFMA to confirm they distributed the first notification about the survey to the CFA and many fisheries groups within the region. They asked if AFMA had any other comments on the proposal. CGG also noted that NOPSEMA requested Spectrum to modify and resubmit their EP for the Otway Deep MSS, primarily due to insufficient consultation with fishers (one point was that individual fishers were not contacted). CGG asked AFMA if they could provide contact details for individual Commonwealth fishers within the operational area. Asked that if not, could they forward the stakeholder consultation letters on to fishers. Via email incoming 25/06/18: AFMA replied to CGG stating that lists of Commonwealth concession holders in each fishery can be found on the AFMA website at: http://www.afma.gov.au/fisheries-services/concession-holders-conditions/ They advised once CGG had identified relevant operators they can request individual contact details through licensing@afma.gov.au and that there is a cost associated with the service. They stated they would contact relevant fisheries managers within AFMA to see if they have any additional comments.	No objections or claims. AFMA advised on how CGG could obtain the contact details of Commonwealth fisheries licence holders. **Action:** CGG to identify relevant licence holders and obtain individual contact details.	CGG commissioned SETFIA to develop a report on the fisheries potentially affected by the survey and the report included a list of Commonwealth and Victorian fisheries associations and individual fishers, with their contact details. CGG used this report and an existing database of fishers as the basis for progressing the consultation process. Further information on this report is summarised under the South East Trawl Fishing Industry Association rows in this table. A copy of the report is provided in Appendix I.
	04/09/18 06/09/18	2nd formal notification fishers and fisheries 3rd formal notification	No feedback received in response to the second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to consult with the AFMA as a relevant stakeholder for the duration of the activity.				
Victorian Fisheries Authority	24/04/18 25/04/18	Email incoming Email outgoing	Via email incoming 24/04/18: In response to a phone call enquiry VFA provided a map for bass strait used by fishers to report their activity. Via email outgoing 25/04/18: CGG followed up with VFA and stated that CGG is in the early stages of planning a seismic survey. Attached a figure showing the overall area that is proposed and highlighted that additional areas for vessel manoeuvres are also shown.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			CGG explained some areas were more important than others for CGG in terms of data collection and that some less important areas may be excluded altogether if they were important to fishers. For example, the southern extension area is the lowest priority and would only be undertaken if there was remaining time after surveys of the main and shallows areas were complete. CGG noted the survey was planned to start in November 2018 and expect that it would take about 4-5 months to complete. They explained that they have commissioned underwater noise and oil spill modelling and that the results from these won't be available for at least 4-8 weeks. Stated that as the areas potentially affected by underwater noise or oil spills is unknown at this time, it would be good to have data across Eastern Bass Strait (i.e. all cells in all rows between columns 35 and 56) to allow CGG to start consultation with fishers. CGG requested catch and effort data for each fishery operating in the survey area, fishery information (open times, excluded areas, etc), location of sensitive or important areas for fisheries, key contacts for consultation, spatial data and any other information that would assist in reducing the potential impacts on fishers. CGG noted they understand there are confidentiality issues with the VFA supplying data and asked for clarification on the services the VFA provides for obtaining more data from licence holders logbooks (referring to their policy, Undertaking seismic surveys in Victorian managed waters). No response was received to this email.		
	28/05/18 12/06/18	1st formal notification Rev 0 1st formal notification Rev 0	No feedback was provided in response to the first stakeholder consultation letter.	NA	NA
	13/06/18 13/06/18 13/06/18	Email outgoing Email outgoing Email incoming	Via emails outgoing (x2) 13/06/18 (regarding consultation): CGG contacted the VFA explaining they wished to ensure that all fishers within the proposed survey area are provided with information on the project. They stated they understood that VFA cannot supply contact details of individual fishers and instead asked if the VFA would forward the information on to fishers operating within the survey area. CGG noted that VFA (cc'd) has been preparing a data request for SEFTIA on CGG's behalf and may be able to assist with identifying fishers. Via email incoming 13/06/18: VFA responded they would discuss the distribution of consultation packages with their team.	NA	NA
	13/06/18 18/06/18 21/06/18	Phone call outgoing Email incoming Email incoming	Via phone call outgoing 13/06/18 (regarding data request in progress): CGG phoned VFA regarding data request and was told it would be somewhat limited. Also asked if they could forward stakeholder letter to Victorian fishers. Via email incoming 18/06/18: The VFA replied and stated they would circulate CGG's first stakeholder consultation letter to those with commercial fishing access rights in the area. The stated that they have strict privacy rules around contacting licence holders but consider it is in their interests to know of the proposal. Via email incoming 18/06/18: The VFA confirmed the letter was posted out to the relevant licence holders today.	NA	NA
	14/08/18	Phone call outgoing	CGG contacted the VFA to ask if they had received any feedback on the letter. They said they hadn't and advised CGG to liaise with SIV.	No objections or claims. VFA advised CGG to consult with SIV. CGG are already consulting with SIV therefore no further action required.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	04/09/18 04/09/18	2nd formal notification fishers and fisheries Email outgoing	Via mail outgoing 04/09/18: CGG notified the VFA the second stakeholder consultation letter had been sent and asked if the VFA could forward to licence holders. No feedback or reply was received in response to the 2nd formal notification or the follow up email.	NA	NA
	29/10/18 01/11/18 02/11/18	Email outgoing Email outgoing Email incoming	Via emails outgoing 29/10/18 and 01/11/18: CGG requested data on quota for commercial scallop within the Scallop (Ocean) Fishery during 2018/19 and asked if any changes to management of the fishery are anticipated during this time. CGG also noted that if there is a report on this, it would be useful if the VFA could forward the details of it. Via email incoming 02/11/18: The VFA replied statin the current 2018/19 TACC for the Scallop (Ocean) Fishery is set at 135 t. They referred CGG to the VFA webpage for further information on the Scallop fishery and findings from the 2018 abundance survey. They noted the quota setting process including consultation for the 2019/20 fishing season will commence in the months leading up to the start of the season on 1 April 2019.	NA	NA
	22/11/18 22/11/18 22/11/18	3rd formal notification Email incoming Email outgoing	Via email incoming 22/11/18: In response to the third stakeholder consultation letter, the VFA acknowledged the information and stated that key contact would be the lead on this. Via email outgoing 22/11/18: CGG confirmed that the key contact has been contacted directly and thanked them for their ongoing involvement.	NA	NA
	22/11/18 23/11/18 23/11/18	Email outgoing Email incoming Email outgoing	Via email outgoing 22/11/18: CGG contacted the VFA and asked for confirmation they would forward the third stakeholder consultation letter to Victorian licence holders within the survey area, on the understanding this arrangement had been previously discussed and agreed with CGG for previous letters. Via email incoming 23/11/18: VFA noted the request and asked for confirmation CGG was consulting with SIV as the peak body for Victorian fisheries. They stated that SIV have a key role in ensuring that their members – all Victorian licenced fishers – are adequately consulted on these matters. SIV have a policy for engaging with fishers on these issues. The VFA strongly recommended CGG utilised SIV as the key point of contact in these matters. The VFA then stated that if CGG believe there were still outstanding consultation issues for Victorian fisheries, the VFA could assist by posting a letter out to licence holders for CGG, but that they would be unable to send out every stakeholder update over the life of the project.	No objections or claims. VFA recommended CGG consult with SIV as their members are all Victorian licence holders (i.e. its membership is compulsory, and it is SIVs role to ensure all licence holders are consulted with). CGG are already consulting with SIV therefore no further action required.	Via email outgoing 23/11/18: CGG confirmed they have been consulting with SIV and all other industry associations with fishers that could be affected by the survey. Thanked VFA for the advice and stated CGG would get back to them if they wished to take VFA up on the offer to post letters to licence holders.
	Ongoing consultation: CGG will continue to consult with the VFA as a relevant stakeholder for the duration of the activity.				
Fisheries associations					
Abalone Council Australia Ltd	28/05/18 09/08/18 09/08/18	1st formal notification Rev 0 Phone call outgoing Email outgoing	No feedback received in response to the first stakeholder consultation letter. Via phone call outgoing 09/08/18: CGG phoned the Abalone Council Australia to discuss the proposal. Followed up with an email with additional information regarding potential changes to the DMAC guidance and mitigation practices that will be undertaken. Via email outgoing 09/08/18: CGG emailed the Abalone Council Australia and reattached the first stakeholder consultation letter to follow up on previous phone call CGG stated they had received advice from NOPSEMA that the current	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			guideline on safe diving distance from seismic surveys (a copy was attached) is currently being revised and proposes the following: • where diving and seismic activity are scheduled to occur within 60 km, all parties should be made aware of the planned activity • where seismic survey/diving SIMOPS are proposed within 30 km, a joint risk assessment should be undertaken. The risk assessment should consider ramp-up trials as well as other risk control measures e.g. reduction in source sizes, changes to firing intervals, timeshare/prioritisation, etc. • if the risk assessment generates a requirement for a ramp-up trial the starting point for the trial will also need to be determined by the risk assessment. CGG stated they thought there would be no interactions with Abalone fishers as the survey is no closer than 15 km to shore but were now thinking there may be some overlap if the proposed draft guideline is applied. CGG asked the Abalone Council Australia if could review the guideline and respond with her thoughts. CGG also noted that the VFA had forwarded the first stakeholder consultation letter to all Victorian licence holders, so they should be aware of CGG's proposal. No response has been received from the Abalone Council Australia.		
	06/09/18 22/11/18	2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: No abalone fishers currently operate in the survey area, however there may be a potential impact on abalone divers diving outside the survey area. Therefore Section 6.3 of the EP mentions that CGG plan to develop a SIMOPs Plan for the survey, which will include diving related procedures where diving operations take place, a joint risk assessment in advance of SIMOPs and an extension of the Cautionary Zone to 10 km. CGG will continue to keep the Abalone Council Australia updated on the activity and will make further reasonable attempts to obtain feedback from the Abalone Council Australia as input to the SIMOPs Plan.				
Abalone Victoria Limited (Central Zone)	28/05/18 04/09/18 22/11/18 23/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 3rd formal notification Email outgoing	No feedback received in response to the first, second and third stakeholder consultation letters. Via email outgoing 23/11/18: CGG emailed Abalone Victoria Limited (Central Zone) noting they had been providing information and received no response. Enquired as to whether they had been receiving the letters and if they had any feedback on the activity. No response has been received.	NA	NA
	Ongoing consultation: CGG will continue to update the Abalone Victoria Limited (Central Zone) on the activity and per the comment above for the Abalone Council Australia will make further reasonable attempts to obtain feedback from them for input to the SIMOPs Plan to mitigate the potential risks to abalone divers.				
Commonwealth Fisheries Association Key contact: CFA mailbox ceo@comfish.com.au	28/05/18 06/09/18 22/11/18 29/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 3rd formal notification Phone call outgoing	No feedback received in response to the first, second and third stakeholder consultation letters. Via phone call outgoing 29/11/18: CGG phoned CFA because email with latest letter bounced. She said to forward it to the chair who had already been sent the letter.	NA	NA
	Ongoing consultation: CGG will continue to update the Commonwealth Fisheries Association on the activity and address any objections or claims raised.				
Eastern Zone Abalone Industry Association	28/05/18 04/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 3rd formal notification	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to update the Eastern Zone Abalone Industry Association on the activity and per the comment above for the Abalone Council Australia will make further reasonable attempts to obtain feedback from them for input to the SIMOPs Plan on the potential risks to abalone divers.				
EastRock	NA	NA	Refer to the content for South East Trawl Fishing Industry Association as Relevant Stakeholder ID 1733 represents both associations.	NA	NA
	Ongoing consultation: Consultation with EastRock will continue via Relevant Stakeholder ID 1733 for the duration of the activity.				
	28/05/18	1st formal notification Rev0	No feedback received in response to first stakeholder consultation letter.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Lakes Entrance Fisherman's Co-operative Ltd	17/07/18 18/07/18	Phone call outgoing Email outgoing	Via phone call outgoing 17/07/18: CGG phoned LEFCOL to discuss the proposed survey and stakeholder consultation. LEFCOL raised concerns about noise impacts on fisheries species and loss of stock. The phone call was documented in a follow up email. Via email outgoing 18/07/18: CGG followed up the phone call via email to document the discussion and discuss meeting at the LEFCOL office. • confirmed that LEFCOL had received the first stakeholder consultation letter and that he had forward it to several people including some politicians (e.g. the Member for Gippsland) • LEFCOL stated that Relevant Stakeholder ID 1733 generally represents LEFCOL for consultation with seismic proponents and CGG said that they had been talking to him and are going to meet with him on Wednesday 25th July in Melbourne • CGG said meetings were planned with individual fishers in Lakes Entrance on Thursday 26th July and that one fisher suggested that they would like a group meeting and that LEFCOL should be involved. • LEFCOL said he would like to meet and that there would be many fishers who would like to attend. LEFCOL told CGG that SSFA would probably want to attend and gave CGG his phone number. CGG said they had left a message with SSFA inviting him to attend. CGG asked if the meeting could be held at LEFCOL's office and LEFCOL indicated this may be possible. CGG asked if he could confirm if the meeting could occur at LEFCOL's office and a suitable time. Also asked LEFCOL who else may wish to attend so that CGG could ensure there was enough material to hand out. CGG noted they asked what LEFCOL's main concerns are with CGG's proposal and LEFCOL stated that it would likely have a large effect on fisheries in the area and that it would be a "nail in the coffin for the fishing industry in Lakes Entrance". No response was received from LEFCOL in direct response to this email.	LEFCOL represents the views and interests of Lakes Entrance commercial and charter fishers as well as some suppliers and businesses involved in the seafood industry. During the phone call on 17/07/18, LEFCOL expressed concern that noise impacts on fisheries species would result in the loss of stock. **Action:** CGG to address this concern and respond to LEFCOL, including any control measures that have been adopted in response to his feedback.	CGG subsequently discussed LEFCOL claim during a meeting with LEFCOL and individual fishers on 26 July 2018. The meeting is summarised in full in rows below. With regard to noise impacts on fisheries species resulting in the loss of stock, in the meeting CGG explained that control measures were being discussed to reduce the displacement of fishers from fishing grounds. CGG were liaising with SETFIA and SIV on how best to notify and communicate with fishers during the survey, to assist fishers with planning their operations day to day/week to week. CGG welcomed suggestions from stakeholders if they hadn't been satisfied with previous methods. CGG later communicated the notifications and other control measures for managing vessel interactions that had been adopted in response to feedback, in the second and third formal consultation letters. The impact assessment summary provided in the second stakeholder consultation letter summarised the available research on noise impacts from seismic operations affecting fisheries catches. It found that there are no documented accounts of drops in catch rates from fishers across the world and therefore no scientific evidence to support the claim. The letter noted research conducted by CSIRO and Geoscience Australia in the Gippsland Basin showing seismic did not have an adverse effect on catches of most commercial fish species. Some reduction was observed for gummy shark, saw shark and red gurnard, however the authors noted this was not evidence of an impact from the seismic survey. All available literature has been considered in the impact assessment and subsequently in determining the control measures adopted for the survey. Impacts on catch were summarised in the second stakeholder consultation letter and adopted control measures were documented in the second and third stakeholder consultation letters sent to LEFCOL. Relevant Stakeholder ID 674 has also subsequently become a member of the Scientific Advisory Committee, which is developing a Fisheries Displacement Mitigation Plan to provide a mechanism for licensed individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG's activities. The Plan sets out the decision rules to deal with payments for verified claims.
	18/07/18 18/07/18	Email outgoing Email incoming	Via email outgoing 18/07/18: CGG emailed saying since sending the previous email they had spoken to SSFA who suggested that the SEAMAC building might be better for the meeting. Noted that Relevant Stakeholder ID 1733 has said that they can meet there between 10 and 12pm Thursday 26th July. CGG asked LEFCOL if he could forward this information on to any interested parties. Via email incoming 18/07/18: LEFCOL replied that he would be at the meeting.	NA	NA
	26/07/18	Meeting	Via meeting 26/07/18 (with CGG and Lakes Entrance fishers (commercial and charter) and LEFCOL): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey	LEFCOL raised the following three objections or claims during the meeting, and all are considered relevant to LEFCOL's functions, interests and activities: 1. justification for the survey occurring 2. monitoring the impacts of the survey 3. disrupted fishing activity during the survey period affecting the rest of the supply chain and the community. **Action:** CGG to address each objection and claim and respond with the outcome, noting any changes or control measures	Via meeting on 26/07/18: During the meeting (and following) CGG responded to LEFCOL's objections and claims as follows: 1. **justification for the survey occurring:** CGG replied that money was a driver for the survey as it is a company responsible to its shareholders. CGG also noted in the meeting that reprocessing of existing data had created a lot of titleholder interest with greater visibility of strata below coal deposits. This has increased prospectively in the context of increasing demand for new gas sources in eastern Australia. Previous seismic surveys had often been done in a patchwork manner, often in the wrong direction and using outdated methods. CGG's proposed survey would provide a complete picture of the region, using the latest technology and acquired in the best directions for processing.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Issues and queries that were directly raised by LEFCOL were: 1. **justification for the survey**: LEFCOL enquired who had contracted CGG to do the survey and said if no one is currently contracting them then the survey is about making money 2. **monitoring of impacts:** LEFCOL asked whether CGG had thought about doing before and after surveys to see if fish have moved away 3. **impacts on the community:** LEFCOL asked whether oil companies would take on community accountability as there is a 'knock on' effect that must be considered. 4. **disrupted supply chain:** LEFCOL noted concerns for LEFCOL from 5 months of disrupted product flow and the potential knock on effects of that. LEFCOL also asked if the SETFIA report developed would be available to fishers.	that have been adopted in response to his feedback.	CGG also explained that the survey area also includes newly gazetted blocks, and that the bidding process for newly gazetted blocks requires potential titleholders to commit to a program of works, which generally includes seismic exploration. Further justification for the survey was also communicated in the second stakeholder consultation letter sent in September 2018. 2. **monitoring the impacts of the survey:** CGG stated they were willing to consider requests for contributions to studies, but they would have to be based on good science. In the meeting CGG also noted it was unlikely that the available catch data would provide a conclusive result to prove or disprove that seismic surveys have an impact. CGG said they will review all available scientific literature but do understand that it is not easy to prove whether seismic has an effect or not since there are many factors affecting the interpretation of fisheries catches, including warmer waters from climate change, and fisheries catches do vary quite widely over time. CGG has since established the Scientific Advisory Committee, which is responsible for determining the studies that will be undertaken for the survey. Relevant Stakeholder ID 674 is a member of the Committee and therefore has direct involvement in the development of these programs. The monitoring programs that are being progressed under this Committee are described in Section 8.3.3 of the EP and was communicated to stakeholders via the third stakeholder consultation letter in November 2018. 3. **disrupted fishing activity during the survey period affecting the rest of the supply chain and the community:** LEFCOL noted concerns for LEFCOL from 5 months of disrupted product flow and the potential knock on effects of that. CGG explained that control measures were being discussed to reduce the displacement of fishers from fishing grounds. CGG were liaising with SETFIA and SIV on how best to notify and communicate with fishers during the survey, to assist fishers with planning their operations day to day/week to week. CGG welcomed suggestions from stakeholders if they hadn't been satisfied with previous methods. CGG later communicated the notifications and other control measures for managing vessel interactions that had been adopted in response to feedback, in the second and third formal consultation letters. The impact assessment summary provided in the second stakeholder consultation letter summarised the available research on noise impacts from seismic operations affecting fisheries catches. It found that there are no documented accounts of drops in catch rates from fishers across the world and therefore no scientific evidence to support the claim. The letter noted research conducted by CSIRO and Geoscience Australia in the Gippsland Basin showing seismic did not have an adverse effect on catches of most commercial fish species. Some reduction was observed for gummy shark, saw shark and red gurnard, however the authors noted this was not evidence of an impact from the seismic survey. All available literature has been considered in the impact assessment and subsequently in determining the control measures adopted for the survey. Impacts on catch were summarised in the second stakeholder consultation letter and adopted control measures were documented in the second and third stakeholder consultation letters sent to LEFCOL. There were subsequent discussions with fishing stakeholders on impacts to the seafood supply during the Christmas period. CGG made changes to the timing of the survey to reduce this potential impact on the fishing seafood industry. The survey is now planned to start in February 2019 (subject to approval) and operations will commence in the offshore zones, avoiding the nearshore zone which is of importance to Danish seine fishers and charter operators. These changes were

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					included in the third stakeholder consultation letter sent to LEFCOL in November 2018. LEFCOL also asked during the meeting if the SETFIA report developed would be available to fishers. CGG stated it would when it was finalised. CGG has since provided the report to LEFCOL for him to forward to his members.
	08/08/18	Email outgoing	Meeting minutes for review. No feedback received from LEFCOL on the minutes.	NA	NA
	20/08/18 20/08/18	Phone call outgoing Email outgoing	Via phone call outgoing 20/08/18: CGG phoned LEFCOL to ask about putting up A4 posters with summary information on the survey and contact details, in key areas where fishers may be (e.g. jetty fuel pumps, LEFCOL office, etc). This was to make sure all fishers are aware of the proposed survey. LEFCOL stated not to worry too much as everyone was well aware of the survey. He said to email the poster to him, and he would distribute himself to LEFCOL members. Also commented that CGG should not expect any positive feedback from fishers and that most would be negative. CGG thanked LEFCOL and agreed to email poster to him. Followed up the phone call with an email the same day refer to right hand column).	LEFCOL claimed that CGG should expect negative feedback from fishers on the survey. CGG considers this comment speculative and no evidence was mentioned or subsequently provided to demonstrate this is the case. CGG will respond to negative feedback from stakeholders in accordance with their consultation process as and when it is received. No response required but the comment was noted.	Via email outgoing 20/08/18: CGG follow up the phone call with email stating they really wanted to engage with as many fishers as possible (commercial and recreational). Noted that many fishers have already received phone calls and emails with information about the program, but CGG wanted to ensure as many fishers are notified as possible. CGG explained to do this they were hoping to put up the poster in areas accessed by fishers – e.g. on fuel pumps, or in the LEFCOL office. CGG asked LEFCOL if he had suggestions on some key areas that might be best and said in the meantime it would be great to distribute the notice to LEFCOL members.
	21/08/18 21/08/18	Email incoming Email outgoing	Via email incoming 21/08/18: In response to CGG's email 20/08/18, LEFCOL stated that it does not constitute consultation in his book, and that if anything it is paying lip service. He claimed the survey would destCO2CRC their industry and that hanging a poster for people to respond to is not proper consultation. He stated not try and divide and conquer an industry and that CGG need to sit down and talk as a group which they have done, but because they didn't like what they heard the first time, they're trying a new tactic.	LEFCOL claimed the following: 1. that posting a notice did not constitute consultation and that CGG was doing this because they did not like the feedback from the meeting held with fishers in July 2. that CGG should hold face-to-face meetings like they have previously. These are considered merited and fair claims with regard to consultation process. **Action:** CGG to review and respond to LEFCOL two claims and further discuss LEFCOL's preferred methods of consultation. LEFCOL also claimed the survey would "destCO2CRC the fishing industry". CGG does not consider this claim is merited since it is a generic, speculative statement and was not supported by any evidence from LEFCOL. The literature review for the impact assessment found no evidence of a seismic survey destCO2CRC ing an entire fishing industry.	Via email outgoing 20/08/18: 1. **that posting a notice did not constitute consultation and that CGG was doing this because they did not like the feedback from the meeting held with fishers in July:** CGG explained that the idea behind the notice was to provide better coverage in case someone had missed the earlier LEFCOL notice and that if he was confident that all relevant fishers had been reached, then there is little value in posting notices as an alternative method for seeking input. CGG stated they would not pursue it further. CGG affirmed they are not ignoring stakeholder feedback and not trying different tactics because they didn't like the feedback the first time. They explained the different methods (email/phone/meetings/ notices etc) are aimed at making sure as many individual fishers' as possible have been reached, and their views and concerns understood (e.g. fishing hot spots/ spawning areas/key times) so that CGG can work to reduce impacts that are identified. 2. **that CGG should hold face-to-face meetings like they have previously:** CGG noted the previous meetings where issues have been discussed and that the feedback was being addressed. Noted they were preparing further information summarising the potential impacts and control measures and it would be distributed in the next week or so. LEFCOL has been subsequently invited to all meetings held with fishers. CGG encouraged LEFCOL to continue to provide feedback and later discussed LEFCOL's preferred approach to consultation via phone call (summarised in the row below).
	22/08/18 24/08/18	Email incoming Phone call outgoing	Via email incoming 22/08/18: In response to CGG's email 20/08/18, LEFCOL stated that not all relevant fishers have been reached and that as mentioned a flyer is not an appropriate way to consult with these stakeholders. He stated he was aware that a report (the SETFIA report *[sic.]*) had been done for CGG and he predicted it could not have been favourable. He asked what CGG believes the impacts to be and asked what plans are in place to reduce the impacts (factual or perceived). LEFCOL claimed that at no stage in any correspondence has CGG said if there are serious impacts they will walk away.	LEFCOL restated his objection to CGG's methods of consultation and his claim that the survey would destCO2CRC the industry (and that it would adversely affect the community who depend on the industry). These objections and claims are addressed in the row above. LEFCOL raised the following additional objections and claims: 4. claimed the SETFIA report done for CGG could not be favourable	Via phone call outgoing 24/08/18: Due to the emotive nature of LEFCOL's email, CGG phoned him to discuss his concerns. LEFCOL stated his key objections and claims were (and CGG's responses are included): • **did not like the attitude of oil and gas companies that they've worked with before who come in and bully the fishing industry to get what they want. They do not care about the impacts after the survey is finished:** During the call it was discussed that NOPSEMA won't accept an EP if the concerns of relevant persons have not been resolved as much as possible and affirmed that CGG was committed to the consultation process and working with stakeholders to find solutions to mitigate impacts. CGG reiterated during the call that the more

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			He claimed the survey will affect more than the fishers and would also affect their town, community and region that have a dependence on the fishing industry. LEFCOL stated that he did not believe that CGG really cared about the after effects and only cared for the 'now' as they believe the after effects are unknown and someone else's mess to fix.	5. claimed that CGG has not acknowledged they would walk away if impacts are determined to be serious 6. claimed the survey will affect more than the fishers and would also affect their town, community and region that have a dependence on the fishing industry **Action:** CGG consider each of these items to have merit therefore CGG to review and respond to each one stating how they are being addressed, including any changes or control measures adopted in response to his feedback. LEFCOL also asked for additional information: • what has CGG determined the predicted impacts of the survey to be? • what control measures has CGG put in place to mitigate impacts? **Action:** CGG to provide the information requested. LEFCOL also claimed that that CGG did not really care about the impacts to fisheries after the survey. CGG's assessment of this claim determined that is does not have merit since (a) CGG has held face to face meeting with LEFCOL and fishers on 26 July 2018 (b) stakeholder consultation letters have been provided to LEFCOL and other relevant stakeholders, each of which expressed CGG's focus on positive engagement with stakeholders and encouraging feedback to minimise impacts on the community. Since this email, a number of face-to-face meetings have been held with LEFCOL and other fishers and a SAC has been convened which Relevant Stakeholder ID 674 is a member of.	stakeholders voice their concerns the more CGG can address the issues raised. • **lack of science to support there will be no impacts and how that should mean the activity doesn't occur:** CGG explained they were working on the impact assessment and reviewing and incorporating stakeholder feedback to identify changes that can be made to reduce impacts. As per CGG's email on 20/08/18 CGG reiterated the assessment would be summarised and provided to fishers for their review and response. A summary of the impact assessment was provided to the fishing industry in September 2018. • **did not like the 'divide and conquer' approach to consultation where operators go to individual fishers rather than through representatives of peak bodies:** CGG said if LEFCOL preferred consultation to be directed through them then CGG would follow that approach. LEFCOL preferred this and said he would forward through some feedback he was receiving from key stakeholders onto CGG, which CGG welcomed. Regarding the four objections and claims raised by LEFCOL in his email 22/08/18: 1. **claimed the SETFIA report done for CGG could not be favourable:** A copy of the final SETFIA report was subsequently provided to members of the Scientific Advisory Committee in preparation for the first Committee meeting held on 23rd November. Relevant Stakeholder ID 674 is a member of the Committee and received the report for review. 2. **claimed that CGG has not acknowledged they would walk away if impacts are determined to be serious:** it was documented in the meeting minutes for meeting held on 26 July that CGG would walk away if it was determined there would be significant impacts. A copy of these minutes was sent to LEFCOL and he did not provide any comments at the time. 3. **claimed the survey will affect more than the fishers and would also affect their town, community and region that have a dependence on the fishing industry:** CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low. The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible. CGG explained that the impacts assessment undertaken has determined that the impact on the fishing community is expected to be low. Information on the predicted impacts of the survey and the control measures in place to mitigate impacts was provided to LEFCOL via the second and third stakeholder consultation letters provided in September 2018 and November 2018 respectively. During a meeting held on 2 November 2018 that LEFCOL attended CGG discussed changes made to the survey and further control measures that had been adopted to mitigate impacts. Refer to rows below for summary of the meeting.
	30/08/18	Letter incoming	LEFCOL forwarded a letter from LEFCOL's Cartage Contractor (Relevant Stakeholder ID 2562) who he said would be impacted by the proposed survey. The contents of the letter are summarised in this table under Relevant Stakeholder ID 2562.	NA	CGG responded to the objections and claims from Relevant Stakeholder ID via letter to LEFCOL (and cc'd Relevant Stakeholder ID 2562 in). CGG's responses are summarised in this table under Relevant Stakeholder ID 2562.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	04/09/18	2nd formal notification fishers and fisheries	No feedback received in response to second stakeholder consultation letter.	NA	NA
	21/09/18 23/09/18 24/09/18 26/09/18	Email outgoing Email outgoing Email incoming Email outgoing	Via email outgoing 21/09/18: CGG stated they were proposing to meet with Lakes Entrance fishers on Tuesday 25 September and that invitations would be sent when a venue and time was agreed. CGG asked LEFCOL if they could pass this information to members who are interested or may be affected by the survey. Via email outgoing 23/09/18: CGG invited fishers to meet on the 25 September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Relevant Stakeholder ID 2494 did not attend the meeting. Via email incoming 24/09/18: Relevant Stakeholder ID 674 replied that he would be an apology and noted that with the weather being favourable CGG may find fishers do not attend. He suggested that 4 days' notice to working fishers is not ideal and the meeting would not represent fair consultation.	Relevant Stakeholder ID 674 indicated that the short notice provided, and weather conditions would mean not many fishers would attend, which would mean the fishing community would not be adequately represented. **Action:** CGG to respond to Relevant Stakeholder ID 674's concern about the timing of stakeholder meetings.	Via email outgoing 26/09/18: CGG apologised for the short notice which was driven by the availability of their executive staff. CGG noted the meeting was constructive; they discussed issues and solutions and the wider social context of fishing and oil and gas production. The anxiety of fishers was well acknowledged and CGG are working to minimise impacts to ALARP. CGG stated a further meeting is planned mid next month to update all on their planning proposal and will aim for a time when most fishers are in port.
	26/10/18	Email outgoing	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2 November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25 September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received from LEFCOL.	NA	NA
	02/11/18	Meeting	Meeting held 2 November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25 September 2018 that Brad was unable to attend. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were raised during the meeting: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	CGG has provided the following responses to the three objections and concerns raised: 1. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders. Once meeting minutes are finalised, they will be distributed to all attendees.
	12/11/18	Email outgoing	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25 September to attendees for review.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			No feedback received from LEFCOL.		
	22/11/18 22/11/18	3rd formal notification Email outgoing	Via email outgoing 22/11/18: CGG followed up the third formal notification with a request for LEFCOL to forward the letter to his members. No feedback or confirmation received.	NA	NA

	23/11/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the first SAC meeting:
			• **Item 1: Study projects:**
			  • Stage 1: to develop 2 explicit projects as pre-proposal to be put to CGG. These being:
			  1.Octopus study – experimental review of physiology and wellbeing and analysis of catch data before and after the marine seismic survey (MSS). UTas to provide a pre-proposal by 30 November.
			  2.Analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery pre the MSS and a non-commercial pre-determined sampling program after the MSS. Fishwell to provide a proposal before 14 December.
			  • Stage 2. CGG will consider these projects and make a determination on the scope and funding of these projects.
			• **Item 2: Zoning sequence:** Committee has agreed that it will be necessary for sectors to identify the timing for the sequence of surveying the zones that minimizes the impact on the commercial fishing industry.
			• **Item 3: Compensation:**
			  • Stage 1: A model for an appeals process for compensation is to be developed for consideration by CGG. CGG to provide this by December 7.
			  • Stage 2: CGG to consider this proposal.
			• **Item 4: Process for Committee:** deal with pre-proposal and appeals model as an out-of-session action via phone/email.
			The following is a summary of general notes from the meeting:
			Octopus:
			• support for a study, UTAS to provide proposal and contact FRDC about funding
			• importance of catch rates as the fishery may move to quota management and that whilst analysis of catch rates is typically difficult, that a change in catch rate signal can be seen if planned (can also see signal in normal catch and effort data for the GAB trawl fishery)
			Scallops:
			• change to survey away from scallop bed will protect adults as is greater than 2 km away from most significant bed. However, recruitment may be impacted since it is localised (spawning late summer/early autumn, and settlement generally early autumn). There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks
			• UTAS noted he was involved with 2015 before and after scallop survey but it was not designed properly (too short-term) so results questionable.
			Danish seine:
			• Fishwell noted an issue is the ability to detect change given 'noise' in catch rate data and the way it is done is different for each fishery. He suggested there were two options:
			  • before/after program: identify power to detect specified change, proper experimental design
				The following objections and claims were raised and discussed at the meeting:
				1. **impacts on LEFCOL's business activities:** LEFCOL claimed that the trawl sector is mobile but if fishers must operate too far away then may impact LEFCOL if product is unloaded elsewhere. That Christmas time is important.
				CGG have assessed this concern as having merit. Similar claims to this have been discussed previously with LEFCOL meetings on 26 July 2018 and 2 November 2018 and responses provided (refer to events above for summary of CGG's responses).
				2. **impacts on recruitment of scallops:** that whilst the scallop bed was removed from the survey area, that recruitment may be impacted
				CGG has assessed this concern as having merit and requires resolution if possible.
				3. **concern about use of 1981 noise modelling and broader scale impacts on food web**
				CGG has assessed this concern as having merit. A response is being drafted to be sent to SSFA regarding his concerns around the sound modelling week starting 21st January.
				4. **impacts of the zoning system on octopus fishery:** five-hour fishing cycle (time period for picking up pots before survey vessel comes through every ~14 hours). Removing surface floats requires VFA approval.
				CGG has assessed this concern as having merit since it has been raised previously by Relevant Stakeholder ID 2510 and requires resolution if possible.
				Action: CGG to discuss zoning plan with Relevant Stakeholder ID 2510 in an additional meeting in January 2019
				5. **compensation for lost catch:** committee members wanted CGG to confirm they will compensate (for lost catch *[sic.]*).
				This concern was assessed as having merit since it was within the remit of the SAC to progress a solution to this issue.
				Action: It was identified in the meeting that CGG would draft an appeals
					1. **impacts on LEFCOL's business activities**:
					CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low. The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible.
					2. **impacts on recruitment of scallops:** There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks.
					3. **concern about use of 1981 noise modelling and broader scale impacts on food web:**
					In selecting the propagation model for the impact assessment used within this EP, CGG considered various factors, including range dependant bathymetry, frequency dependence (relevant for all marine faunal groups assessed), the seismic source characteristics, and balancing errors / uncertainties across factors.
					In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang et al. (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, the seismic source will contain a significant amount of energy above this frequency. the suitable frequency range for parabolic equation models would not cover any of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals, as well as those animals (fish and invertebrates) that hear above 1 kHz (e.g. fish with swim bladders which respond to higher frequencies of 200 Hz to 3kHz (Carroll et al. 2017), and lobsters up to 5 kHz (Pye and Watson 2004 in: Carroll et al. 2017).
					Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchRelevant Stakeholder ID 2491ed against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been peer reviewed and benchRelevant Stakeholder ID 2491ed, with good agreement, against other transmission loss models (e.g. Toso et al., 2014; Etter 2013; Schulkin and Mercer 1985).

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			◦ utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. • displacement of fish and fishers was expected but some fisheries and species are more impacted than others. Focus is on those that are more mobile – which Danish seine and octopus are the two sectors with least ability to move. • noted that use of noise loggers important in understanding impacts on octopus and would also inform study on impacts to Danish seiners. • LAFCOL raised that trawl sector is mobile but if fishers have to operate too far away then may impact LEFCOL if product is unloaded elsewhere. Also noted that Christmas time is important. SIV – part of broader study on economic impacts **<u>Zoning system:</u>** • SSFA believes that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. He also noted the unpredictable arrival of South Australian fishers adds to the competition. He also expressed concern about use of 1981 noise modelling and broader scale impacts on food web • Relevant Stakeholder ID 2510 said with regard to octopus and zoning that the best fishing is during day. He was concerned about five-hour fishing cycle (time period for picking up pots before survey vessel comes through (every ~14 hrs)). Removing surface floats requires VFA approval. • discussion regarding the order in which they should be done varies between fishery. It was stated that this should have been dealt with through consultation previously. CGG stated that it had been presented at the last two stakeholder meetings at Lakes Entrance. **<u>Compensation:</u>** • committee should consider a safety net in place in case impacts are identified • CGG suggested a revenue neutral situation was required, using catch and effort data of individual fishers, which requires fishers' permission to access data committee members wanted CGG to confirm they will compensate. CGG will generate a draft appeals process for discussion based on other models used.	process (compensation plan) for review by the SAC. **SSFA raised** that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. The unpredictable arrival of South Australian fishers adds to competition. This claim was assessed as not having merit since (a) the zoning system was introduced in response to consultation with the fishing industry to enable them to forward plan their activities and many have expressed support for the approach, (b) the order of the zones being surveyed is also being planned in consultation with the fishing industry to reduce impacts on the fishing industry associated with certain areas/zones and timing (e.g. avoiding nearshore areas during summer/Christmas period), (c) CGG cannot control the activities of South Australian fishermen and can only reduce the impacts of their own activities, (d) no alternative approach was/has been suggested bySSFA who raised the claim. (e) the percentage of the actively fished area of the fishery that overlaps the survey area is relatively small and being highly mobile fishers, it is expected that they will spread out and not congregate in a small area within the survey area.	RPS has carried out additional benchRelevant Stakeholder ID 2491ing tests using the extended Rogers propagation model in comparison to other propagation models and found generally very good agreement with the other models (i.e. Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model). 4. **impacts of zoning system on octopus fishery:** Relevant Stakeholder has agreed to meet with CGG regarding the octopus study and fishery. CGG to discuss planning and logistics for the octopus regarding the zoning schedule. This meeting is planned to occur in January. **compensation for lost catch:** It was agreed during the meeting that CGG would generate a draft appeals process (compensation plan) based on other models used, for review by the SAC. A Fisheries Displacement Mitigation Plan has been drafted and reviewed by the SAC and CGG is seeking internal approval. Further notes on this are summarised below for the SAC meeting dated 3 January 2019.
	29/11/18	Email outgoing	Via email outgoing 29/11/18: CGG offered LEFCOL the opportunity to provide notifications to local fishers should the survey go ahead. CGG are interested in discussing the best format and timeframe for communication with fishers and the costs involved. No response received.	NA	NA
	17/12/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the second SAC meeting: **<u>Octopus study</u>** • discussed proposal scope and costs, considering outside/industry funding and CGG asked if the scope could be scaled back. Cost mostly due to vessel costs. Could be reduced by reducing time. UTas to look at options to reduce costs and follow up with FRDC. **<u>Danish seine study</u>** • there were concerns about the timing of the survey starting in January/February and that the Danish seine proposal would be provided in January. Would need to start surveying before survey start date. • it was suggested that log book data could be used for C&E for analysis if necessary but would need cooperation from individual	The following concerns were raised and discussed at the meeting: 1. that the timing of the survey didn't allow adequate time for planning Danish seine study and collecting data before the survey start date (starting in January/February and the Danish seine proposal would be provided in January). 2. concern about the ability to detect change given 'noise' in catch rate data.	CGG has responded to the two objections and claims as follows: 1. **timing of the survey start date and the Danish seine study:** this concern was discussed in more detail in the SAC meeting on 3 January 2019 (refer to event summarised below). CGG stated that they need to remain flexible and that the 'go ahead' for studies will depend on EP approval. Once approved, they will decide timing and other operational details. Planning is ongoing, proposals have been received and SAC members will advise on the timing for studies during future meetings. 2. **ability to detect changes in catch and effort data:** Fishwell explained that using log book data for C&E for analysis would need cooperation from individual fishers and you can't rely on their data as they may be fishing in a totally different area. He suggested there were two options:

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			fishers to use their data. Fishwell noted if they wanted to get the fishers to participate in a proper BACI study, can't rely on their data as they may be fishing in a totally different area. • Fishwell stressed that if the experimental study was not properly planned and executed it would be a waste of time. **Zoning system** • Fishwell completing analysis on zoning order. Currently indicates there is not a lot of difference between zones in terms of timing of catch. • CGG noted that from an operational perspective they propose to start deep (southern) and move to shallow. Plan to do Zone 4 in March/April. **Fisheries Displacement Mitigation Plan** • draft Plan provided to SAC members prior to meeting. CGG asked how it would work if there is a bad fishing season in general – would the proposed Danish seine study be useful? It was noted that the Danish seine study would be another piece of evidence for identifying any changes to fishing data as a consequence of the proposed survey. CGG requested the relationship between the sampling plan and how it feeds into the Mitigation Plan. **Update on EP** submitted last Monday and response will be available from NOPSEMA 9 January 2019. CGG noted the zones have been renumbered and changed (which SAC members were notified of in the lead up to the meeting).		• before/after program: identify power to detect specified change, proper experimental design • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. Per minutes of SAC meeting on 23 November 2018, Fishwell was in process of conducting an analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery (pre-survey) and was to provide a proposal for a non-commercial pre-determined sampling program (after the survey). Since this meeting, two approaches have been adopted (refer to Section 8.3.3.2 of the EP): (1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and (2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.
	03/01/19	Meeting (Scientific Advisory Committee)	The following items were discussed and agreed during the third SAC meeting: **Danish seine study**: • Fishwell explained that the seasonality analysis report as expected, has shown that there is not a big seasonal component for separate zones and that based on analysis he wouldn't say any one zone is better than another. Results were therefore as expected with Danish seine summer catch (Dec-Feb) being higher and more variable, and Otterboard trawl tending to build up towards winter. • With regard to peak catches in Zone 6, SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". It was clarified that the area being referred to was South East reef, for which a smaller gun will be used. • CGG requested a recommendation as to which direction to begin surveying in, based on the data. Fishwell noted it was different for different fisheries, but he could combine values and analyse on combined worth, providing figures with values in zones and see which way would minimise cost. CGG agreed to this. • SSFA expressed concern that the GHaT data will be lost within the aggregated data (once that data is overlaid with Danish seine fishery). Fishwell explained you can see gap values in individual analysis. • There was further discussion about technical aspects of the study and a proposed survey design would be available for the SAC to review to understand the impact of events. • CGG stated they had been in touch with the FRDC and WAFIC regarding funding and/or involvement in the study. **Octopus study:** • UTAS advised he had reviewed the quote but couldn't reduce the cost much, due to cost of vessels required. Noted that FRDC funding would be useful as their involvement then changes it to a category 1 study and certain costs would be removed. Also, easiest way for FRDC to be involved in terms of timing.	The following concerns were discussed at the meeting: 1. SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". This concern was assessed as not having merit since it was clarified during the meeting that the area being referred to in the discussion was South East reef, for which control measures have been adopted to mitigate impacts in this area (i.e. reducing power setting of the airguns including a 500 m buffer zone around the reef to avoid TTS injury to fish (including sharks). 2. SSFA also expressed concern that the GHaT data will be lost within the aggregated data analysis performed by Fishwell (once that data is overlaid with Danish seine fishery). This concern was assessed as not having merit since it was clarified Fishwell during the meeting that you can see gap values in the individual analysis. No further control measures or changes are warranted. 3. There was some concern expressed with regard to reducing costs of the research studies. Difficulties included cost of vessels blowing out the quote for octopus study, the need for funding (FRDC or other). Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies.	In response to the fourth concern (that required action), CGG and Relevant Stakeholder ID 2510 agreed to meet to discuss the need for extra equipment up to three months prior to survey commencement. These discussions are in progress.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• CGG asked if the study was ready to start sampling in February 2019. UTAS advised he was waiting for CGG to provide funding to get extra equipment, and they will need 3 months to get mesh bags/extra lines. Also noted it was tough to organize as currently in peak charter time and vessels are booked out. Also noted some operators are in the prawn season, which will also take some time to sort out. However, from a scientific perspective they could be ready to go in February 2019. • CGG stated they were exploring options for additional support and equipment and meeting with the FRDC. **Compensation:** • CGG advised they were dealing with internal management sign off of the Fisheries Displacement Mitigation Plan, and the effect of displacement on catch. They would like to put them forward as separate documents to SAC and then feed suggestions back to CGG. Timing for this was end of next week and a draft to be distributed to SAC by mid-late January 2019. **Status of EP:** • CGG advised they were responding to additional queries from NOPSEMA, including clarification on the SAC and its processes. Specifically, they want to know the scope and frequency of future meetings. Since the EP was submitted before the last meeting CGG weren't able to provide NOPSEMA the minutes. **Other:** • Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG advised they plan to go ahead regardless. CGG and Relevant Stakeholder ID 2510 agreed to catch up when returned from leave to discuss the need for extra equipment up to three months before available. • CGG noted their preference was to survey from Zones 1 to 6 and it was noted that zone numbers should be used and not 'north-south' to avoid confusion. CGG noted at the next meeting the compensation proposals and funding information should be available and CGG would be in a better position to make commitments with regard to funding the studies.	CGG has assessed this concern as having merit since it is important that the studies are properly planned and executed to get reliable data. CGG stated regardless of funding they would proceed with the studies anyway. No further action required. 4. UTAS raised concern about planning aspects and timing of the octopus study and the seismic survey (i.e. tough to organize vessels as currently in peak charter time and they are booked out, also noted some operators are in the prawn season, which will also take some time to sort out). CGG has assessed this concern as having merit since it is important that data is collected prior to the survey commencing. **Action:** CGG to discuss planning and logistics for the octopus survey in more detail with Relevant Stakeholder ID 2510, in terms of getting equipment on time to support execution of the study before the seismic survey commences.	
	16/01/19	Email outgoing	CGG followed up on the email sent to LEFCOL on 29/11/18 about LEFCOL providing operational communications to fishers in regard to CGG's planned 3D marine seismic survey. Noted in the email that the tasks would include: • forwarding updates and reminders from CGG to all relevant fishing stakeholders about the survey including commencement date and duration, survey line plan layout, vessel communication details and protocols • notifications to fishers about any suspension of the survey and its completion • notifications to fishers in the area of operation of the survey vessel's location and planned movements over the next 24 hours • contact information for fishers to provide information back to CGG on planned fishing activity. CGG requested a proposal from LEFCOL, how they would execute the tasks and what the fee would be. No response received.	NA	NA
	21/01/19	Meeting (Scientific Advisory Committee)	The fourth SAC meeting was held on 21 January 2019 however the minutes are not available for summary and inclusion in this EP update. The following items were discussed: • update on research projects • compensation • survey communications protocols	Objections and claims will be identified and assessed when the minutes have been drafted and reviewed.	NA

RPS

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			update on study on zone order.		
	Ongoing consultation: Consultation with LEFCOL will be ongoing throughout the activity, particularly given the stakeholders they represent includes fishers, transport operators, city Relevant Stakeholder ID 2491ets that on sell the product and other businesses that are involved in the seafood industry that operates out of Lakes Entrance. CGG has also had discussions with LEFCOL about their role in notifications during the survey. Relevant Stakeholder ID 674 is a member of the Scientific Advisory Committee which will play a major role in resolving objections and claims from the fishing industry for the duration of the activity.				
Scallop Fishermen's Association of Tasmania	29/05/18 08/08/18 08/08/18 04/09/18 22/11/18	1st formal notification Rev 0 Phone call outgoing Email outgoing 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the first stakeholder consultation letter. Via phone call outgoing 08/08/18: CGG called to see if SFAoT had any feedback on the first stakeholder consultation letter. SFAoT said he wasn't sure if he'd received the email. CGG said they would resend the letter and SFAoT stated he would review it with his members and get back to CGG. SFAoT stated he is opposed to seismic, but he would review with his members and respond within the next week if there are any issues. Via email outgoing 08/08/18: CGG resent the first stakeholder consultation letter to SFAoT. No response has been received in response to the first, second and third stakeholder consultation letters.	The Scallop Fishermen's Association of Tasmania represents the views and interests of Tasmanian scallop licence holders, some of who may have interests, activities or functions within the survey area. SFAoT stated he objected to seismic surveys but has provided no specific feedback for CGG to address and respond to. No action required.	NA
	Ongoing consultation: CGG will continue to update the Scallop Fishermen's Association of Tasmania on the activity and address any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Scuba Divers Federation of Victoria	28/05/18 06/09/18 06/12/18	1st formal notification Rev 0 2nd formal notification general 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to update the Scuba Divers Federation of Victoria on the activity and as per the comment above for the Abalone Council Australia will make further reasonable attempts to obtain feedback from them for input to the SIMOPs Plan to mitigate the potential risks to divers.				
Seafood Industry Victoria	28/05/18 29/05/18 19/06/18 02/07/18 23/07/18	1st formal notification Rev 0 Email incoming Phone call outgoing Email outgoing Email incoming	Via email incoming 29/05/18: In response to the first stakeholder consultation letter, SIV replied and attached SIV's policy (co-signed with Tasmanian Seafood Industry Council) in relation to mining, gas and petroleum sector consultation with the Professional Seafood Industry. The policy identifies the ever-increasing level of ongoing consultation imposed on the seafood industry and the burden this implies. He welcomed CGGs review of the policy and was happy to discuss a way forward once they had done so. Via phone call outgoing 19/06/18: Following review of SIV's policy, CGG phoned SIV to discuss the proposed survey. He stated he had received no feedback from members but that he sees the main concerns are the potential for noise impacts on fisheries species and their food chains. This phone call was followed up with an email that contains more detail on what was discussed (see below). Via email outgoing 02/07/18: CGG noted that the main concerns SIV raised were about the potential for noise impacts on fisheries species and their food chains. SIV stated he was keen to meet and agreed that overlapping operations and noise impact issues could be discussed at that time, which would also allow him time to consult with SIV's members. CGG stated they have some flexibility in the planning of certain parts of the survey and that face-to-face meetings are planned for mid-late July (when the underwater noise modelling would be available). CGG explained their proposed consultation process. Explained that CGG had been engaged as a Fisheries Liaison Officer (FLO) to assist with the consultation and had also engaged the SETFIA to prepare a report on fisheries affected by the survey, based on data obtained from the VFA and AFMA. SIV agreed that good information is required for consultation but was not convinced that CGG would represent the best interests of SIV's	SIV represents the views and interests of the Victorian seafood industry (fishers, wholesale, processors and retail). SIV stated they had received no feedback from members, but raised the following objections and claims that were likely for their members (and are relevant to their functions, interests and activities): 1. potential for noise impacts on fisheries species and their food chains 2. overlapping operations. SIV also raised the following concerns: 3. concerned that CGG would not represent the best interests of SIV's members or that the SETFIA report would be adequate for Victorian fisheries 4. that the increasing amount and greater complexity, of consultation requests was putting a strain on SIV's resources as they must fund the costs of consultation internally. CGG's assessment of these objections and claims determined that whilst consultation was in the early stages, and the first two claims were not based on evidence (actual feedback from members), that given the organisations past experience with seismic survey consultation, that these issues had merit and should be reviewed to determine if changes or control measures could be adopted to resolve them. **Action:** CGG to review to each objection and claim and respond, including any changes or	CGG responded to SIV's objections and claims as follows: 1. **potential for noise impacts on fisheries species and their food chains:** during the meeting held on 25 July 2018 (see below), SIV and CGG discussed the potential impacts of the survey on Victorian fisheries, mostly scallops. The second stakeholder consultation letter contained a summary of the impact assessment on Victorian commercial fisheries and the second and third stakeholder consultation letters contained the control measures CGG has adopted such as; reducing airguns to a low power setting within the boundary of Southeast Reef and a buffer area of 500 m around the reef (based on the distance at which behavioural effects are predicted for fish), no seismic undershooting of the four existing platforms over or in the vicinity of Southeast Reef, and surveying the area containing Southeast Reef during the March - April period (lowest sensitivity for spawning of commercially important fish and invertebrate species), not acquiring adjacent sail lines over a period of <24 hours to allow recovery of fish species. 2. **overlapping operations:** whilst this claim was not discussed in any detail via phone, email or during the subsequent meeting on 25 July 2018 (see below), changes to the survey area and survey timing to reduce the impacts of the survey overlapping with fishing activities were provided in the second and third stakeholder consultation letters. These included reducing the survey area, adopting a zoning system where each zone is only occupied by the seismic vessel for one month, a notification schedule to reduce short-term impacts on fishers activities, and changing the timing of survey to occur from January to end of July in response to concerns about short-term impacts to businesses over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 3. **concerned that CGG would not represent the best interests of SIV's members or that the SETFIA report would be adequate**

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			members or that the SETFIA report would be adequate for Victorian fisheries. SIV said that the increasing amount and greater complexity, of consultation requests was putting a strain on SIV's resources, noting that SETFIA can fund their consultation costs through contracts with proponents, but SIV must fund the costs internally. CGG asked if SIV had previously prepared such reports and Johnathon stated they hadn't but are keen to do so. CGG suggested they could look at getting SIV to review the SETFIA data, consult with their members, and provide a brief report specific to Victorian fisheries. SIV welcomed this approach and CGG requested a proposal from SIV to provide a brief report on their members operations and concerns. Via email incoming 23/07/18: SIV provided a proposal for consultation and engagement for the proposed survey.	control measures adopted in response to the feedback.	**for Victorian fisheries:** as recorded via email outgoing on 02/07/18, CGG suggested they could look at getting SIV to review the SETFIA data, consult with their members, and provide a brief report specific to Victorian fisheries. SIV welcomed this approach and CGG requested a proposal from SIV to provide a brief report on their members operations and concerns. SIV later provided a proposal. During a subsequent meeting on 25 July 2018 (see below), CGG explained they could not pay SIV to conduct consultation activities due to potential conflict of interest, and legal and company requirements that prohibit such payments, but that they could provide funds for SIV to undertake a technical review of the VFA and AFMA data that SETFIA had obtained. SIV agreed to this and to submitting a revised proposal for the technical work (removing the consultation from the scope of the proposal). A revised proposal has never been received from SIV. 4. **that the increasing amount and greater complexity, of consultation requests was putting a strain on SIV's resources as they must fund the costs of consultation internally:** refer to Item #3 above.
	25/07/18	Meeting	Meeting with CGG and SIV. The following matters were discussed: **SIV/TSIC Policy:** • attendees agreed that both industries operated in a shared environment • CGG noted they have contacted all the peak bodies representing fishers within the operational area. Noted that NOPSEMA required Spectrum to modify and resubmit their EP, with a specific comment that they must contact individual fishers. CGG noted that VFA had forwarded the first stakeholder consultation letter to all Victorian licence holders on behalf of CGG. • CGG stated if they were to pay SIV to consult with their members, there would be (at least) a perception of 'conflict of interest' for both CGG and SIV. CGG also operates under legal (and company) requirements which would prohibit such payments. Noted that CGG's engagement of SETFIA to prepare a technical report on fishing excluded SETFIA's consultation with their members. CGG noted they could provide funds for SIV to undertake a technical review of the VFA and AFMA data that SETFIA had obtained. • SIV questioned the engagement of advisors by O&G companies. CGG replied that advisors are engaged as it is difficult for O&G companies to understand what the issues may be and difficult to obtain data on fishing within a region. SIV welcomed funding to undertake a technical review of the VFA and AFMA data. **SIV's key issues:** • SIV advised the proposed area encompassed Victorian inshore trawl out to 3 NM; and Giant Crab, Rock Lobster, Ocean Access and Scallop fisheries which have broader boundaries. He anticipated a lot of consultation would be required with scallop fishers **Scallops:** • SIV asked what the likely effect on scallops might be because they are concerned about the species recovery in the proposed survey area. He noted that scallops haven't recovered in region since 2010 and that scallop fishers are concerned about the cumulative impacts of seismic. • CGG asked if there were any correlations with previous surveys and claims of fisheries impacts (nearly all the proposed area had been surveyed before). The discussion then centred on scallops life	SIV represents the views and interests of the Victorian seafood industry (fishers, wholesale, processors and retail). The following objections and concerns were raised by SIV and are relevant to their functions, interests and activities: 1. overlap of the area with Victorian inshore trawl out to 3 NM and the Giant Crab, Rock Lobster, Ocean Access and Scallop fisheries 2. concern about the potential impacts on the recovery of scallops in the area 3. cumulative impacts on scallops from multiple surveys 4. significant concerns that seismic surveys contributed to stock collapses of scallops 5. questioned the 'selectivity of science' used by proponents and recommended pre- and post-surveys 6. claimed the area is important for pilchards from November to May **Action:** CGG to review and respond to each objection and claim raised, noting any changes or control measures adopted in response to the feedback. SIV mentioned there was a lot of Danish seine activities in the area, however (as acknowledged by Johnathon) this fishery is represented by SETFIA and not relevant to SIV's functions, interests and activities and has therefore not been addressed with SIV. SIV claimed there would be considerable opposition from fishers. This does not have merit as (a) it was raised in initial meetings as a passing comment, (b) raised no evident to support his comment and (c) CGG has been in consultation with fishers expecting to be affected by the survey	CGG provided responses to SIV objections and claims in the meeting, later via email on 06/09/18 when the impact assessment summary was available for stakeholders (second stakeholder consultation letter) and via the third stakeholder consultation letter. The following is a summary of the responses: 1. **overlap of the area with Victorian inshore trawl out to 3 NM and the Giant Crab, Rock Lobster, Ocean Access and Scallop fisheries:** In response to CGG's query about the Victorian fisheries that would be impacted, CGG responded in writing that the coastal waters inshore of the 3 NM boundary will not be affected by the survey. The impact assessment and consultation to date were summarised in the second stakeholder consultation letter sent to SIV. 2. **concern about the potential impacts on the recovery of scallops in the area:** As indicated by SIV in the meeting, effort in the scallop fishery has reduced and CGG has determined as part of the impact assessment and based on the SETFIA report that there is little scallop fishing effort in the survey area, reducing displacement impacts on fishers. A summary of the impact assessment for potential sound impacts on scallop stocks, including the outcomes of the literature review and sound modelling conducted were communicated to SIV in the second stakeholder consultation letter. CGG stated that the impact assessment indicates that impacts on scallops are expected to be minor and limited to short-term effects within 625 m of the seismic source. They noted that while scallops may occur down to 60 m, the commercial scallop fishery is mainly in depths of 10-20 m. The main scallop grounds are in less than the minimum depth of the survey area (34 m) and are mainly to the south of the survey area. CGG has since liaised with scallop fishers and later in the consultation process they identified an important scallop bed. CGG subsequently adjusted the survey area to remove overlap with the scallop bed. This change was communicated to SIV in the third stakeholder consultation letter sent. 3. **cumulative impacts on scallops from multiple surveys:** the science of impacts on scallops was discussed in the meeting and CGG asked if there were any correlations with previous surveys

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			history, annual fluctuations in abundance, scientific knowledge and anecdotal information. ◦ SIV said the IMAS study showed that after 120 days all the scallops exposed to seismic were dead and that the most recent studies on plankton were very worrying as the area studied didn't have rock lobster larvae ◦ CGG referred to the Aguilera study where scallop larvae were exposed to continuous noise for an extended period in a tank had died. This study had not been well accepted because it did not replicate the conditions likely to exist around a seismic survey. • SIV said there were 91 scallop licences in Victoria, but he didn't know who were fishing. CGG asked if scallop fishing was allowed in the operational area at present and SIV said the boats that were fishing usually had a licence package enabling Victorian, Commonwealth and Tasmanian access. He said there were only 12 vessels left in the Victorian scallop fishery • He said that, in the Gippsland region, catches dropped from about 7,000t in 2006 to about 2,000t in 2009 and then 400t in 2011 and that fishing hadn't really occurred since. CGG noted that scallops are known to be a boom/bust species. SIV agreed but noted that there are significant concerns that seismic surveys contributed to stock collapses. **Science used by proponents:** • SIV questioned the 'selectivity of science' used by proponents and noted that the pre- and post-surveys conducted by CarbonNet were welcomed by SIV. **Other fisheries:** • SIV noted there is a fair bit of effort for rock lobster in shallow areas and referred to the Golden Beach area as having rock lobster. He noted that rock lobster occurred out to 150 m • SIV was aware of one person fishing for giant crab (in about 200-600 m water depth). • SIV confirmed that there were ~2-3 people fishing for octopus in the operational area • SIV said there were many Danish seiners in the area but only in Commonwealth fisheries (talk to SETFIA) • SIV represented the purse seiners and the 147 Ocean Access licence holders • SIV noted that the inshore trawl fishery is limited to 3 NM offshore • CGG noted abalone hadn't featured in the SETFIA report and SIV stated that SIV also represents abalone divers • SIV noted that the area is also important for pilchards, and that these small pelagic fishers can operate out to about 20 NM offshore. He said the period from November to May is important for pilchards. Attendees discussed the proposed activity, drivers for the survey and the approvals process. Further consultation: • SIV stated he would consult with his members • He said he expected that CGG's consultation should be at least as extensive as that required for Spectrum's proposal. • He noted that he expects considerable opposition from fishers. • He cannot provide details of areas or times of importance to fishers now • SIV said he would provide a proposal to review VFA data gathered by SETFIA. CGG asked if this review could be complete by mid-August and Johnathon agreed this was achievable.		and claims of fisheries impacts. He stated the fishery collapsed in 2010 (when the last seismic survey occurred). The justification for the survey was discussed in the meeting, with CGG explaining that reprocessing of existing data had created a lot of titleholder interest with greater visibility of strata below coal deposits. This has increased in the context of increasing demand for new gas sources in eastern Australia. Previous seismic surveys had often been done in a patchwork manner, often in the wrong direction and using outdated methods. CGG's proposed survey would provide a complete picture of the region, using the latest technology and acquired in the best directions for processing. In this regard, CGG believes it would reduce the need for further surveys in the area. 4. **significant concerns that seismic surveys contributed to stock collapses of scallops:** in the meeting variation in catches around the 2010 survey was discussed (catches dropped from about 7,000 t in 2006 to about 2,000 t in 2009 and then 400t in 2011 and that fishing hadn't really occurred since). It was agreed that scallops were a boom/bust species but that fishers were concerned. CGG subsequently replied to this concern via email on 06/09/18 following the release of second stakeholder consultation letter that summarised the outcomes of the impact assessment and current stakeholder feedback. CGG stated it is difficult to tease apart the various factors affecting the productivity of fisheries, particularly scallops which are subject to large natural variation in recruitment success. They noted they have completed a comprehensive assessment of impacts on fish stocks and population-level effects on catches or fishery viability in the long-term are not predicted. CGG also advised that nine scallop fishermen had been identified, all consulted, and they were also consulting with the Victorian Scallop Fisherman's Association. 5. **the 'selectivity of science' used by proponents:** CGG responded in the meeting that CGG was committed to reviewing all available literature and noted that they could look at the funding of studies. In subsequent written response to SIV, CGG acknowledged there are gaps in scientific understanding of the impacts on sound on marine life and has taken a precautionary approach where uncertainty exists. They noted the results of the CarbonNet study will be assessed when publicly available and considered the predicted impacts for this survey. CGG committed that additional or modified controls may be implemented to further reduce impacts to ALARP. CGG also provided information on studies they were participating in led by the University of Leiden (Netherlands) and supported by the Joint Industry Program Sound and Marine Life. 6. **claimed the area is important for pilchards from November to May:** CGG subsequently provided SIV with the second stakeholder consultation letter that contained a summary of the impact assessment on fish, including the literature considered, modelling undertaken and prediction of impacts on fish. The letter also covered impacts on behaviour and spawning of fish. 7. **claimed there would be considerable opposition from fishers:** Via written communication on 06/09/18 CGG reiterated their intention to work with the fishing industry to identify their concerns and find ways to reduce impacts on their activities. Subsequent information on the outcomes of the consultation undertaken and the changes and control measures adopted in response to

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					stakeholder feedback was also provided to Johnathon in the second and third stakeholder consultation letters. Via email on 06/09/18 CGG noted they had not received feedback on the draft minutes from the meeting so assume they were taken as an accurate reflection of meeting discussions. CGG has received no feedback on either the second or third stakeholder consultation letters, or subsequent invitations to fishing industry meetings.
	08/08/18	Email outgoing	CGG sent the meeting minutes for meeting held on 25th July to SIV for review. No comments were received from SIV.	NA	NA
	10/08/18 30/08/18	Phone call outgoing Email outgoing	Via phone call outgoing 10/08/18: CGG followed up with SIV about the proposal and SIV said he would get the revised proposal back to CGG today. Discussed option of involving an 'independent expert' in consultation. SIV said he would like to see pre and post surveys, involving the industry and said that the surveys for CarbonNet and Crowes Foot were well received. Via email outgoing 30/08/18: CGG queried the status of the proposal. Stated there had been a lot of discussions about the program and changes to the survey were being proposed in response to stakeholder feedback. CGG welcomed SIV's proposal ASAP. No proposal or response has been received from SIV.	NA	NA
	04/09/18	2nd formal notification fishers and fisheries	No feedback was received in response to the second stakeholder consultation letter.	NA	NA
	06/09/18	Email outgoing	CGG provided written response to the issues SIV raised during meeting held on 25 July 2018. Refer to the meeting event above.	NA	NA
	16/10/18	Email incoming	SIV contacted CGG and asked who most appropriate contact was going forward. He apologised for not responding to 'draft' minutes and stated he considered they are still draft and there were changes he believed should be made. He stated there has been no response from CGG to his initial proposal to assist with consultation with Victorian. He said it was briefly discussed with SIV at the July meeting but had received no formal response and request for revision has been received. He stated that once he knew who the most appropriate contact was, that he would seek to figure out a joint-approach as soon as possible.	SIV also stated he had objections to the content of the meeting minutes from 25 July 2018. **Action:** CGG to request SIV comments on the meeting minutes. In addition, SIV requested clarification on the point of contact for consultation going forward and wanted a formal response about his proposal. **Action:** CGG to clarify the point of contact with SIV and provide formal response on his proposal.	Via email outgoing 09/12/18: CGG apologised and stated they were disappointed he hadn't received a reply to email dated 16/10/18 and explained it was an internal miscommunication. CGG clarified the points of contact, asked for SIV to send his comments back on the meeting minutes so the minutes could be updated. Regarding SIV proposal CGG noted he had not revised his proposal as was agreed in the meeting with CGG in July 2018 and documented some of CGG's consultation records since that meeting. Asked SIV if it was his understanding that he was to revise his proposal and resubmit to CGG.
	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.	NA	NA
	26/10/18	Email outgoing	CGG invited fishers to meet on the 2 November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25 September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received from SIV.	NA	NA

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	22/11/18	3rd formal notification	No feedback was received in response to the third stakeholder consultation letter.	NA	NA
	09/12/18	Email outgoing	Email responding to SIV email to CGG on 16/10/18 (refer to that event for a summary of CGG's response).	NA	NA
	08/01/19 10/01/19 11/01/19 16/01/19	Email incoming Email outgoing Phone call outgoing Email outgoing	Via email incoming 08/01/18: SIV followed up on email from CGG 9 December 2018. He made the following comments: • **consultation with SIV:** RPS was following up with CGG to discuss the status of consultation with SIV and way forward. SIV asked where discussions were up to and what steps are being progressed to contact and engaged meaningfully with all Victorian fishers. • **CGG's response to SIV proposal:** SIV noted he had still had no response. • **CGG requests for SIV to update their proposal:** SIV stated he could update and resubmit if that is required, however noting the progress, it is now the consultation and engagement CGG require assistance with not the technical information. Stated that having never received any further information, documentation or anything aside from minutes from this meeting he was unaware of what is being worked up by RPS or CGG. • **SAC:** SIV heard through the industry that there is now a science working group and no formal engagement of SIV in this process. He stated that it again appears the only interest in CGG's consultation process is with the Commonwealth and that this was not acceptable. • **CGG's query regarding the matter of: 'potential independent review into the scope' of SIV's proposal:** CGG stated in email 09/12/18, *"[SIV] apparently discussed Associate as an option on 10th Aug and you said you'd send revised proposal through that day"*. SIV stated he had no recollection of this conversation or the associate professors name being mentioned. • stated he was astounded by the lack of genuine engagement with the Victorian seafood industry and SIV and recommended CGG improve their engagement processes.	SIV represents the views and interests of the Victorian seafood industry (fishers, wholesale, processors and retail). The following objections and claims were raised by SIV and are relevant to his functions, interests and activities: 1. clarity on the status of CGG's consultation with SIV and the Victorian seafood industry 2. lack of response from CGG on SIV's proposal provided in July 2018 and update and resubmission of his proposal 3. lack of formal engagement with SIV about the SAC and that CGG is only interested in consulting with Commonwealth fisheries 4. lack of genuine engagement with SIV and the Victorian seafood industry. CGG considers the four objections and claims listed above have merit and must be reviewed and responded to. **Action:** CGG to review and respond to SIV objections and claims and if relevant, include any control measures that have been adopted in response to his feedback. SIV also claimed that he had not received sufficient information other than minutes from meeting held on 25 July 2018. CGG's assessment of this claim is that it does not have merit. As summarised in this table, information on the project, including activity description, summary of the impact assessment and modelling, changes made to the survey and control measures adopted in response to stakeholder consultation were provided to Johnathon via the first, second and third stakeholder consultation letters. SIV was also invited to the stakeholder meeting in Lakes Entrance on 2 November 2018 which he did not attend. SIV was also notified about NOPSEMA not accepting the EP on 19/10/18. No response was received to any of these communications, except for the first stakeholder consultation letter sent on 28 May 2018.	Via email outgoing 10/01/19: CGG replied stating that the approach to future consultation with SIV was still one of the main priorities to be sorted out ASAP and that now everyone is back from holidays this week, a meeting is planned for next week to review this. Stated they would be in contact with SIV following the internal meeting next week. Via phone call outgoing 11/01/18: CGG phoned SIV (no answer) and left a message on stating that that CGG is keen to discuss SIV concerns in his recent emails and will call him early next week. Via email outgoing 16/01/19: CGG emailed SIV, apologised that his expectations on communication had not been met. Provided a summary of CGG's (proposal-related *[sic.]*) communications with SIV (from CGG's records) and asked SIV to advise if anything was missed. CGG provided the following responses to the objections and claims SIV raised: 1. **clarity on the status of CGG's consultation with SIV and the Victorian seafood industry:** CGG expressed intent to continue to work with SIV and requested a revised proposal from him that covered services related to communications with their members during the survey. CGG also stated he was happy to meet in person to discuss SIV issues further at the end of the month. 2. **lack of response from CGG on SIV's proposal provided in July 2018 and update and resubmission of his proposal:** CGG acknowledged that CGG should have followed up following SIV email on 16 October 2018, re-iterating why the original proposal needed to remove consultation with SIV's members from the scope of work. CGG stated they would appreciate SIV updating and resubmitting his proposal, even at this late stage. CGG noted they have been working with LEFCOL on an agreement for them to facilitate communications with fishers and are interested in working with SIV in a similar manner. CGG asked if SIV could provide a proposal on how he could contact members who are stakeholders in the area and what the fee for this would be. Stated the following tasks were required: • send update and reminder to all relevant stakeholders of survey including commencement date and duration, survey line plan layout, vessel communication details and protocols and contact details for further stakeholder feedback • reminder to fisheries and fishing stakeholders of survey details and contact information for fishers to provide information on planned fishing activity • notify fisheries and fishing stakeholders on suspension and on completion of survey • notify all relevant stakeholders in the area of the survey vessel location and planned movements over the next 24 hours. 3. **lack of formal engagement with SIV about the SAC and that CGG is only interested in consulting with Commonwealth**

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					fisheries: CGG acknowledged concern about SIV not being involved in the SAC. Explained that the SAC consists of representatives from fishing organisations in the survey area, in addition to academics and experts in fishery management. There were a limited number of seats on the committee and CGG believed that SIV's members (as described on SIV's webpage) are also engaged by SETFIA, LEFCOL and SSFA and as such are represented on the committee. 4. **lack of genuine engagement with SIV and the Victorian seafood industry:** refer to Item #1 above.
	16/01/18 16/01/18 16/01/18 17/01/19 17/01/19 17/01/19 17/01/19	Email incoming Email outgoing Email incoming Email outgoing Email incoming Phone call outgoing Email outgoing	Via email incoming 16/01/19: In response to CGG's email, SIV responded stating he had issues with what CGG presented in their email (see row above). Stated he was disappointed as he was told (via voicemail on 11/01/19) that CGG was going to call him to discuss. He noted the following: • failed to mention that the email from RPS on 2 July 2018 finished with 'CGG are keen to see a proposal from SIV to provide a brief report on their members operations and concerns.' This is what his initial proposal was and then at the meeting on 25 July 2018 it was noted that CGG did not want to engage SIV to undertake any form of consultation and instead develop more of a technical report. • he acknowledged that he had not provided a revised proposal because he did not know what was required in a 'technical report'. Noted he had not seen the report prepared by SETFIA (using limited Victorian data) so he was unable to gauge what was required. He claimed he raised this with RPS during the phone call on 2 July 2018. • stated that during the phone call with RPS it was discussed that the SIV proposal was to be finalised and submitted upon receipt of the technical paper, which has not been received. • stated he has no record of receiving any email from CGG or RPS on 30 August 2018, so he does not agree that it happened. • he was unsure who from RPS or CGG is working on this project. Referred to emails being sent from 'CGG' when it was an RPS representative emailing and that he was not sure how the structure is setup. • he appreciated that LEFCOL and some Victorian fishers have been included in the consultation process, however claimed the current delivery of CGG's consultation and engagement program has been severely selective and has not reached all potentially affected fishers. Explained that not all fishers are associated with LEFCOL nor do they all operate out of Lakes Entrance. He stated CGG must implement strategies that enable consultation with all relevant persons, as per legislation and this has not been achieved. • he claimed the SAC as was not representative and that he has some significant concerns with it. Noted he would welcome a discussion with CGG when possible either in Melbourne or via phone.	The following objections and claims were raised by SIV and are relevant to his functions, interests and activities: 1. claimed the delivery of CGG's consultation program has been severely selective and has not reached all relevant persons 2. claimed the SAC as was not representative. CGG considers the two objections and claims listed above have merit and must be reviewed and responded to. **Action:** CGG to review and respond to SIV objections and claims and if relevant, include any control measures that have been adopted in response to his feedback. SIV also claimed that CGG did not email him about the revised proposal on 30 August 2018. CGG's assessment of this claim is that it does not have merit since CGG has records of the email being sent. A record of the email was forwarded to SIV on 17 January 2019.	Via emails outgoing (x2) and incoming (x2) on 16/01/19 and 17/01/19: Emails back and forth between SIV and CGG about an appropriate day and time to speak via phone. Via phone call outgoing 17/01/18: CGG phoned SIV and they discussed the following: • CGG stated they would like to engage him to provide notifications to his members if and when the survey starts – essentially the same arrangement as with LEFCOL • SIV noted he is concerned that CGG have not engaged with Victorian licence holders and thinks it is too early to submit the EP • CGG explained they would share the research plans from the SAC, that they could not have everyone on the SAC but would be happy to hear comments from him on proposals • SIV questioned the authority of the SAC to make research proposals and CGG explained that the original ideas actually came from CGG and the SAC were able to comment on their validity and develop the proposals • SIV stated he was very wary of SETFIA and Fishwell and thinks they have a conflict of interest. He was also wary of CGG and thinks he is not up-to date with license holders • SIV said he would provide bullet points on the issues that he sees important going forward. In response to the two objections and claims raised by SIV: 1. **claimed the delivery of CGG's consultation program has been severely selective and has not reached all relevant persons:** CGG expressed intent to continue to work with SIV and requested a revised proposal from him that covered services related to communications with their members during the survey. This issue was also responded to in writing on 16/01/19 (refer to Item #1 in row above). 2. **claimed the SAC as was not representative:** CGG explained they could not have everyone on the SAC but would be happy to hear comments from SIV on the research proposals. This issue was also responded to in writing on 16/01/19 (refer to Item #3 in row above) where CGG explained why they believe the SAC is representative. Via email outgoing 17/01/19: CGG forwarded SIV a copy of the email sent to him on 30 August 2018.
	Ongoing consultation: CGG will continue to consult with SIV as a relevant stakeholder. CGG has recently had discussions with SIV about SIV's role in notifications during the survey and have requested a proposal for this service. CGG has also offered for SIV to provide comment on behalf of SIV on the research proposals developed by the SAC.				
South East Trawl Fishing Industry Association, (also covers Southern Shark	16/04/18 18/04/18	Email outgoing Email incoming	Via email outgoing 16/04/18: CGG contacted SETFIA to discuss the proposed activity and to discuss engaging him to prepare a report investigating the commercial fishing sectors potentially affected by the proposed survey. Via email incoming 18/04/18: SETFIA sent a proposal for developing the report.	No objections or claims.	Note that work on the report commenced immediately and a contract was executed on 15/05/18.

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Industry Alliance and EastRock)	28/05/18 29/05/18 29/05/18	1st formal notification Rev 0 Email incoming Email outgoing	Via email incoming 29/05/18: SETFIA noted that initial contact had been made with fishers and provided a list of the fisheries whose area overlaps the survey area to assist with CGG's consultation. Note that a final version of the list was later included in a report that CGG commissioned SETFIA to develop (provided in Appendix I).	No objections or claims.	Via email outgoing 29/05/18: CGG stated they would forward the stakeholder consultation letter to any organisations or stakeholders he identified that had not received any information. Asked for clarification on SETFIA contact details and the organisations he represents. Note that CGG subsequently forwarded the first stakeholder consultation letter to organisations and fishers on SETFIA list that had not already been sent the letter.
	29/05/18 13/06/18 13/06/18 13/06/18	Email incoming Email outgoing Email incoming Phone call outgoing	Via email incoming 29/05/18: In response to CGG's email (see row above), SETFIA confirmed he represents SETFIA, SPFIA and SSIA. He advised CGG not to underestimate the impact of what is being proposed. He stated that the news has broken and people are very concerned about their livelihoods. Via emails (x2) on 13/06/18: CGG asked SETFIA to forward the first stakeholder consultation letter to members of the Commonwealth fisheries that he represents. SETFIA replied that he would forward it to gillnet and trawl fishers and to Victorian cray fishers on their database who might be affected. He noted he would keep records. SETFIA reiterated that CGG cannot underestimate the effect of what they are proposing as it is very significant for several fisheries, but that CGG was approaching the task of minimising effects on the fishing industry in the right way.	Two claims were raised by SETFIA that are relevant to his functions, interests and activities (via emails 29/05/18 and 13/06/18): 1. that stakeholders were concerned about the impact of the survey on their livelihood 2. that CGG should not underestimate the effect of what they are proposing as it is very significant for several fisheries, but that CGG was approaching the task of minimising effects on the fishing industry in the right way. CGG's assessment of these two claims determined that they did not warrant a specific response given (a) the generic nature of the claims, (b) no evidence had been provided that fishers had expressed these concerns, (c) the consultation process had only just been initiated and future consultation with fishers would identify more specific objections or claims that will be addressed, and (d) since SETFIA acknowledged that CGG were approaching consultation in the right way. No action required at this stage. Note that SETFIA raised objections or claims via further consultation events (documented in the rows below).	Via phone call outgoing 13/06/18: In response to SETFIA emails on 13/06/18, CGG phoned SETFIA to further confirm the fisheries he represents, and he clarified in more detail that he represents the Victorian Eastern Zone Rock Lobster fishers and the CTS and GHT of the SESSF and SPFIA. CGG and SETFIA also discussed potential times for a face to face meeting.
	04/07/18	Email incoming	Via email incoming 04/07/18: SETFIA provided CGG with his draft report.	No objections or claims.	NA
	10/07/18	Email outgoing	Via email outgoing 04/07/18: Confirmed dates for face to face meeting.	No objections or claims.	NA
	11/07/18	Email incoming	Via email incoming 11/07/18: Generic SETFIA email sent to their stakeholders notifying them that the 'Fishery Independent Survey' (FIS) usually conducted in winter every second year and scheduled for 2018 was on hold pending a review of its results over the last 10+ years. Noted that it may or may not occur again in July and August 2020 and that they would advise as soon as a decision is made.	No objections or claims. If CGG's proposed activity extends to July 2020, SIMOPs planning may need to occur if the SETFIA survey involves field operations. This is dependent on confirmation from SETFIA (on whether it goes ahead in 2020). No action required at this stage.	NA
	18/07/18 18/07/18	Email incoming Email outgoing	Via emails (x2) 18/07/18: Confirmed agenda for face to face meeting, location and time.	No objections or claims.	NA
	24/07/18	Email incoming	Via email incoming 11/07/18: SETFIA sent CGG a paper released for a survey of scallops beds (for information) - https://vfa.vic.gov.au/__data/assets/pdf_file/0007/423736/Copy-of-DOC-18-385073-FINAL_Vic-Ocean-Scallop-2017-18-Survey-Final-Report-1.PDF	No objections or claims. Despite this, the paper provided should be considered in the impact assessment (if it has not already).	The results of this study have been considered in the impact assessment for the proposed activity. The paper is specifically referred to in Section 4.6.5.2.2 (Scallop (Ocean) Fishery), Section 6.1.4.2.1 (Impacts on lobsters and scallops), Table 6.8 and Appendix E.

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
				Action: CGG to ensure the paper has been included as part of the literature review for the impact assessment.	

	25/07/18	Meeting	Via meeting with SETFIA 25/07/18:
			CGG noted the need to separate the report SETFIA is writing on behalf of CGG from the consultation he undertakes on behalf of his members. Clarified that the scope of SETFIA report does not include consultation. SETFIA agreed with this.
			The following topics were discussed that were relevant to consultation and not the report:
			• attendees agreed that both industries operated in a shared environment
			• **fisheries affected:** SETFIA noted the following fisheries would be affected by the survey:
			  ◦ the Commonwealth Trawl Sector in general (including the Otter-board trawl and Danish seine sub-sectors) would be severely affected. He noted that the operational area is the most important area within the SESSF fishery
			  ◦ the Danish seine sub-sector would be particularly affected as almost all vessels in the sub-sector work within the operational area with very little effort elsewhere. Danish seine vessels are small and dependant on favourable weather conditions and therefore have limited range with almost all operating from Lakes Entrance.
			  ◦ the otter-board trawl fishery is less affected, but the impact remains major
			  ◦ did not anticipate that there would be much impact on the Small Pelagic Fishery or the Eastern Tuna and Billfish Fishery
			  ◦ did think there would be impacts on the Commonwealth Gillnet, Hook and Trap (GHaT) fishery.
			• **displacement of fishers:** fishers believed that fish move away from areas where seismic has occurred and don't return for 12-18 months. Due to the size of the survey area and 5-month timeframe of CGG's proposal, he believes that most of the fleet would be displaced with little opportunity to fish elsewhere. This was likely to result in the end of many fishing and associated businesses in East Gippsland.
			• **cumulative impacts from multiple seismic surveys:** the cumulative effects of seismic over the entire area was a problem. He stated that fishers didn't know where the fish move to and why they don't return. He noted there is international evidence showing that fish move away in the short term and that there is international agreement among fishers that fish move away and do not return for some time.
			• **overlap of the survey area with fishing grounds:** noted that Danish seine is predominantly inshore and on the shelf, whereas otter board is primarily around the shelf break and slope. Stated that survey lines would cover heavily fished areas for both sectors and that any changes that CGG made would not make much difference to displacement of these and other fisheries
			• **impacts on the community:** SETFIA stated that based on SETFIA's history of working in cooperation with the seismic and oil/gas sector, that there was no way that such a large survey could occur without structural changes to the fishing fleets, co-operatives and local communities. He noted that in his view it was highly unlikely that elected politicians would support such an intrusive survey.
			Attendees agreed further consultation would occur.
				Five objections and claims were raised by SETFIA that are relevant to his functions, interests and activities:
				1. **the following fisheries would be affected by seismic operations:**
				  • Commonwealth Trawl Sector (including Otter-board trawl and Danish seine and Gillnet, Hook and Trap (GHaT) sub-sectors)
				  • Danish seine sub-sector would be severely affected as almost all vessels in the sub-sector work within the operational area with very little effort elsewhere (vessels have limited range therefore almost all operate from Lakes Entrance)
				  • Otter-board trawl fishery would be less affected than the Danish seine fishery but impacts still significant
				  • SETFIA did not anticipate major impacts on the Small Pelagic Fishery or the Eastern Tuna and Billfish Fishery.
				2. **the size of the survey area and timing will displace fishers from their fishing grounds, reduce their catch and therefore affect their businesses**
				3. **cumulative impacts of multiple seismic surveys result in fish moving away from the area**
				4. **overlap of the survey area with important fishing grounds**
				  • survey lines would cover heavily fished areas for the Danish seine and otter-board trawl subsectors
				  • any changes CGG made to the survey area would make little difference in reducing impacts to these and other fisheries
				5. **in order to proceed, the size of the survey would require changes to the activities of fishers, cooperatives and local communities.**
				CGG considers the five objections and claims listed above have merit and must be reviewed and responded to, including control measures that have been adopted.
				Action: CGG to review and respond to the five objections and claims listed above and respond with any control measures that have been adopted in response to SETFIA feedback.
				SETFIA noted at the end of the meeting that the survey would not be supported by elected politicians. CGG considers this comment speculative and not merited due
					CGG reviewed and responded to the five objections and claims as follows:
					1. **fisheries likely to be affected by seismic operations:**
					  • during the meeting it was noted that the report that SETFIA was preparing at the time would cover each of the fisheries identified, and that CGG would ensure the results from the report and the outcomes of the impact assessment would inform the control measures adopted to reduce impacts
					  • a summary of the impact assessment was provided to SETFIA via the second stakeholder consultation letter. This stated that disruption to commercial fishing activities would be minor, localised and short-term, with the possible exception of the octopus fishery (not relevant to SETFIA functions, interests and activities) and the Danish seine fishery (relevant to Simon's functions, interests and activities)
					  • specific changes made to the survey and control measures adopted (relevant to the fisheries raised) were included in the second and third stakeholder consultation letters sent to SETFIA, as follows:
					    Commonwealth Trawl Sector (SESSF) – adopted a zoning system; adopted a notification schedule (before, during and after the survey) to reduce short-term impacts on fishing operations; reduced the size of survey area by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removed overlap with 'Big Horseshoe Canyon' (an area of high ecological value) to the northeast of the survey area and with fishing habitat in this area, particularly grounds that are targeted by Danish seiners; timing of survey was shifted from January to end of July in response to concerns about short-term impacts over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update.
					    Danish seiners (operating as part of the SESSF) – in addition to the measures above, reduced the size of the survey area; removed Zones 1 and 2, which reduced overlap with grounds targeted by Danish seiners; concerns raised by Danish seine fishers have been incorporated into the scope of the SAC and a research program proposed to monitor potential impacts
					    Otter-board trawlers (operating as part of the SESSF) – refer to above notes for Commonwealth Trawl Sector
					    GHaT (subsector of the SESSF) – refer to above notes for Commonwealth Trawl Sector
					    Small Pelagic Fishery and Eastern Tuna and Billfish Fishery – no impacts are predicted to these fisheries, as noted in the impact assessment summary (second stakeholder consultation letter) and SETFIA comments, therefore no fishery specific control measures have been adopted.
					2. **size of the survey area and timing will displace fishers from their fishing grounds, reduce their catch and therefore affect their businesses:**
					  • CGG noted in the meeting that the survey vessel (and accompanying support/chase vessels) would not occupy the entire area for 5 months and would be sailing on predetermined strips. CGG stated that at any one time, they would occupy approximately 5% of the total area
					  • CGG also stated in the meeting that the maximum area over which they would realistically acquire seismic data was about 10,000 km^2

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
				to; (a) the generic nature of the claim, (b) no evidence was provided that politicians would not support the survey, (c) the consultation process was in the early stages, (d) CGG were consulting directly with elected representatives (including the Member for Gippsland the following day 26 July 2018). Direct consultation between CGG and elected representatives will identify objections or claims relevant to their functions, interests and activities.	and that the 13,000 km^2 area referred to in the first stakeholder letter was now out of date. CGG were anticipating the area would be reduced as consultation progressed. CGG noted they were prepared to consider not undertaking seismic acquisition, or modifying the survey, in important fishery areas if they are identified by fishers • updates on changes to the survey area and survey timing were provided in the second and third stakeholder consultation letters, including reducing the survey area, adopting a zoning system where each zone is only occupied by the seismic vessel for one month, a notification schedule to reduce short-term impacts on fishers activities, and changing the timing of survey to occur from January to end of July in response to concerns about short-term impacts to businesses over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 3. **cumulative impacts of multiple seismic surveys resulting in fish moving away from the area:** • the second stakeholder consultation letter provided a summary of the impact assessment that included discussion on short term and longer-term impacts of seismic sound on the fish species relevant to Simon's functions, interests and activities. The assessment considered the predicted distance of impacts to species from the seismic source. The letter stated: *"There is likely to strong response from fish within tens of meters of the operations and moderate level effects within hundreds of meters, with a low risk of disturbance >1000 m (Popper et al. 2014). Behavioural effects include changes in schooling and feeding behaviour, decreased predatory avoidance (although predators are also likely to be similarly impacted), and disruption to spawning. However, such behavioural changes are expected to be temporary as the seismic vessel traverses each survey line, localised in spatial extent, and most relevant to continental slope habitat which comprises only a small part of the overall survey area. Further, any effects are expected to be short-term and limited to duration that the fish is exposed to the source, which for a pelagic (free swimming) species would be limited to the time taken for the fish to swim away from the source."* • Impacts to the planktonic stages of fish was also covered in the second stakeholder consultation letter, which stated: *"… impacts on their biomass is predicted to be very localised and short-term, with negligible population level effects compared to the natural high rates of planktonic turnover."* • The assessment concluded (stated in the letter); *"No medium or long-term effects are therefore predicted for fish species as a result of seismic operations. No significant effects on key biological process[es] of spawning, feeding, breeding or migration, are predicted for commercially important [fish] species."* • despite only minor and localised impacts being predicted, control measures have been adopted to reduce the impacts of noise on fish species to ALARP and these were documented in the second and third stakeholder consultation letters (i.e. reduced air gun over Southeast Reef, spawning assessment conducted and timing of acquisition over Southeast Reef adjusted, undershooting to not occur over Southeast reef, adjacent sail lines will not be shot during the main survey over a period of <24 hours to allow recovery of fish species). • CGG also adopted the following control; *"In the event that another vessel is acquiring seismic data in the region, the seismic vessel shall not acquire data simultaneously within 40 km of the other*

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					seismic vessel in order to avoid cumulative impacts to marine fauna." This is captured in Section 6 of the EP. 4. **overlap of the survey area with important fishing grounds:** • during the meeting CGG said that one of their primary objectives is to survey in a generally East-West direction from the slope into waters approximately 40 m deep. Other key objectives stated included collecting data around several the oil and gas fields and platforms. CGG suggested that some changes to the survey area could be made to reduce the overlap, or to change the timing to particular parts of the survey to reduce impacts, subject to logistical constraints. • changes to the survey area and timing were subsequently made and control measures adopted to reduce the displacement of fishers from their fishing grounds. Refer to Items 1 and 2 above. 5. **in order to proceed, the size of the survey would require changes to the activities of fishers, cooperatives and local communities:** • during the meeting it was discussed and agreed that both industries operated in a shared environment. CGG noted that consultation with SETFIA was in the early stages and would continue so that impacts on the fishing industry and any flow-on impacts to the community could be reduced to ALARP • changes to the survey area and timing were subsequently made and control measures adopted to reduce impacts on the fishing industry. Refer to Items 1, 2 and 3 above. SETFIA is also a member of the SAC, responsible for trying to resolve potential impacts on the industry and therefore has an ongoing role in advocating for the activities of the fishers that he represents.
	01/08/18 01/08/18 01/08/18 01/08/18	Email outgoing Email incoming Email outgoing Email outgoing	Via emails (x4) 01/08/18: CGG asked SETFIA to confirm the stakeholders he forwarded the stakeholder letter to in a spreadsheet. SETFIA replied that he sent an SMS to a number of SETFIA members that was very high level and just gave some preliminary notice of CGG's intentions. He stated he did not think that it was adequate consultation to reduce impacts, but it does get the ball rolling. SETFIA also stressed that there is an urgent need to give as much notice to affected fishers as possible and that the list in his report is a good place to start. CGG replied and asked SETFIA if he would forward the email to his members. He confirmed it had been sent.	SETFIA made the following claims: 1. the first stakeholder consultation letter got the ball rolling but was not adequate consultation to reduce impacts 2. CGG needed to notify fishers ASAP to give them as much notice as possible. CGG's assessment of these claims determined they were both merited (i.e. that further consultation would be required with fishers, additional information on the survey provided to fishers and that they should be given as much notice as possible about survey (particularly with regard to survey timing and location)). **Action:** Since other methods of consultation were already planned as part of the consultation process, these two claims will be addressed by CGG continuing to follow its process (identify and consult with relevant fishing industry stakeholders, providing them with sufficient information on the survey ASAP).	CGG reviewed and responded to the two objections and claims as follows: 1. **the first stakeholder consultation letter got the ball rolling but was not adequate consultation to reduce impacts:** since the first stakeholder consultation letter, another two letters have been sent to relevant stakeholders, an advertisement placed in the Gippsland Times, information posted on CGG's website, face-to-face meetings have been held and the SAC established. Simon received the letters, has been involved in face-to-face meetings, sent/received numerous emails and is a member of the SAC. 2. **CGG needed to notify fishers ASAP to give them as much notice as possible:** • <u>identify and consult with fishing industry stakeholders</u> – each person on SETFIA contact list (in his report) was contacted except for three fishers for whom no details were available, and SETFIA did not know who they were – see rows below). CGG also identified many other fishers not on SETFIA list (refer to Tables H-2 and H-3). All have been consulted with and consultation has been summarised in this table. Fishers that were not considered relevant are listed in Table H-3 of this appendix. • <u>provide sufficient information in timely manner</u> – all relevant stakeholders have been notified of the activity, in particular the location and timing of the survey. CGG has also kept relevant stakeholders updated on changes made to the survey area and timing in response to stakeholder feedback.
	03/08/18	Email incoming	SETFIA submitted final report to CGG.	No objections or claims.	NA
	08/08/18 08/08/18 09/08/18 09/08/18	Email outgoing Email incoming Email outgoing Email incoming	Via emails (x2) 08/08/18: CGG sent draft minutes for review from the meeting held with SETFIA on 25th July 2018. SETFIA provided some comments. Via emails (x2) 09/08/18:	SETFIA made the following claims: 1. CGG would need to do a lot more consultation than sending letters through third parties 2. CGG should tell stakeholders why they are doing the survey.	The second stakeholder consultation letter (sent to all stakeholders in September 2018, including SETFIA) contained justification for the survey; *"The Gippsland marine seismic survey is a typical 3D survey similar to the majority of seismic surveys conducted in Australian marine waters in terms of technical methods and procedures. While there have been seismic surveys in the Gippsland Basin over the last ~50 years, this survey has*

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			CGG noted the comments on the minutes and asked SETFIA to update the attached spreadsheet with the fishers that he sent the stakeholder letter to. SETFIA stated he thought he had already updated the spreadsheet with SETFIA members that were sent the stakeholder letter. He noted that CGG would need to do a lot more than send fishers a letter through a third party (RPS) since the survey could end some of their businesses. He stated he believed the fair thing to do is to tell them why CGG is doing the survey.	CGG's assessment of these claims determined that whilst CGG acknowledges using consultation methods other than letters was important, that SETFIA had already raised claim #1 and it was already being addressed by CGG (refer to row above for events dated 01/08/18). CGG's determined that claim #2 was merited and that fishers should be told why the survey was occurring, particularly since other fishers also queried this. **Action:** CGG to communicate to stakeholders justification for the survey.	*been proposed because CGG has identified a number of issues with previous surveys that prevent a comprehensive regional geological evaluation of the Gippsland Basin. This survey is intended to resolve these issues by achieving a basin-wide coverage of seismic data to accurately map the extent of geological structures within the basin with confidence. Discovery of further hydrocarbon reserves could extend the working life of the existing petroleum industry in the region."* The need for the survey was also discussed in meetings with SIV (25 July 2018) and fishers (26 July 2018 and 25 July 2018). Individual fishers who raised the query via email direct to CGG were responded to directly (and are included in this table).
	15/08/18	Email incoming	SETFIA emailed CGG and noted he was called by ABC radio this morning and gave them an interview. He advised CGG that SETFIA stated that they cannot support the survey for the reasons already discussed with CGG. He also asked CGG to confirm they had received his final report (with an improved and more accurate methodology).	SETFIA stated SETFIA and SSIA objected to the survey for the reasons already discussed with CGG. Given no new objections or claims were raised, no direct response to this event is merited. The objections and claims raised are listed in the rows above.	CGG later confirmed the SETFIA report was received.
	24/08/18	Phone call outgoing	CGG phoned SETFIA to confirm the fisheries he advocates on behalf of (since there was confusion from previous communications with SETFIA on this) and also to ask him to confirm he did not have any contact details for three other fishers that were listed as relevant stakeholders in his report (SETFIA report). SETFIA confirmed he formally represents Commonwealth Trawl, Commonwealth Small Pelagic (not affected by CGG survey), Eastern Zone Rock Lobster Victoria, SESSF Gillnet Hook and Trap (GHTS) – Shark Subsector. He said that he also advocates for SESSF GHTS – Scalefish Subsector and the SESSF GHTS – Trap Subsector. SETFIA confirmed he did not have contact details for the three fishers and did not know who they were.	No objections or claims.	NA
	04/09/18 04/09/18 05/09/18	2nd formal notification fishers and fisheries Email outgoing Email incoming	No feedback received in response to the second stakeholder consultation letter. Via emails 04/09/18 and 05/09/18: CGG asked SETFIA to forward the letter to his members and he acknowledged that he had distributed the letter to the associations that he represents.	No objections or claims.	NA
	23/09/18	Email outgoing	NA	NA	Via email outgoing 23/09/18: CGG invited fishers to meet on the 25 September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. No response received and Simon did not attend the meeting.
	17/10/18	Email incoming	Via email incoming 17/10/18: In response to email sent by CGG on 23/09/18, SETFIA noted that four of SETFIA's calls over the last two weeks had not been returned. SETFIA noted that SETFIA and SSIA represent fisheries that catch $8 m of the total $8.2 m of the catch revenue from the survey area. SETFIA stated they wished to work with CGG to limit the impact of the survey on the fishing industry and that would mean a significant reduction in size/duration and/or compensation for lost catch. He said that since SETFIA and SSIA have the benefit of effectively being a single point of communication representing 97% of the revenue taken from the survey area, he encouraged CGG to engage with them. SETFIA asked for CGG to contact him.	SETFIA made the following four objections and claims: 1. poor consultation with SETFIA/SSIA as a relevant stakeholder 2. the survey area should be reduced in size 3. the survey timing should be reduced 4. fishers should receive compensation for lost catch. CGG's assessment of these objections and claims determined the first three were merited (i.e. that CGG had not responded to SETFIA in a timely manner, and that reducing the survey area and duration of	The response to these objections and claims is provided in the row below (email outgoing 24/10/18).

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
				the survey should continue to be reviewed with stakeholder input so that impacts are reduced to ALARP). For item #4, CGG's compensation policy (at the time) was that fishers will be reimbursed for any damage to equipment caused directly by the survey and no compensation would be provided for lost catch since survey operations will not preclude them from fishing during the survey. Despite this, given the revenue produced by the fisheries represented by Relevant Stakeholder 712 and that compensation for lost catch has been raised by other fishers, CGG later determined this claim was also merited and has subsequently been reviewed. **Action:** CGG to address the four objections and claims listed above and respond with any control measures that have been adopted in response to SETFIA feedback.	
	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.	NA	NA
	22/10/18 24/10/18	Email incoming Email outgoing	Via email incoming 22/10/18: SETFIA stated he was glad they were considered relevant stakeholders and claimed he had called six times without a return call and several emails have gone unanswered. SETFIA asked for CGG's view about the industry proposal put forward as follows: 1. a much smaller area, and/or 2. a faster survey, and/or 3. compensation. SETFIA believe this proposal is the only way the fishing industry can survive the survey. SETFIA also asked when the next meeting would be held as November and December are busy times of year. He also asked CGG how many fishers CGG have spoken to in person.	SETFIA raised the following objections and claims: 1. poor consultation with SETFIA/SSIA as a relevant stakeholder 2. the survey area should be reduced in size 3. the survey area timing should be shortened 4. fishers should receive compensation for lost catch. Given these same four objections and claims were also raised by SETFIA on 17/10/18, they are merited, and a response is warranted. **Action:** CGG to address the four objections and claims listed above and respond with any control measures that have been adopted in response to his feedback.	CGG reviewed and responded to the four objections and claims as follows: 1. **poor consultation with SETFIA/SSIA:** CGG replied via email on 24/10/18 apologising for the poor communication and explained they were discussing the consultation process internally in response to his feedback on 17/10/18 (and 22/10/18). 2. **smaller survey area:** changes to the survey area in response to this claim have been made and were communicated to SETFIA in the second and third stakeholder consultation letters, including reducing the survey area by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removed overlap with 'Big Horseshoe Canyon' (an area of high ecological value) to the northeast of the survey area and with fishing habitat in this area, particularly grounds that are targeted by Danish seiners (who SETFIA represents). Reduction of the survey area was also communicated in a meeting with SETFIA on 13/11/18 (refer to event below). 3. **faster survey:** CGG explained in the email that the speed and duration of the survey is determined by its overall size and also factors outside of their control such as weather, environmental (e.g. whales) and technical downtime. The timing that has been communicated to stakeholders was conservative and has downtime estimates built-in. CGG stated that the speed of the vessel cannot be increased as it is limited by both the in-sea equipment and geophysical requirements. A later email from CGG on 26 October 2018 explained to SETFIA that a bit like fishing trawlers, it is not possible to pull recording equipment through the water any faster and that if they could it would reduce CGG's costs significantly. Subsequent updates on changes to the timing of the survey (to reduce impacts on catch) were provided to SETFIA in the third stakeholder

RPS

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					consultation letter (timing of survey was shifted from January to end of July in response to concerns about short-term impacts over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 4. **compensation:** CGG stated via email they will pay for any damage to equipment caused directly by their operation but would not pay compensation based on fishers' annual estimated catch value, since survey operations will not preclude them from fishing during the survey (given control measures adopted such as dividing the survey area into zones and notification schedule developed for communications with fishers during the survey). CGG's compensation policy has since been expanded and the SAC is providing advice on a Fisheries Displacement Mitigation Plan (described in Section 8.3.3 of the EP). The purpose of the Plan is to provide a mechanism for licensed individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG's activities. The Plan sets out the decision rules to deal with payments for verified claims. This falls within the remit of the SAC, which SETFIA is a member of. CGG noted that Christmas is a busy period and stated the next meeting is scheduled for Friday 2 November 2018, that all fishers were invited, and that they welcomed a large attendance. CGG encouraged SETFIA to forward the invitation around.
	24/10/18 26/10/18	Email incoming Email outgoing	Via email incoming 24/10/18: In response to CGG's email, SETFIA asked for clarification on the point of contact going forward. He stated they do not accept CGG's argument that fishing operations will not *[sic.]* be affected and said their view is that vessels will be affected for 7 months and then face reduced catch rates following the survey. He noted the research on scallop mortality and crayfish. Then stated that if CGG believed there will be no impact on commercial fishing then they should have no issue in negotiating compensation for lost catch. SETFIA expressed dissatisfaction at the last-minute notice for the meeting proposed on 2 November and stated he could not attend. He explained that meetings with fishers needed to be organised around the weather and moon phase. SETFIA said that SETFIA (and SSIA) request a separate meeting to discuss their proposal with CGG, affirming that the groups he represents (SSIA and SETFIA) catch ~97% of the total commercially caught fish within the survey area. He stated their view is that CGG have not modified plans in any way and have not taken any steps to reduce impacts on the fishing industry. SETFIA asked again how many fishers CGG has sat down with and stated that the SE commercial fishing industry and he suspected the SE Australian community does not support a January 2019 start date.	SETFIA made the following objections and claims: 1. that there would be impacts on fishing operations for the 7 months during the survey 2. that following the survey fishers would experience a decline in catch rates, specifically scallops and rock lobster 3. that if CGG believes there will be no impact on commercial fishing, they should have no problem negotiating compensation for lost catch 4. inadequate notice for meeting on 2 November and that meetings should be scheduled around the weather and moon phase 5. claimed that CGG had adopted no control measures or made any changes to the survey to reduce impacts on the fishing industry 6. queried the extent of CGG's face-to-face meetings with fishers 7. objected to the start date for the survey. CGG's assessment of these objections and claims determined they were merited and warranted review to determine if further changes could be made or control measures adopted. **Action:** CGG to address the seven objections and claims listed above and respond with any control measures that have been adopted in response to this feedback. SETFIA also requested clarification on the point of contact for consultation going	Via email outgoing 26/10/18: CGG reviewed and responded to SETFIA seven objections and claims via email as follows: 1. **that there would be impacts on fishing operations for the 7 months during the survey:** CGG explained via email that for each month of the survey, ~85% of the survey area will not be affected at all and within the 15% affected area, fishing vessels are not excluded, they just needed to be aware of CGG's movements. CGG provided updates on changes to the survey area and survey timing in the second and third stakeholder consultation letters (the second letter was sent prior to his email on 24/10/18), including reducing the survey area, adopting a zoning system where each zone is only occupied by the seismic vessel for one month, a notification schedule to reduce short-term impacts on fishers activities, and changing the timing of survey to occur from January to end of July in response to concerns about short-term impacts to businesses over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 2. **that following the survey fishers would experience decline in catch rates, specifically scallops and rock lobster:** Via email 26/10/18, CGG noted that research has shown little or no impact from seismic on the scallop fishery of Bass Strait as follows: • a technical report produced by Monash University, (Assessment of environmental effects of seismic testing on scallop fisheries in Bass Strait) by Parry et al. (2002) stated that; *"There was no evidence that seismic testing affected the mortality or adductor muscle strength of Scallops 19 m beneath the survey vessel "Geco Beta" in Bass Strait. Indeed, the mortality of scallops was slightly lower, and muscle strength slightly higher on the plot impacted by the seismic testing than on the control plot."* They concluded that *"any effects on scallops at greater depths would be expected to be smaller."* They also note the resilience of invertebrates to much higher levels of sound and indeed shock waves (from powerful explosions) noted from other studies and conclude that these *"suggest that molluscs are at risk of damage from airguns when*

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
				forward and a separate meeting with CGG to discuss SETFIA and SSIA's proposal. These requests do not meet the definition of an objection or claim in the NOPSEMA EP Decision-making Guideline (NOPSEMA 2018), however they will be responded to. **Action:** CGG to clarify the point of contact for consultation and arrange a separate meeting with SETFIA/SSIA to discuss their proposal.	*these are closer than 1-2 m, but there is minimal likelihood of damage at greater distances."* CGG noted the experience of fishers might be different to the scientific literature but that in the report they commissioned from SETFIA, Figure 61 shows that three of the grid cells with the largest effort in 2002 were covered by the G01A Seismic Survey carried out by the "Geco Beta" in January and February of 2002. Had there been substantial mortality amongst the scallops it should have been noticed by the scallop fishers at the time, and presumably fishing effort would have been expended elsewhere. So, the commercial activity seems to bear out the scientific studies in this case. CGG had also previously provided evidence on the impacts of seismic surveys on scallops in the second consultation letter sent to all relevant stakeholders, including SETFIA. CGG's assessment of impacts to scallops, incorporating feedback from scallop fishers is in Section 6.1.4.2.1 of the EP. Changes to the survey area have subsequently been made in response to concerns about impacts to scallops. The survey area was reduced to avoid an important scallop bed. This was described in the third stakeholder consultation letter sent in November 2018. • For rock lobster, a summary of the impact assessment was provided in the second stakeholder consultation letter sent to all relevant stakeholders including SETFIA in September 2018. CGG's assessment of impacts to rock lobster, incorporating stakeholder feedback is in Section 6.1.4.2.1 of the EP. 3. **that if CGG believes there will be no impact on commercial fishing, they should have no problem negotiating compensation for lost catch**: Via email, CGG noted they understood the issues with fishers with fixed gear and were discussing associated compensation for short-term effects on fishing due to damaged gear. CGG stated that for the rest of the industry, it's noted in the SETFIA report catch rates are highly variable from year to year. These are likely due to external environmental effects, previous fishing effort, etc. CGG have not identified any studies which indicate that seismic has a longer-term effect on fish catches. CGG also noted in the email the study by CSIRO in 2014 (Examining Fisheries Catches and Catch Rates for Potential Effects of Bass Strait Seismic Surveys) that concluded*: "This study has not clearly identified negative (or positive) effects of seismic surveys on fisheries catch rates. Any potential impacts of seismic surveys are confounded with changes in the relative abundance of target species brought about by other factors, and this is especially the case with relatively short-lived species (such as scallops). Despite attempting novel and relatively sophisticated methods to try to separate the effects of the various factors thought to effect catch rates (including a number of ways of characterizing seismic surveys) no clear impact of seismic surveys was detected, but neither can such effects be ruled out.*" CGG asked SETFIA how he would propose to separate the effects of seismic surveys from the inherent variability (of other factors *[sic.]*). CGG noted that CGG do take all comments seriously and if slow in responding it is due to the time it takes to investigate the claims and to ensure that our response can be supported. No response was received from SETFIA on this query, Since the email on 26 October 2018, compensation for lost catch has been included as a key item for the Scientific Advisory Committee to address and Relevant Stakeholder 712 is a member of the Committee. The SAC is providing advice on a draft Fisheries Displacement Mitigation Plan (described in Section 8.3.3 of the EP). The purpose of the Plan is to provide a mechanism for licensed individuals or entities

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG's activities. The Plan sets out the decision rules to deal with payments for verified claims. This falls within the remit of the SAC, which the relevant stakeholder is a member of. 4. **inadequate notice for meeting on 2 November and that meetings should be scheduled around the weather and moon phase:** CGG explained that the meeting date was picked based on potentially poor weather conditions and the likelihood of fishers not being at sea (CGG attached weather predictions that were used and noted that it is difficult to forecast weather conditions beyond about 10 days). 5. **claimed that CGG had adopted no control measures or made any changes to the survey to reduce impacts on the fishing industry**: CGG noted that (as shown in the second stakeholder consultation letter sent to SETFIA *[sic.]*), CGG have excluded an area that was identified by a stakeholder as having high fishing value (SE Reef) and that no other specific areas have been communicated to them (despite repeated requests/direct queries made by CGG to stakeholders, encouraging them to provide specific feedback on areas of importance *[sic.]*). He noted that CGG were looking at further modifications to reduce impacts on cetaceans based on feedback, particularly with respect to the timing of the operations. CGG have since made significant changes to the survey area and timing and these were communicated to all stakeholders, including SETFIA via the third stakeholder consultation letter. 6. **queried the extent of CGG's face-to-face meetings with fishers:** Whilst this was not responded to in writing in the email 26 October 2018, SETFIA is invited to all meetings involving the fishing industry, so he is aware of the meetings that have been held. 7. **objected to the start date for the survey:** this objection was responded to directly in a meeting held on 13 November and via the third stakeholder consultation letter sent to Simon on 22 November 2018 (see rows below). The timing of the survey period has been shifted from January to end of July in response to concerns raised by charter fishers and seafood suppliers about shore-term impacts over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. In response to SETFIA/SSIA's request for clarification on the point of contact for consultation going forward and a separate meeting with CGG to discuss SETFIA and SSIA's proposal: • CGG explained that RPS employee is no longer working for RPS and to please ensure any correspondence is directed to RPS and also copied to cgggippsland@rpsgroup.com.au (mailbox publicised and documented in media releases, stakeholder letter and emails sent from CGG). • CGG stated CGG is happy to meet with SETFIA when SETFIA is available and that he was largely based in Melbourne. A meeting was held on 13 November 2018 (see rows below).
	26/10/18	Email outgoing	NA	NA	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2 November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25 September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received.
	27/10/18 28/10/18	Email incoming Email outgoing	Via email incoming 27/10/18: SETFIA invited CGG to the next SETFIA meeting in Melbourne on 13 November. The agenda would be: 1. CGG's view on reducing the survey size by 75% 2. Compensation for lost catches.	SETFIA disagreed with CGG's responses (on 26/10/18) to the following two objections and claims: 1. that fishers would experience a decline in catch rates, referring to research	Via email outgoing 28/10/18: CGG replied stating that SETFIA raised many issues that would take time to consider and respond to. He confirmed he would be available in Melbourne on the 13 of November 2018.

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			SETFIA stated that SETFIA and CGG differ on our view of lowered catch rates post survey. He stated that he can quote international literature that shows that fish depart the area following a seismic survey and stated CGG had not cited the very recent IMAS work which showed 5% mortality with each pass, or crays that cannot right themselves or straighten their tail (ever again), or zooplankton mortality (all of which was in our report). SETFIA restated if CGG is confident that catch rates will not drop then there should be no issue in discussing compensation for lowered catches post survey. He noted he was happy to build a buffer in for biological variances and that if rates don't drop and nothing is paid, they would be as happy as CGG. He noted that he did not state in the SETFIA report that catch rates were highly variable. Catch rates are not highly variable over time but may be variable day to day or week to week. He restated that their group, which is 90%+ of the effort and revenue in the survey area, did not propose a small area as more important than the others. It is wrong for CGG to 'fish' for consultation points that they like and that is what we feel that you are doing. We have been clear - smaller area and/or compensation of lost catches (if they occur). SETFIA asked if CGG was available on the 13 November in Melbourne to hear from fishers in person.	indicating rock lobster (and zooplankton) mortality following a seismic survey 2. that if CGG believes there will be no impact on commercial fishing, they should have no problem negotiating compensation for lost catch SETFIA also stated his report did not state that catch rates are highly variable, however page 60 and 61 of his report (Appendix I) states for the Victorian Ocean Scallop Fishery: *"Total catches (fishery wide) are <u>highly variable</u>, ranging 266–1182 t during 2000–01 to 2009–10, but for the 2010–11, 2011–12 and 2012–13 seasons, a zero TACC was set."* *"Scallop fisheries are renowned for their boom and bust cycles due to <u>their highly variable</u> recruitment."* SETFIA claim was incorrect and no mention or evidence of fluctuations day to day or week to week was provided in his report. It therefore does not have merit. SETFIA invited CGG to a meeting in Melbourne to hear from fishers. **Action:** CGG to meet with SETFIA/SSIA and discuss their objections and claims further to identify ways impacts on fishers can be reduced to ALARP.	SETFIA's objections and claims were discussed and responded to at the meeting on 13 November 2018 (see row below).
	13/11/18	Meeting	Via meeting 13/11/18 (SETFIA invited CGG representative to attend their meeting): The following were summarised by SETFIA from the meeting: • SETFIA wants to work with CGG to find a way the survey can occur with minimal effects on commercial fishing within the survey area • attendees at the meeting today were a third of the Commonwealth trawl quota ownership (within the survey area), all fish Relevant Stakeholder ID 2491et sales, some catching effort and some retail and secondary users • fishers with 125 years of experience explained that they were concerned about short term displacement of the fishing industry and then medium-term declines in catch rates • SETFIA is particularly affected by the CGG survey given its size, long duration and the importance of catches from the survey area. The following were also discussed: 1. RPS in Perth is the new point of contact for consultation on the survey. SETFIA noted they requested RPS be the point of contact. 2. CGG to consider appointing Relevant Stakeholder ID 2811 as a member of the Scientific Advisory Committee. This would be a remunerated position. The first meeting date for the Committee is to be confirmed. The Committee would consider items 3 and 4 below. 3. there was in principle agreement to discuss a study that involves monitoring pre-survey catch rates against post-survey catch rates. 4. any proposal for compensation that is not open-ended would be considered by CGG. The maximum time for negative effects proposed by SETFIA is 6 months. Long term recruitment would be excluded from the proposal.	SETFIA represents the views and interests of licence holders, fishers and businesses with a commercial interest in the SESSF, specifically the Commonwealth Trawl Fishery, Shark GHaT and Scalefish Hook subsectors. The following four objections and claims were raised, and all are relevant to their functions, interests and activities: 1. that SETFIA members are primarily concerned about short term displacement of the fishing industry from the survey area, and then medium-term declines in catch rates 2. that SETFIA members are particularly affected by the survey given its size, long duration and the importance of catches from the survey area 3. that a monitoring program should be discussed involving pre-survey catch rates against post-survey catch rates 4. SETFIA believe there should be a compensation agreement in place in the event there are impacts on catch as a result of the survey. Whilst none of these objections and claims are not new, given they have been raised repeatedly, CGG's assessment determined they were merited and warranted review to	Via meeting 13/11/18: CGG provided the following responses to the objections and concerns raised during the meeting: 1. **short-term displacement of fishers from survey area and then medium-term declines in catch rates:** CGG noted in the meeting that changes have been made to the survey area in response to stakeholder feedback to date, including reducing the area in size, trimming it to avoid habitat important to fishers, implementing a zoning system, and adopting a notification schedule before the survey, and communications measures during the survey to reduce short-term impacts to fishing operations. These changes and control measures were documented and provided to SETFIA via the third stakeholder consultation letter sent on 22 November 2018. **medium-term declines in catch rates:** CGG has assessed the impacts of seismic operations on the fisheries species that are relevant to the organisations that Simon represents. A summary of the assessment (citing current research available on medium to long-term impacts on catch rates) was provided in the second stakeholder consultation letter. CGG also noted the uncertainty associated with measuring longer-term impacts attributable to seismic activities in the letter. 2. **size, duration and importance of catches from the survey location:** CGG explained that changes have been made to the survey area and timing. These changes were documented in the third stakeholder consultation letter sent on 22 November 2018. This included; the survey area reduced in size by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removes overlap with the nationally important 'Big Horseshoe Canyon' – an area of high ecological value – to the northeast of the survey area and with

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				determine if further changes could be made or control measures adopted, to resolve the claims. **Action:** CGG to address and respond to SETFIA's objections and claims listed above, noting any change or control measures adopted in response to the feedback. SETFIA also recommended CGG consider inviting Relevant Stakeholder ID 2811 onto the SAC. **Action:** CGG to invite Relevant Stakeholder ID 2811 onto the Scientific Advisory Committee.	fishing habitat in this area, particularly grounds that are targeted by Danish seiners and an important nearshore scallop bed. The timing has been shifted from January to end of July in response to concerns raised by charter fishers and seafood suppliers about shore-term impacts over the Christmas period. The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 3. **monitoring of catch rates before and after the seismic survey:** during the meeting the group discussed the formation of a SAC and it was agreed that a before-after survey would be further discussed by that Committee. The outcomes of discussions have resulted in the studies summarised in Section 8.3.3 of the EP. 4. **compensation for impacts to catch that are attributable to survey:** CGG explained that the SAC has now been tasked to discuss compensation arrangements for the survey, including compensation for lost catch to identify a potential solution. The SAC is currently providing advice on a draft Fisheries Displacement Mitigation Plan (described in Section 8.3.3 of the EP). The purpose of the Plan is to provide a mechanism for licensed individuals or entities undertaking commercial fishing activities to assert and demonstrate an evidenced claim for loss of catch and displacement that may arise from CGG's activities. The Plan sets out the decision rules to deal with payments for verified claims. CGG appointed Relevant Stakeholder ID 2811 a member of the Scientific Advisory Committee. The first SAC meeting was held on 23 November 2018.
	22/11/18 22/11/18	3rd formal notification Rev 0 Email outgoing	No feedback received in response to the third stakeholder consultation letter. Via email outgoing 22/11/18: CGG emailed SETFIA to ask him to forward the letter to his members.	No objections or claims.	NA

	23/11/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the first SAC meeting:
			• **Item 1: Study projects:**
			  ◦ Stage 1: to develop 2 explicit projects as pre-proposal to be put to CGG. These being:
			   1.Octopus study – experimental review of physiology and wellbeing and analysis of catch data before and after the marine seismic survey (MSS). UTas to provide a pre-proposal by 30 November.
			   2.Analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery pre the MSS and a non-commercial pre-determined sampling program after the MSS. Fishwell to provide a proposal before 14 December.
			  ◦ Stage 2. CGG will consider these projects and make a determination on the scope and funding of these projects.
			• **Item 2: Zoning sequence:** Committee has agreed that it will be necessary for sectors to identify the timing for the sequence of surveying the zones that minimizes the impact on the commercial fishing industry.
			• **Item 3: Compensation:**
			  ◦ Stage 1: A model for an appeals process for compensation is to be developed for consideration by CGG. CGG to provide this by December 7.
			  ◦ Stage 2: CGG to consider this proposal.
			• **Item 4: Process for Committee:** deal with pre-proposal and appeals model as an out-of-session action via phone/email.
			The following is a summary of general notes from the meeting:
			<u>Octopus:</u>
				The following objections and claims were raised and discussed at the meeting:
				6. **impacts on LEFCOL's business activities:** LEFCOL claimed that the trawl sector is mobile but if fishers must operate too far away then may impact LEFCOL if product is unloaded elsewhere. That Christmas time is important.
				CGG have assessed this concern as having merit. Similar claims to this have been discussed previously LEFCOL during meetings on 26 July 2018 and 2 November 2018 and responses provided (refer to events above for summary of CGG's responses).
				7. **impacts on recruitment of scallops:** that whilst the scallop bed was removed from the survey area, that recruitment may be impacted
				CGG has assessed this concern as having merit and requires resolution if possible.
				8. **concern about use of 1981 noise modelling and broader scale impacts on food web**
				CGG has assessed this concern as having merit. A response is being drafted to be sent to SSFA regarding his
					5. **impacts on LEFCOL's business activities**:
					CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low. The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible.
					6. **impacts on recruitment of scallops:** There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks.
					7. **concern about use of 1981 noise modelling and broader scale impacts on food web:**
					In selecting the propagation model for the impact assessment used within this EP, CGG considered various factors, including range dependant bathymetry, frequency dependence (relevant for all marine faunal groups assessed), the seismic source characteristics, and balancing errors / uncertainties across factors.
					In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang et al. (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, the seismic source will contain a significant amount of energy above this frequency. the suitable frequency range for parabolic equation models would not

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			• support for a study, UTAS to provide proposal and contact FRDC about funding
			• importance of catch rates as the fishery may move to quota management and that whilst analysis of catch rates is typically difficult, that a change in catch rate signal can be seen if planned (can also see signal in normal catch and effort data for the GAB trawl fishery)
			Scallops:
			• change to survey away from scallop bed will protect adults as is greater than 2 km away from most significant bed. However, recruitment may be impacted since it is localised (spawning late summer/early autumn, and settlement generally early autumn). There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks
			• UTAS noted he was involved with 2015 before and after scallop survey but it was not designed properly (too short-term) so results questionable.
			Danish seine:
			• Fishwell noted an issue is the ability to detect change given 'noise' in catch rate data and the way it is done is different for each fishery. He suggested there were two options:
			  ◦ before/after program: identify power to detect specified change, proper experimental design
			  ◦ utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared.
			• displacement of fish and fishers was expected but some fisheries and species are more impacted than others. Focus is on those that are more mobile – which Danish seine and octopus are the two sectors with least ability to move.
			• noted that use of noise loggers important in understanding impacts on octopus and would also inform study on impacts to Danish seiners.
			• LEFCOL raised that trawl sector is mobile but if fishers have to operate too far away then may impact LEFCOL if product is unloaded elsewhere. Also noted that Christmas time is important. SIV – part of broader study on economic impacts
			Zoning system:
			• SSFA believes that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. He also noted the unpredictable arrival of South Australian fishers adds to the competition. He also expressed concern about use of 1981 noise modelling and broader scale impacts on food web
			• Relevant Stakeholder 2510 said with regard to octopus and zoning that the best fishing is during day. He was concerned about five-hour fishing cycle (time period for picking up pots before survey vessel comes through (every ~14 hrs)). Removing surface floats requires VFA approval.
			• discussion regarding the order in which they should be done varies between fishery. It was stated that this should have been dealt with through consultation previously. CGG stated that it had been presented at the last two stakeholder meetings at Lakes Entrance.
			Compensation:
			• committee should consider a safety net in place in case impacts are identified
			• CGG suggested a revenue neutral situation was required, using catch and effort data of individual fishers, which requires fishers' permission to access data
				concerns around the sound modelling week starting 21st January.
				9. **impacts of the zoning system on octopus fishery:** five-hour fishing cycle (time period for picking up pots before survey vessel comes through every ~14 hours). Removing surface floats requires VFA approval.
				CGG has assessed this concern as having merit since it has been raised previously by Relevant Stakeholder ID 2510 and requires resolution if possible.
				Action: CGG to discuss zoning plan with Relevant Stakeholder ID 2510 in an additional meeting in January 2019
				10. **compensation for lost catch:** committee members wanted CGG to confirm they will compensate (for lost catch *[sic.]*).
				This concern was assessed as having merit since it was within the remit of the SAC to progress a solution to this issue.
				Action: It was identified in the meeting that CGG would draft an appeals process (compensation plan) for review by the SAC.
				
				SSFA raised that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. The unpredictable arrival of South Australian fishers adds to competition.
				This claim was assessed as not having merit since (a) the zoning system was introduced in response to consultation with the fishing industry to enable them to forward plan their activities and many have expressed support for the approach, (b) the order of the zones being surveyed is also being planned in consultation with the fishing industry to reduce impacts on the fishing industry associated with certain areas/zones and timing (e.g. avoiding nearshore areas during summer/Christmas period), (c) CGG cannot control the activities of South Australian fishermen and can only reduce the impacts of their own activities, (d) no alternative approach was/has been suggested by SFFA who raised the claim. (e) the percentage of the actively fished area of the fishery that overlaps the survey area is relatively small and being highly mobile fishers, it is expected that they will spread out and not congregate in a small area within the survey area.
					cover any of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals, as well as those animals (fish and invertebrates) that hear above 1 kHz (e.g. fish with swim bladders which respond to higher frequencies of 200 Hz to 3kHz (Carroll et al. 2017), and lobsters up to 5 kHz (Pye and Watson 2004 in: Carroll et al. 2017).
					Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchRelevant Stakeholder ID 2491ed against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been peer reviewed and benchRelevant Stakeholder ID 2491ed, with good agreement, against other transmission loss models (e.g. Toso et al., 2014; Etter 2013; Schulkin and Mercer 1985). RPS has carried out additional benchRelevant Stakeholder ID 2491ing tests using the extended Rogers propagation model in comparison to other propagation models and found generally very good agreement with the other models (i.e. Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model).
					8. **impacts of zoning system on octopus fishery:** Relevant Stakeholder ID 2510 has agreed to meet with CGG regarding the octopus study and fishery. CGG to discuss planning and logistics for the octopus regarding the zoning schedule. This meeting is planned to occur in January.
					9. **compensation for lost catch:** It was agreed during the meeting that CGG would generate a draft appeals process (compensation plan) based on other models used, for review by the SAC. A Fisheries Displacement Mitigation Plan has been drafted and reviewed by the SAC and CGG is seeking internal approval. Further notes on this are summarised below for the SAC meeting dated 3 January 2019.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• committee members wanted CGG to confirm they will compensate. CGG will generate a draft appeals process for discussion based on other models used.		
	26/11/18 26/11/18 26/11/18 26/11/18 26/11/18	Email incoming Email outgoing Email outgoing Email incoming Email outgoing	Via emails (x2) 26/11/18: SETFIA confirmed he had forwarded the third stakeholder consultation letter on to his members. Via emails (x3) 26/11/18: CGG asked for clarification on a mobile phone number. Simon confirmed the number was correct.	No objections or claims.	NA
	04/12/18 04/12/18 04/12/18	Phone call outgoing Email outgoing Email incoming	Via phone call outgoing 04/12/18: CGG phoned SETFIA to clarify SETFIA's membership requirements. Simon explained that SETFIA has a voluntary membership (i.e. not all Commonwealth commercial fishers in the SESSF must be a member). SETFIA stated that SETFIA covers 80-85% of the SESSF operators and that of those that are not a member of SETFIA, around half of them are still on their mailing/distribution list and they are sent information and newsletters. SETFIA stated that there are around 5 boats that are not a part of SETFIA. Simon explained that SETFIA and SSIA operate under Commonwealth and state legislation. SETFIA stated that SIV have a compulsory membership for Victorian commercial fishers. Via email outgoing 04/12/18: CGG followed phone call up with an email summarising the discussion and asked for confirmation of the following: • SIV membership is compulsory for Victorian commercial fishers. CGG asked if it is also in force for recreational fishers • SETFIA maintains a voluntary membership for operators in the Southern and Eastern Scalefish and Shark Fishery, in particular Commonwealth Trawl (Otterboard and Danish Seine) • SETFIA cover between 80-85% of operators in this fishery • SETFIA and SSFA are both incorporated organisations, meaning there are legalities to their operations and they are operating under Commonwealth and state legislation, the Commonwealth Corporations Act and the Victorian Consumer Affairs Act respectively. Via email incoming 04/12/18: SETFIA replied that most recreational fishers require a licence (some don't i.e. old/young) from the Victorian government and he understood VRFish was the organisation that receive funding from the Victorian government for representing recreational fishers. In that way, recreational fishers sort of have compulsory representation. SSIA is incorporated under the Victorian legislation and that "SSF Inc" is just a group and is not incorporated.	No objections or claims.	NA. CGG are following up with SIV to confirm their membership requirements.
	17/12/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the second SAC meeting: **Octopus study** • discussed proposal scope and costs, considering outside/industry funding and CGG asked if the scope could be scaled back. Cost mostly due to vessel costs. Could be reduced by reducing time. UTAS to look at options to reduce costs and follow up with FRDC. **Danish seine study** • there were concerns about the timing of the survey starting in January/February and that the Danish seine proposal would be provided in January. Would need to start surveying before survey start date. • it was suggested that log book data could be used for C&E for analysis if necessary but would need cooperation from individual fishers to use their data. Fishwell noted if they wanted to get the	The following concerns were raised and discussed at the meeting: 3. that the timing of the survey didn't allow adequate time for planning Danish seine study and collecting data before the survey start date (starting in January/February and the Danish seine proposal would be provided in January). 4. concern about the ability to detect change given 'noise' in catch rate data.	CGG has responded to the two objections and claims as follows: 3. **timing of the survey start date and the Danish seine study:** this concern was discussed in more detail in the SAC meeting on 3 January 2019 (refer to event summarised below). CGG stated that they need to remain flexible and that the 'go ahead' for studies will depend on EP approval. Once approved, they will decide timing and other operational details. Planning is ongoing, proposals have been received and SAC members will advise on the timing for studies during future meetings. 4. **ability to detect changes in catch and effort data:** Fishwell explained that using log book data for C&E for analysis would need cooperation from individual fishers and you can't rely on their data as they may be fishing in a totally different area. He suggested there were two options: • before/after program: identify power to detect specified change, proper experimental design

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			fishers to participate in a proper BACI study, can't rely on their data as they may be fishing in a totally different area. • Fishwell stressed that if the experimental study was not properly planned and executed it would be a waste of time. **Zoning system** • Fishwell completing analysis on zoning order. Currently indicates there is not a lot of difference between zones in terms of timing of catch. • CGG noted that from an operational perspective they propose to start deep (southern) and move to shallow. Plan to do Zone 4 in March/April. **Fisheries Displacement Mitigation Plan** • draft Plan provided to SAC members prior to meeting. CGG asked how it would work if there is a bad fishing season in general – would the proposed Danish seine study be useful? It was noted that the Danish seine study would be another piece of evidence for identifying any changes to fishing data as a consequence of the proposed survey. CGG requested the relationship between the sampling plan and how it feeds into the Mitigation Plan. **Update on EP** • submitted last Monday and response will be available from NOPSEMA 9 January 2019. CGG noted the zones have been renumbered and changed (which SAC members were notified of in the lead up to the meeting).		• utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. Per minutes of SAC meeting on 23 November 2018, Fishwell was in process of conducting an analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery (pre-survey) and was to provide a proposal for a non-commercial pre-determined sampling program (after the survey). Since this meeting, two approaches have been adopted (refer to Section 8.3.3.2 of the EP): (1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and (2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.
	03/01/19	Meeting (Scientific Advisory Committee)	The following items were discussed and agreed during the third SAC meeting: **Danish seine study**: • Fishwell explained that the seasonality analysis report as expected, has shown that there is not a big seasonal component for separate zones and that based on analysis he wouldn't say any one zone is better than another. Results were therefore as expected with Danish seine summer catch (Dec-Feb) being higher and more variable, and Otterboard trawl tending to build up towards winter. • With regard to peak catches in Zone 6, SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". It was clarified that the area being referred to was South East reef, for which a smaller gun will be used. • CGG requested a recommendation as to which direction to begin surveying in, based on the data. Fishwell noted it was different for different fisheries, but he could combine values and analyse on combined worth, providing figures with values in zones and see which way would minimise cost. CGG agreed to this. • SSFA expressed concern that the GHaT data will be lost within the aggregated data (once that data is overlaid with Danish seine fishery). Fishwell explained you can see gap values in individual analysis. • There was further discussion about technical aspects of the study and a proposed survey design would be available for the SAC to review to understand the impact of events. • CGG stated they had been in touch with the FRDC and WAFIC regarding funding and/or involvement in the study. **Octopus study:** • UTAS advised he had reviewed the quote but couldn't reduce the cost much, due to cost of vessels required. Noted that FRDC funding would be useful as their involvement then changes it to a category 1 study and certain costs would be removed. Also, easiest way for FRDC to be involved in terms of timing. • CGG asked if the study was ready to start sampling in February 2019. UTAS advised he was waiting for CGG to provide funding to	The following concerns were discussed at the meeting: 5. SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". This concern was assessed as not having merit since it was clarified during the meeting that the area being referred to in the discussion was South East reef, for which control measures have been adopted to mitigate impacts in this area (i.e. reducing power setting of the airguns including a 500 m buffer zone around the reef to avoid TTS injury to fish (including sharks). 6. SSFA also expressed concern that the GHaT data will be lost within the aggregated data analysis performed by Fishwell (once that data is overlaid with Danish seine fishery). This concern was assessed as not having merit since it was clarified by Fishwell during the meeting that you can see gap values in the individual analysis. No further control measures or changes are warranted. 7. There was some concern expressed with regard to reducing costs of the research studies. Difficulties included cost of vessels blowing out the quote for octopus study, the need for funding (FRDC or other). Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies.	In response to the fourth concern (that required action), CGG and Relevant Stakeholder ID 2510 agreed to meet to discuss the need for extra equipment up to three months prior to survey commencement. These discussions are in progress.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			get extra equipment, and they will need 3 months to get mesh bags/extra lines. Also noted it was tough to organize as currently in peak charter time and vessels are booked out. Also noted some operators are in the prawn season, which will also take some time to sort out. However, from a scientific perspective they could be ready to go in February 2019. • CGG stated they were exploring options for additional support and equipment and meeting with the FRDC. **Compensation:** • CGG advised they were dealing with internal management sign off of the Fisheries Displacement Mitigation Plan, and the effect of displacement on catch. They would like to put them forward as separate documents to SAC and then feed suggestions back to CGG. Timing for this was end of next week and a draft to be distributed to SAC by mid-late January 2019. **Status of EP:** • CGG advised they were responding to additional queries from NOPSEMA, including clarification on the SAC and its processes. Specifically, they want to know the scope and frequency of future meetings. Since the EP was submitted before the last meeting CGG weren't able to provide NOPSEMA the minutes. **Other:** • Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG advised they plan to go ahead regardless. CGG and Relevant Stakeholder ID 2510 agreed to catch up when returned from leave to discuss the need for extra equipment up to three months before available. • CGG noted their preference was to survey from Zones 1 to 6 and it was noted that zone numbers should be used and not 'north-south' to avoid confusion. • CGG noted at the next meeting the compensation proposals and funding information should be available and CGG would be in a better position to make commitments with regard to funding the studies.	CGG has assessed this concern as having merit since it is important that the studies are properly planned and executed to get reliable data. CGG stated regardless of funding they would proceed with the studies anyway. No further action required. 8. UTAS raised concern about planning aspects and timing of the octopus study and the seismic survey (i.e. tough to organize vessels as currently in peak charter time and they are booked out, also noted some operators are in the prawn season, which will also take some time to sort out). CGG has assessed this concern as having merit since it is important that data is collected prior to the survey commencing. **Action:** CGG to discuss planning and logistics for the octopus survey in more detail with Relevant Stakeholder ID 2510, in terms of getting equipment on time to support execution of the study before the seismic survey commences.	
	21/01/19	Meeting (Scientific Advisory Committee)	The fourth SAC meeting was held on 21 January 2019 however the minutes are not available for summary and inclusion in this EP update. The following items were discussed: • update on research projects • compensation • survey communications protocols • update on study on zone order.	Objections and claims will be identified and assessed when the minutes have been drafted and reviewed.	NA
	Ongoing consultation: Given the large membership of SETFIA and SSIA that SETFIA represents, consultation with SETFIA will be ongoing throughout the activity. SETFIA is a member of the SAC which will play a major role in resolving objections and claims from the fishing industry for the duration of the activity. CGG has also had discussions with SETFIA about his role in notifications during the survey and communications protocols are being discussed by the SAC.				
Southern Rocklobster Limited	28/05/18 04/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to update Southern Rocklobster Limited on the activity and address any objections or claims raised.				
Southern Shark Industry Alliance Key contacts:	NA	NA	Refer to the content for South East Trawl Fishing Industry Association as Relevant Stakeholder ID 712 represents both associations. SSIA has been provided with all materials sent to Relevant Stakeholder ID 712, however all feedback and responses come via Relevant Stakeholder ID 712.	NA	NA
	Ongoing consultation: Consultation with SSIA will continue via Relevant Stakeholder ID 712 for the duration of the activity.				
	28/05/18 17/08/18	1st formal notification Rev 0 Phone call outgoing	No feedback received in response to the first stakeholder consultation letter.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Sustainable Shark Fishing Association			Via phone call outgoing 17/08/18: CGG phoned SSFA to discuss the proposed survey and his role as the Executive Officer of the SSFA. No answer, left message to call back.		

	20/08/18
	30/08/18
		Email incoming
		Email outgoing
			Via email incoming 20/08/18:
			SSFA replied to CGG's message and attached questions he quickly drafted for SSFA to raise at the meeting in Lakes Entrance on 26 July as SSFA was unable to attend. He noted that SSFA may not have raised all of the points listed. He stated that the list of questions do not appear to have been addressed. The attachment covered the following:
			• the activity description provided is vague; requested more detail similar to CarbonNet:
			  ◦ spacing between adjacent and sequential sail lines for shallow and main and undershoot
			  ◦ map of lines
			  ◦ the horizontal spacing between the three airgun arrays
			  ◦ the volume of the array is not sufficient, they requested the far field source levels
			  ◦ the actual tow depth.
			• the stakeholder engagement should follow that outlined by CarbonNet:
			  ◦ timely engagement
			  ◦ transparency
			  ◦ providing accurate and objective information
			  ◦ monitoring stakeholder interests
			  ◦ ongoing active consideration of stakeholder feedback
			  ◦ tailoring appropriate communications to meet audience needs.
			  ◦ the MSS will include four main phases of stakeholder engagement, these being:
			    1. planning and conducting engagement activities until the EP is approved
			    2. pre-mobilisation communications
			    3. communications during the survey
			    4. community survey results after the survey is completed.
			• they expect there to be greater environmental work:
			  ◦ a pre- and post-MSS non-invasive habitat assessment (i.e. towed video) within and adjacent to the operational area
			  ◦ fish (shark) monitoring work
			  ◦ sound validation work.
			• recommendations from the Geoscience Australia paper "An integrated approach to assessing marine seismic impacts: Lessons learnt from the Gippsland Marine Environmental Monitoring project" should be considered and responded to.
			• further information on the modelling: would like to see the modelling report and expect similar resolution as CarbonNet. They want to see metrics per the CarbonNet EP Summary:
			  ◦ Peak Pressure
			  ◦ Peak to Peak Pressure
			  ◦ SPL
			  ◦ SEL
			• Also want to see the same thresholds as used in the CarbonNet work so they can compare the impact assessment.
			• do not believe that the survey area should be considered a single area. CGG should consider splitting into southern, central and northern parts
			• want to know what measures are being taken to mitigate impacts on their fishery
				The SSFA represents the views and interests of Commonwealth-licenced shark gillnet and shark hook members in the Gillnet Hook and Trap Fishery. The primary target species for this fishery are gummy shark, and to a lesser extent common school shark and elephant fish.
				CGG identified the following five objections and claims that are relevant to the SSFA's functions, interests and activities:
				1. insufficient information provided on the activity description, modelling, control measures for their fishery, information on the timing of survey in relation to spawning, size of the sound source. David requested more information in order to understand the impacts on SSFA members
				2. that the stakeholder engagement should follow that outlined by CarbonNet
				3. that there should be monitoring programs (habitat assessment, sharks, sound validation)
				4. requested that CGG consider and respond to recommendations from the Geoscience Australia paper referred to
				5. claimed the survey area should be divided into separate parts (zones).
				CGG's assessment determined that all five claims are merited and should be addressed and resolved as far as possible.
				Action: CGG to review each objection and claim and respond to the SSFA, including any changes or control measures adopted in response to the feedback.
					Via email outgoing 30/08/18:
					CGG acknowledged the feedback and thanked SSFA for sending it. Noted the questions and issues raised and described in the notes had also been raised by other stakeholders (though not in the detail SSFA included). CGG explained that in response to this, they have proposed changes to their survey plans and some additional control measures. Noted they were finalising an information package to distribute that provides more detail on the outcomes of the environmental impact assessment, including the noise modelling conducted; and the control measures CGG have adopted to reduce the environmental impacts to ALARP.
					CGG also attached the meeting minutes from the Lakes Entrance meeting in July in case SSFA had not received a copy. Also noted that a CGG representative would be in Lakes Entrance again in the next couple of weeks to meet with stakeholders and asked if SSFA would like a face-to-face meeting with CGG.
					No response was received.
					CGG has responded to SSFA objections and claims as follows:
					1. **requested more information on the survey as follows:**
					  • **more detailed activity description** (than what was provided in the first stakeholder consultation letter): during the meeting on 26 July 2018 aspects of the activity were discussed with stakeholders, including number and length streamers, operating along pre-determined sail lines, support vessel operations, vessel interactions, exclusion areas around the seismic vessel, 24-hour operations and justification for the survey in terms of filling existing gaps in data, etc.
					  • **copy of the modelling report** (with similar resolution, metrics and thresholds used for CarbonNet): during the meeting on 26 July 2018, CGG stated they had commissioned underwater sound modelling for the survey and the results would be available soon to allow an assessment. The JASCO modelling validation study done was also noted in the meeting. Summaries of modelling input into the impact assessment on sharks was included in the second consultation letter sent to fishing industry stakeholders and additional information was provided in a subsequent written response to SSFA on 26/10/18.
					  • **control measures for their fishery:** during the meeting issues associated with displacement of fishers from their fishing grounds and vessel interactions and communications were discussed. The majority of control measures that CGG has adopted to mitigate impacts on the fishing fishery, including the GHaT fishery were listed in the second and third stakeholder consultation letters (sent in September 2018 and November 2018, respectively). Only one control measure was not included that was developed more recently. A full list of all control measures will be included in the next stakeholder consultation letter (see below).
					  • **information on the timing of survey in relation to spawning:** the concern of impacts on spawning was raised and discussed during the meeting, primarily in relation to blue warehou, and also octopus (a key gummy shark prey species), snapper and swordfish. The outcomes of the impact assessment on these species (including sharks, octopus and other prey species of shark) were described in the second stakeholder consultation letter sent to David in September 2018 and in a written response to SSFA on 26 October 2018.
					  • **size of the sound source:** information on the size of the sound source for the survey was provided in the second stakeholder

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• timing of survey in relation to spawning • queried the size of the sound source.		consultation letter sent to David in September 2018 and in a written response to SSFA on 26 October 2018. This information included the sizes used in the modelling. In response to this request and subsequent information requests by the SSFA (see rows below), CGG has recently prepared an information package for SSFA that contains a copy of the Activity Description from the EP, the noise modelling documents that are in Appendix E of the EP, the fisheries related impact assessment sections of the EP (covering underwater sound impacts and interactions with other marine users and including control measures). The information package has been prepared, is currently being reviewed by CGG and will be sent to SSFA ASAP (week beginning 21 January 2019). In addition, CGG is planning the next stakeholder consultation letter, which will include a figure showing the most up to date zoning system, a full list of control measures that apply to the fishing industry and an update on the outcomes of the SAC meetings held to date. This will be sent to all relevant stakeholders. 2. **the stakeholder engagement should follow that outlined by CarbonNet**: CGG's consultation approach has been summarised on each project update sent to SSFA, and feedback has been welcomed in all meetings he has attended and in written responses. CGG has worked to improve relationships with fishers over time, by holding more face-to-face meetings and in setting up the Scientific Advisory Committee, which SSFA is a member of. CGG is currently in the planning and engagement and consultation phase prior to EP approval and is currently in discussions with organisations (e.g. LEFCOL, SIV) about communication protocols with stakeholders during the survey. 3. **expect there to be greater environmental monitoring work**: during the July meeting monitoring and research studies were discussed, including suggestions for CGG to fund studies in Lakes Entrance area, doing before and after surveys to see if fish have moved away (like CarbonNet), JASCO modelling validation study, Worley Parsons habitat study, measuring and monitoring effects on sharks, noting that it takes about 12 months to affect gummy sharks. • CGG noted there was a problem with the CarbonNet study in that there was no 'before' data detected, but that they were willing to consider funding studies as long as they were based on good science. • subsequent stakeholder consultation has involved further discussions and progress towards monitoring studies, and these are described in the rows below, particularly via the SAC which SSFA is a member of. The research programs the SAC is advising on are summarised in Section 8.3.3 of the EP and include a Danish seine study which is of particular relevance to the SSFA. 4. **requested that CGG consider and respond to recommendations from the Geoscience Australia paper referred to:** CGG has considered the Przeslawski (Geoscience Australia) paper in the impact assessment. The second consultation letter provided to SSFA contained a summary of the impact assessment on fish including sharks and how the Przeslawski paper was considered in the assessment. 5. **recommended the survey area be divided into separate parts (zones):** during the meeting on 26 July 2018 the idea of dividing the survey area into separate parts was raised and CGG has subsequently adopted this approach. The zones were communicated to stakeholders via the second and third stakeholder consultation letters, including the considerations that has informed the zoning scheme. There has been further discussion on the zoning system in SAC meetings (summarised in the rows below).
	04/09/18	2nd formal notification fishers and fisheries	No feedback received in response to the second stakeholder consultation letter.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	21/09/18	Email outgoing	CGG provided advance notification of plans to meet with fishers in Lakes Entrance on 25 September 2018 and would provide final details when a venue was arranged. Asked if SSFA could pass this on to his members who may be interested or affected by the project and those who attended the first meeting. No response received.	NA	NA
	23/09/18	Email outgoing	CGG invited fishers to meet on the 25 September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made.	NA	NA
	25/09/18	Meeting	CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. The concerns and queries raised by SSFA were: • the lack of scientific information on the impacts of noise on fish • stated he had worked with a fisheries biologist on the decline of snotties (blue warehou) and he was sceptical, fearing lies and statistics were being used as a cover-up of the actual impacts • the need for CGG to convince fishers that the survey would not cause damage and that the footprint of the survey needed to be minimised • asked that noise monitoring be conducted like that done for the CarbonNet survey. That it was needed and that he wanted to see the noise modelling documentation for the CGG proposal • advised CGG not to pick meetings when it was full moon as this was a prime fishing time • asked how impacts were going to be monitored • asked if the EP had been submitted • repeated his interest in receiving documentation of sound modelling.	The following objections and claims were raised: 1. scientific uncertainty on the impacts of noise on fish 2. feared statistics were being used by companies as a cover-up of the actual impacts 3. CGG must convince fishers that the survey would not cause damage 4. requested the footprint of the survey be minimised 5. recommended noise monitoring be conducted 6. recommended meetings not be held during full moon. SSFA also asked how impacts would be monitored and requested sound modelling information. **Action:** CGG to address and respond to each objection and claim, stating how they have been addressed and any changes or additional controls adopted. **Action:** CGG to provide sound modelling information to SSFA.	CGG responded to SSFA objections and claims as follows: 1. **scientific uncertainty:** CGG replied during the meeting that operators rely on scientific papers to inform them of potential effects and that the regulator has to weigh fisheries concerns with peer reviewed scientific knowledge and the broader context, which included consideration of whales and national energy needs. The second stakeholder consultation letter sent in September 2018 also contained a summary of CGG's response regarding scientific uncertainty and how it was being approached. CGG provided a written response (26/10/18) to issues raised by SSFA on 05/10/18) noting they recognise there are gaps in scientific understanding of the impacts of sound on marine life and consistent with NOPSEMA's guidance, where there is uncertainty in impacts levels, assessments of sound impacts are highly conservative, and the actual impacts are expected to be lower. 2. **the use of statistics in impact assessment:** during the meeting CGG responded that the impact assessment for the activity relied on scientific papers to inform potential effects. CGG engaged SETFIA to conduct data analysis and prepare a report on the Commonwealth and Victorian fisheries that could be impacted by the survey and the report has been used in the impact assessment. A summary of the impact assessment was provided in September 2018. Data analysis is also being conducted under the advice of the SAC for research programs. 3. **convincing fishers that the survey would not cause damage**: the second stakeholder consultation letter provided to SSFA contained a summary of the initial impact assessment and during the meeting CGG explained they were working to identify evidence of environmental effects and address comments from NOPSEMA. The third stakeholder consultation letter contained further information on changes made to the survey and control measures adopted in response to stakeholder input. This included the formation of the SAC who are advising on research programs and the concerns of the fishing industry with a view to mitigating impacts of the survey on the industry. 4. **reduce the footprint:** at the beginning of the meeting CGG explained they had removed South East Reef from the survey area and further reductions were communicated via the third stakeholder consultation letter sent to SSFA on 22 November 2018 (a reduction of ~20%). 5. **noise monitoring**: during the meeting CGG asked fishers for their views on how monitoring should be done and their experience with the CarbonNet survey. They stated the difference between that survey and CGG's would mean the approaches would not be identical and reiterated that CGG had been reviewing existing science for the past 6 months for any evidence of effects on fisheries. The third stakeholder consultation letter provided to SSFA explained that CGG were examining the practicality and usefulness of deploying noise loggers and that the earliest date that they may be available is March 2019. The letter stated the SAC would be asked to consider the value of late deployment of loggers or alternative way of measuring the seismic amplitudes in the environment such as ocean bottom

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					seismometers. SSFA is a member of the Committee and will have direct input to these discussions. 6. **scheduling meetings**: CGG apologised for the short notice of the meeting and noted that future meetings were planned for October (subsequent meeting was held on 2 November 2018). They stated it was not the only opportunity for consultation, which was welcome before and after acceptance of the EP. In response to SSFA query about impact monitoring, the third stakeholder consultation letter provided to SSFA explained that the SAC was discussing potential studies for the survey and they would oversee implementation of studies. SSFA is a member of the Committee and has direct input to the studies, which are summarised in Section 8.3.3 of the EP. Sound modelling information was summarised in the second stakeholder consultation letter previously provided to SSFA. Subsequent information was provided in response to further queries submitted by SSFA (refer to letter sent to SSFA on 26/10/18 below). CGG has more recently prepared an information package for SSFA that contains the noise modelling documents that are in Appendix E of the EP (and other information he has requested). The information package has been prepared, is currently being reviewed by CGG and will be sent to SSFA ASAP (week beginning 21 January 2019).

	05/10/18	Letter incoming	The issues documented in the letter are:
			• Environment Plan not available for industry review (including description of impact mitigation measures).
			• request for information regarding:
			  • impacts of seismic noise, specifically:
			    cumulative impacts of noise from vessels involved in seismic activities, including chase boats and other shipping traffic, on threatened and endangered species
			    monitoring the survey impacts e.g. pre- and post-survey monitoring
			• asked if any potential consequences been identified or considered (for example) for Australian seals, seahorses, great white shark, gulper shark, school shark, etc.
			• requested details on underwater sound modelling, specifically:
			  • spatial and temporal dynamics of all individual sound sources
			  • assessment of impulsive and continuous sounds simultaneously
			  • address masking potential, and asked if the modelling assessed which species could potentially be impacted
			  • also asked if the model considered elevated noise levels between impulses as a result of reverberation and reflections.
			• requested further technical information:
			  • tables of frequency band levels as a function of distances
			  • maps of sound level versus depth and range along transects
			  • plots of broadband sound level versus distance from source
			  • table of frequency weighted levels based on audiogram information.
			• requested that the survey be conducted using the same methods as used by CarbonNet.
				The following objections and claims were raised in SSFA letter:
				1. Environment Plan not available for industry review, including control measures
				2. request for information on the impacts of seismic noise, specifically the cumulative impacts of vessel noise and monitoring of impacts, underwater sound modelling and further technical information
				3. asked if any potential consequences been identified or considered (for example) for Australian seals, seahorses, great white shark, gulper shark, school shark
				4. requested that the survey be conducted using the same methods as used by CarbonNet.
				Action: CGG to address and respond to each objection and claim, stating how they have been addressed and any changes or additional controls adopted.
				Action: CGG to provide the information requested to SSFA.
					SSFA objections and claims were formally responded to via letter sent on 26/10/18. Refer to the rows below for a summary of the response.

	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.		
	22/10/18 22/10/18 26/10/18	Email incoming Email outgoing Letter outgoing	Via email incoming 22/10/18: SSFA contacted CGG and advised his letter sent on 05/10/18 had not been acknowledged or responded to.	**Action:** CGG to acknowledge and respond to SSFA email. The assessment of merit for the objections and claims in SSFA letter is summarised above against the event dated 05/10/18.	Via email outgoing 22/10/18: CGG apologised for the delay and stated they were working through the concerns raised and would respond formally in the next few days. Via letter outgoing 26/10/18: CGG replied to SSFA letter sent on 05/10/18 and noted upfront that the responses provided focus on the specific functions, interests and activities of the SSFA in its role representing the interests of the Commonwealth-licenced shark gillnet and shark hook sector members in the GHaT fishery. CGG has addressed the SSFA's objections and claims as follows: 1. **Environment Plan not available for industry review:** The OPGGS(E) Regulations do not require titleholders to make the full EP publicly available, however, to improve transparency, CGG has consulted with fishing industry associations, individual fishers from state and Commonwealth fisheries, government bodies, titleholders and charter operators via a wide variety of methods including emails, letters, meetings, media releases and consultation letters. The second consultation letter in particular contained a summary of the impact assessment from the EP. 2. **request for information on the impacts of seismic noise, monitoring of impacts, underwater sound modelling and further technical information on the survey:** CGG responded in writing and noted if SSFA was not satisfied with the information provided to provide additional clarification on the information her requires. The second stakeholder consultation letter contained a summary of the impact assessment from the EP, including a summary of the noise modelling. CGG noted they were involved in an international study to assist in closing knowledge gaps about sound impacts. The experiment involves monitoring tagged free-ranging fish exposed to seismic sound. CGG also noted there were discussions about potential monitoring studies for the survey would consider any proposals put forward by the SSFA. The third stakeholder consultation letter provided to SSFA explained that the SAC was discussing potential studies for the survey and they would oversee implementation of studies. The letter listed the studies being proposed. SSFA is a member of the Committee and has direct input to the studies. In response to previous information requests and this information request by the SSFA, CGG has more recently prepared an information package for SSFA that contains a copy of the Activity Description from the EP, the noise modelling documents that are in Appendix E of the EP, the fisheries related impact assessment sections of the EP (covering underwater sound impacts and interactions with other marine users and including control measures). The information package has been prepared, is currently being reviewed by CGG and will be sent to SSFA ASAP (week beginning 21 January 2019). 3. **asked if any potential consequences been identified or considered (for example) for Australian seals, seahorses, great white shark, gulper shark, school shark:** CGG responded that they consider the gummy shark is the key target species relevant to the SSFA's interests, with other species such as school shark also important. They explained the potential impacts of seismic noise on those species has been assessed using underwater sound propagation modelling to estimate the spatial extent of potential sound impacts, based on information available in the literature. This modelling process took a conservative approach in representing the worst-case impact scenarios. The assessment concluded that there is a high risk of behavioural disturbance within tens of meters of the seismic source, and the

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					potential for some moderate level effects within hundreds of meters, with a low risk of disturbance >1,000 m. Behavioural effects may include changes in schooling and feeding behaviour, decreased predatory avoidance (although predators are also likely to avoid the area), and disruption to spawning aggregations. However, such behavioural changes are expected to be temporary as the seismic vessel traverses each survey line, localised in spatial extent, and most relevant to continental slope habitat which comprises only a small part of the overall survey area. Further, any effects are expected to be short-term and limited to the duration that the fish are exposed to the source, which for a pelagic (free swimming) species would be limited to the time taken for the fish to swim away from the source. 4. **requested that the survey be conducted using the same methods as used by CarbonNet**: CGG explained the methods used during the proposed survey must be appropriate for the specific nature and scale of the survey. They asked for clarification of this request in the context of the specific interests of SSFA members.
	26/10/18	Email outgoing	CGG invited fishers to meet on the 2 November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25 September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys.	NA	NA
	02/11/18	Meeting	Via meeting held 2 November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25 September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The SAC and ongoing consultation was also discussed. CGG advised that a SAC would be developed and would comprise fishing and technical representatives. The purpose of the SAC would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the SAC. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and claims were addressed and responded to during the meeting: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	Via meeting held 2 November 2018 (CGG, fishing representatives and fishers): CGG provided the following responses to the three objections and claims raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the SAC will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the SAC to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders in November 2018.
	09/11/18	Email incoming	Via email incoming 09/11/18: SSFA replied to CGG's responses to his original objections and claims and provided an attachment setting out their concerns that were not adequately addressed in CGG's response. **Overlap of survey area with SSFA fishery:** They stated the area of overlap between the survey and their active fishery area is significant,	CGG has identified ten key objections and claims in the letter provided, each of which is relevant to their functions, interests and activities including: 1. the scale of the activity as currently proposed and the significant overlap	Via email outgoing 19/11/18: CGG replied to SSFA email acknowledging it had been received, that they were still working through the issues raised and would respond as soon as possible. In response to all information requests to date by the SSFA, CGG has more recently prepared an information package for SSFA that contains a

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			and they are extremely concerned about the scale of the survey, the potential impacts on the target species and the species that comprise their food chain. They stated they requested information to allow them to understand CGG's planned activities, the assessment process and the risk that CGG has determined to our fishery, so they can evaluate from our perspective. **Consultation:** They stated they believed CGG is not interested in engaging with them in good faith and they did not consider that sufficient information has been provided, or that it can be provided in a meeting. They cited NOPSEMA guidance for stakeholders and Carroll et al 2017 (Conclusion of a critical review of the potential impacts of marine seismic surveys on fish & invertebrates) in regard to communication with stakeholders and stated they considered the SSFA was meeting the recommendations in those documents. **Demonstrating impacts are managed to as low as reasonably practicable (ALARP) and acceptable levels:** They stated they were aware of the NOPSEMA paper 'Acoustic impact evaluation and management' and given the lack of information provided did not see how CGG could 'demonstrate that impacts from acoustic emissions are managed to as low as reasonably practicable (ALARP) and acceptable levels'. **Continuous and impulsive cumulative sound impacts:** Regarding Item 7 (has the impact assessment properly accounted for the potential disturbance from continuous and impulsive sound sources), SSFA noted the information has focused only on continuous sources and not responded to the other concerns raised. They requested that CGG properly describe the cumulative impacts considering operation of two seismic sources simultaneously during undershooting as they believed it could lead to greater impacts. They restated the reason they asked for the Project Description section of the EP was to understand the activity properly. **Monitoring of impacts:** Regarding CGG's request for input on potential monitoring studies, SSFA thought Bruce et al (2018) 'Quantifying fish behaviour and commercial catch rates in relation to a marine seismic survey' was a good start for investigating the potential effects on gummy sharks. They noted that Bruce et al (2018) and Skalski et al (1992) showed a change in CPUE for commercial species following seismic exposure. SSFA noted the exposure changed normal swimming patterns in the species involved making the species more vulnerable to fishing gear (at minimum) – hence the reduction in CPUE (Skalski et al 1992). SSFA wish to see more work such as Bruce et al (2018) completed again, using the identified improvements along with a more systematic CPUE assessment and perhaps better fish school monitoring. They said they would like to see this monitoring combined with acoustic recording of the sound levels close to an array. They stated that if a smaller scale version of the survey was approved, the SSFA would support appropriate research to be conducted. **Potential impacts on target species:** SSFA noted CGG's response to this issue was selective in nature and provides no acknowledgement of mortality, only behaviour. Popper et al. (2014) clearly states that at sound levels over 213 dB PK, or 219 dB SELcum, mortality and potential mortal injury to fish without a swim bladder (which includes shark) could occur. They requested the thresholds be assessed, and the information provided to the SSFA. The SSFA also requested all details of the calculations of area of the SSFA fishery that is exposed to sound levels greater than those defined in Popper et al. (2014) for potential mortality, and that CGG	between the survey area and their fishery area 2. dissatisfied with CGG's approach to stakeholder engagement, lack of transparency and lack of information provided to them to understand the activity and potential impacts on their fishery 3. do not understand how CGG can demonstrate impacts are managed to as low as reasonably practicable (ALARP) and acceptable levels 4. concerned about cumulative sound impacts from two sound sources 5. the need to monitor impacts combined with undertaking acoustic measurements 6. concerns about the potential impacts on their target species and on food web species 7. concern that the survey overlaps with areas of protection for gummy shark and school shark that fishers voluntarily avoid 8. concerns about the model used, modelling methodology and robustness of the modelling 9. the period and area of disturbance on their target species 10. potential impacts on the movement's species transiting parallel to the coast. The SSFA also made multiple requests for further information to support their ability to understand the potential impacts and risks on their fishery. **Action:** CGG to address and respond to each objection and claim in both letters sent on 05/10/18 and 09/11/18, stating how each has been addressed and any changes or additional controls adopted. **Action:** CGG to provide the information requested by SSFA in both letters sent on 05/10/18 and 09/11/18.	copy of the Activity Description from the EP, the noise modelling documents that are in Appendix E of the EP, the fisheries related impact assessment sections of the EP (covering underwater sound impacts and interactions with other marine users and including control measures). The information package has been prepared, is currently being reviewed by CGG and will be sent to SSFA ASAP (week beginning 21 January 2019).

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			applies these in the risk assessment. They said they weren't aware of literature that demonstrates that sharks are not impacted in the way defined in Popper et al. (2014), and in absence of such data, the assessment must be conducted in a precautionary manner. **Potential impacts on food web species:** SSFA said their concern also applies to the food web species for the shark (which they provided a list of). They cited research on impacts to squid (McCauley et al. 2000a, McCauley et al. 2000b and Fewtrell and McCauley (2012) and requested CGG use the terminology and findings from Carroll et al. 2017 and Bruce et al. 2018 in terms of displacement of fish, sharks and other species. SSFA requested CGG present the areas over which their target species and food chain species could be impacted by the survey (in the form of maps and also in terms of square kilometres (per the PGS Rollo EP for example). **Areas of protection for gummy shark and school shark:** SSFA said they voluntarily sacrificed the following areas for the protection of pups and school shark and have significant concerns about the scale of impact on these grounds from the CGG survey: 1) entire Victorian coastline extending to 3 miles to sea for the protection of pupping grounds for gummy shark and school shark. 2) all water depths exceeding 100 fathoms for the protection of school shark. Since they have restricted operations for specific areas, they asked why CGG believes it should be allowed exposure to these areas without presenting the exposure data to SSFA. They confirmed they rarely fish over reef areas due to equipment damage and that catch information can be found through CSIRO and AFMA. They said they do not maintain spatial records of effort and catch beyond what is mandated, and do not have the ability to produce a map for you as the fishery association. **Modelling of impacts:** SSFA stated they do not accept the data minimal summary of the modelling and high-level response as a meaningful engagement. Said they wanted to understand if the proposed methods are appropriate and widely used for other seismic survey impact assessments. They noted the primary sound model used and asked why more recent acoustic performance predictors are not utilised. They were concerned that Rogers (1981) 'Onboard prediction of propagation loss in shallow water' notes the model produces a 'depth averaged propagation loss' value and that this could underestimate the sound levels at the seafloor which is the water column region of prime interest to the SSFA (i.e. if the sound levels are high at the seafloor, but low at the surface). They asked why CGG has chosen to use depth averaged propagation loss and if CGG had confidence they could predict these levels accurately using this model compared to other models. Noted that CGG's model doesn't use any waveform data and predicts Sound Exposure Level based upon a point source approximation, and other factors (e.g. peak pressure) are estimated based on conversion factors. They said given the conversion factors can be environmentally specific, how CGG's factors are relevant to the Gippsland region. They referred to reports attached to other EPs that seem significantly more robust than the approach CGG outlined. Regarding the use of streamer data to benchRelevant Stakeholder ID 2491 the model, SSFA referred to a NZ Department of Conservation's Technical Working Group from their seismic code review, which list issues with the method of using the streamers for validation (e.g. tends to underestimate received levels and may not be sufficiently accurate for all depths). SSFA asked why CGG has not considered the NZ DOC Technical Working Group identification of the flaw in the methodology.		

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			Regarding CGG's conclusion that 'the measured levels were found to be significantly lower than those predicted by the conservative modelling, which provides confidence in the modelling results and confirms precaution in the impact assessment which is based on impact ranges predicted from the modelling' SSFA noted that according to the NZ DOC Technical Working Group, that this is exactly what should have occurred, especially given the type of propagation model being used, that the levels at the streamers are; typically lower than real received levels and that they are only measured at a single depth. SSFA asked the following additional questions related to modelling: • if, according to the NZ DOC Technical Working Group, the streamers cannot measure the highest sound levels from the array, which are in the broadside direction, then has the comparison been factored in by CGG? • can CGG's model look at the levels from the airgun source that allows sounds in different directions to be predicted properly? • lots of maps of seismic surveys show quite different sound levels in the fore-aft and broadside directions. Does the CGG model account for this? • in addition to CGG's benchRelevant Stakeholder ID 2491ing with streamers, does CGG have any information about the sound levels directly below the array – including particle motion which is particularly important for sharks? Has this been compared to CGG's model? The SSFA said they have little faith that the results from any of CGG's modelling or validation programs are correct as there are serious inconsistencies in the methods used to justify CGG's approach. These questions are why we asked to see your sound modelling and impact assessment work, as we do not have faith that CGG is doing things using best practice approaches. You state that you have considered a range of criteria, without providing any specifics, and that you have distances for injury and disturbance for these criteria. The Association has requested all this in our previous communication. We request this information so that we can assess if we consider your impacts to be acceptable. **Period and area of disturbance:** SSFA have heard other operators in their region consider the potential recovery to take 12 to 60 months including for disturbed fish to move back into an area (from historical surveys). They asked if CGG were considering the approach taken by local fishery operators to note potential impacts, and if not, why not. SSFA expressed concern with the direction of the proposed survey lines and claim this will interrupt normal migration patterns of animals transiting. They asked how CGG has accounted for this in the impact assessment and claim the potential lack of recruitment for an entire year with animals not reaching their spawning area, and the knock-on effects in future years could significantly impact them well after they survey is completed. **Conclusions:** SSFA repeated the requests from their previous letter, and additionally requested that CGG address the new concerns raised in this letter. They stated they are extremely concerned about: • the scale of the activity as currently proposed • the lack of transparency, including how the assessment is being conducted, and if the methods are appropriate • CGG's approach to stakeholder engagement. The SSFA stated they were not convinced how CGG can be confident in their assessment of risk and potential impacts and was looking for this to be demonstrated in a rigorous and proper manner.		

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	12/11/18	Email outgoing	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25 September 2018 to attendees for review. No feedback received from SSFA.	NA	NA
	19/11/18	Email outgoing	Email sent by CGG in response to email from SSFA on 09/11/18 (refer to row above).	NA	NA
	22/11/18	3rd formal notification Rev 0	No feedback received in response to the third stakeholder consultation letter.	NA	NA
	23/11/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the first SAC meeting: • **Item 1: Study projects:** ◦ Stage 1: to develop 2 explicit projects as pre-proposal to be put to CGG. These being: 1.Octopus study – experimental review of physiology and wellbeing and analysis of catch data before and after the marine seismic survey (MSS). UTas to provide a pre-proposal by 30 November. 2.Analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery pre the MSS and a non-commercial pre-determined sampling program after the MSS. Fishwell to provide a proposal before 14 December. ◦ Stage 2. CGG will consider these projects and make a determination on the scope and funding of these projects. • **Item 2: Zoning sequence:** Committee has agreed that it will be necessary for sectors to identify the timing for the sequence of surveying the zones that minimizes the impact on the commercial fishing industry. • **Item 3: Compensation:** ◦ Stage 1: A model for an appeals process for compensation is to be developed for consideration by CGG. CGG to provide this by December 7. ◦ Stage 2: CGG to consider this proposal. • **Item 4: Process for Committee:** deal with pre-proposal and appeals model as an out-of-session action via phone/email. The following is a summary of general notes from the meeting: **Octopus:** • support for a study, UTas to provide proposal and contact FRDC about funding • importance of catch rates as the fishery may move to quota management and that whilst analysis of catch rates is typically difficult, that a change in catch rate signal can be seen if planned (can also see signal in normal catch and effort data for the GAB trawl fishery) **Scallops:** • change to survey away from scallop bed will protect adults as is greater than 2 km away from most significant bed. However, recruitment may be impacted since it is localised (spawning late summer/early autumn, and settlement generally early autumn). There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks • UTas noted he was involved with 2015 before and after scallop survey but it was not designed properly (too short-term) so results questionable. **Danish seine:**	The following objections and claims were raised and discussed at the meeting: 11. **impacts on LEFCOL's business activities:** LEFCOL claimed that the trawl sector is mobile but if fishers must operate too far away then may impact LEFCOL if product is unloaded elsewhere. That Christmas time is important. CGG have assessed this concern as having merit. Similar claims to this have been discussed previously with LEFCOL during meetings on 26 July 2018 and 2 November 2018 and responses provided (refer to events above for summary of CGG's responses). 12. **impacts on recruitment of scallops:** that whilst the scallop bed was removed from the survey area, that recruitment may be impacted CGG has assessed this concern as having merit and requires resolution if possible. 13. **concern about use of 1981 noise modelling and broader scale impacts on food web** CGG has assessed this concern as having merit. A response is being drafted to be sent to David regarding his concerns around the sound modelling week starting 21st January. 14. **impacts of the zoning system on octopus fishery:** five-hour fishing cycle (time period for picking up pots before survey vessel comes through every ~14 hours). Removing surface floats requires VFA approval. CGG has assessed this concern as having merit since it has been raised previously by Relevant Stakeholder ID 2510 and requires resolution if possible. **Action:** CGG to discuss zoning plan with Relevant Stakeholder ID 2510 in an additional meeting in January 2019 15. **compensation for lost catch:** committee members wanted CGG to confirm they will compensate (for lost catch *[sic.]*).	10. **impacts on SSFA's business activities**: CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low. The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible. 11. **impacts on recruitment of scallops:** There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks. 12. **concern about use of 1981 noise modelling and broader scale impacts on food web:** In selecting the propagation model for the impact assessment used within this EP, CGG considered various factors, including range dependant bathymetry, frequency dependence (relevant for all marine faunal groups assessed), the seismic source characteristics, and balancing errors / uncertainties across factors. In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang et al. (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, the seismic source will contain a significant amount of energy above this frequency. the suitable frequency range for parabolic equation models would not cover any of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals, as well as those animals (fish and invertebrates) that hear above 1 kHz (e.g. fish with swim bladders which respond to higher frequencies of 200 Hz to 3kHz (Carroll et al. 2017), and lobsters up to 5 kHz (Pye and Watson 2004 in: Carroll et al. 2017). Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchRelevant Stakeholder ID 2491ed against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been peer reviewed and benchRelevant Stakeholder

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			• UTas noted an issue is the ability to detect change given 'noise' in catch rate data and the way it is done is different for each fishery. He suggested there were two options:
			  • before/after program: identify power to detect specified change, proper experimental design
			  • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared.
			• displacement of fish and fishers was expected but some fisheries and species are more impacted than others. Focus is on those that are more mobile – which Danish seine and octopus are the two sectors with least ability to move.
			• noted that use of noise loggers important in understanding impacts on octopus and would also inform study on impacts to Danish seiners.
			• LEFCOL raised that trawl sector is mobile but if fishers have to operate too far away then may impact LEFCOL if product is unloaded elsewhere. Also noted that Christmas time is important. SIV – part of broader study on economic impacts
			Zoning system:
			• SSFA believes that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. He also noted the unpredictable arrival of South Australian fishers adds to the competition. He also expressed concern about use of 1981 noise modelling and broader scale impacts on food web
			• Relevant Stakeholder ID 2510 said with regard to octopus and zoning that the best fishing is during day. He was concerned about five-hour fishing cycle (time period for picking up pots before survey vessel comes through (every ~14 hrs)). Removing surface floats requires VFA approval.
			• discussion regarding the order in which they should be done varies between fishery. It was stated that this should have been dealt with through consultation previously. CGG stated that it had been presented at the last two stakeholder meetings at Lakes Entrance.
			Compensation:
			• committee should consider a safety net in place in case impacts are identified
			• CGG suggested a revenue neutral situation was required, using catch and effort data of individual fishers, which requires fishers' permission to access data
			committee members wanted CGG to confirm they will compensate. CGG will generate a draft appeals process for discussion based on other models used.
				This concern was assessed as having merit since it was within the remit of the SAC to progress a solution to this issue. **Action:** It was identified in the meeting that CGG would draft an appeals process (compensation plan) for review by the SAC.
				
				SSFA raised that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. The unpredictable arrival of South Australian fishers adds to competition.
				This claim was assessed as not having merit since (a) the zoning system was introduced in response to consultation with the fishing industry to enable them to forward plan their activities and many have expressed support for the approach, (b) the order of the zones being surveyed is also being planned in consultation with the fishing industry to reduce impacts on the fishing industry associated with certain areas/zones and timing (e.g. avoiding nearshore areas during summer/Christmas period), (c) CGG cannot control the activities of South Australian fishermen and can only reduce the impacts of their own activities, (d) no alternative approach was/has been suggested by SSFA who raised the claim. (e) the percentage of the actively fished area of the fishery that overlaps the survey area is relatively small and being highly mobile fishers, it is expected that they will spread out and not congregate in a small area within the survey area.
					ID 2491ed, with good agreement, against other transmission loss models (e.g. Toso et al., 2014; Etter 2013; Schulkin and Mercer 1985). RPS has carried out additional benchRelevant Stakeholder ID 2491ing tests using the extended Rogers propagation model in comparison to other propagation models and found generally very good agreement with the other models (i.e. Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model).
					13. **impacts of zoning system on octopus fishery:** Relevant Stakeholder ID 2510 has agreed to meet with CGG regarding the octopus study and fishery. CGG to discuss planning and logistics for the octopus regarding the zoning schedule. This meeting is planned to occur in January.
					compensation for lost catch: It was agreed during the meeting that CGG would generate a draft appeals process (compensation plan) based on other models used, for review by the SAC. A Fisheries Displacement Mitigation Plan has been drafted and reviewed by the SAC and CGG is seeking internal approval. Further notes on this are summarised below for the SAC meeting dated 3 January 2019.

	17/12/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the second SAC meeting:
			Octopus study
			• discussed proposal scope and costs, considering outside/industry funding and CGG asked if the scope could be scaled back. Cost mostly due to vessel costs. Could be reduced by reducing time. UTas to look at options to reduce costs and follow up with FRDC.
			Danish seine study
			• there were concerns about the timing of the survey starting in January/February and that the Danish seine proposal would be provided in January. Would need to start surveying before survey start date.
			• it was suggested that log book data could be used for C&E for analysis if necessary but would need cooperation from individual fishers to use their data. UTas noted if they wanted to get the
				The following concerns were raised and discussed at the meeting:
				5. that the timing of the survey didn't allow adequate time for planning Danish seine study and collecting data before the survey start date (starting in January/February and the Danish seine proposal would be provided in January).
				6. concern about the ability to detect change given 'noise' in catch rate data.
					CGG has responded to the two objections and claims as follows:
					5. **timing of the survey start date and the Danish seine study:** this concern was discussed in more detail in the SAC meeting on 3 January 2019 (refer to event summarised below). CGG stated that they need to remain flexible and that the 'go ahead' for studies will depend on EP approval. Once approved, they will decide timing and other operational details. Planning is ongoing, proposals have been received and SAC members will advise on the timing for studies during future meetings.
					6. **ability to detect changes in catch and effort data:** UTas explained that using log book data for C&E for analysis would need cooperation from individual fishers and you can't rely on their data as they may be fishing in a totally different area. He suggested there were two options:
					  • before/after program: identify power to detect specified change, proper experimental design
					  • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			fishers to participate in a proper BACI study, can't rely on their data as they may be fishing in a totally different area. • UTas stressed that if the experimental study was not properly planned and executed it would be a waste of time. **Zoning system** • UTas completing analysis on zoning order. Currently indicates there is not a lot of difference between zones in terms of timing of catch. • CGG noted that from an operational perspective they propose to start deep (southern) and move to shallow. Plan to do Zone 4 in March/April. **Fisheries Displacement Mitigation Plan** • draft Plan provided to SAC members prior to meeting. CGG asked how it would work if there is a bad fishing season in general – would the proposed Danish seine study be useful? It was noted that the Danish seine study would be another piece of evidence for identifying any changes to fishing data as a consequence of the proposed survey. CGG requested the relationship between the sampling plan and how it feeds into the Mitigation Plan. **Update on EP** submitted last Monday and response will be available from NOPSEMA 9 January 2019. CGG noted the zones have been renumbered and changed (which SAC members were notified of in the lead up to the meeting).		Per minutes of SAC meeting on 23 November 2018, UTas was in process of conducting an analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery (pre-survey) and was to provide a proposal for a non-commercial pre-determined sampling program (after the survey). Since this meeting, two approaches have been adopted (refer to Section 8.3.3.2 of the EP): (1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and (2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.
	03/01/19	Meeting (Scientific Advisory Committee)	The following items were discussed and agreed during the third SAC meeting: **Danish seine study**: • UTas explained that the seasonality analysis report as expected, has shown that there is not a big seasonal component for separate zones and that based on analysis he wouldn't say any one zone is better than another. Results were therefore as expected with Danish seine summer catch (Dec-Feb) being higher and more variable, and Otterboard trawl tending to build up towards winter. • With regard to peak catches in Zone 6, SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". It was clarified that the area being referred to was South East reef, for which a smaller gun will be used. • CGG requested a recommendation as to which direction to begin surveying in, based on the data. UTas noted it was different for different fisheries, but he could combine values and analyse on combined worth, providing figures with values in zones and see which way would minimise cost. CGG agreed to this. • SSFA expressed concern that the GHaT data will be lost within the aggregated data (once that data is overlaid with Danish seine fishery). UTas explained you can see gap values in individual analysis. • There was further discussion about technical aspects of the study and a proposed survey design would be available for the SAC to review to understand the impact of events. • CGG stated they had been in touch with the FRDC and WAFIC regarding funding and/or involvement in the study. **Octopus study:** • UTas advised he had reviewed the quote but couldn't reduce the cost much, due to cost of vessels required. Noted that FRDC funding would be useful as their involvement then changes it to a category 1 study and certain costs would be removed. Also, easiest way for FRDC to be involved in terms of timing. • CGG asked if the study was ready to start sampling in February 2019. UTas advised he was waiting for CGG to provide funding to	The following concerns were discussed at the meeting: 9. SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". This concern was assessed as not having merit since it was clarified during the meeting that the area being referred to in the discussion was South East reef, for which control measures have been adopted to mitigate impacts in this area (i.e. reducing power setting of the airguns including a 500 m buffer zone around the reef to avoid TTS injury to fish (including sharks). 10. SSFA also expressed concern that the GHaT data will be lost within the aggregated data analysis performed by UTas (once that data is overlaid with Danish seine fishery). This concern was assessed as not having merit since it was clarified by UTas during the meeting that you can see gap values in the individual analysis. No further control measures or changes are warranted. 11. There was some concern expressed with regard to reducing costs of the research studies. Difficulties included cost of vessels blowing out the quote for octopus study, the need for funding (FRDC or other). Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies.	In response to the fourth concern (that required action), CGG and Relevant Stakeholder ID 2510 agreed to meet to discuss the need for extra equipment up to three months prior to survey commencement. These discussions are in progress.

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			get extra equipment, and they will need 3 months to get mesh bags/extra lines. Also noted it was tough to organize as currently in peak charter time and vessels are booked out. Also noted some operators are in the prawn season, which will also take some time to sort out. However, from a scientific perspective they could be ready to go in February 2019. • CGG stated they were exploring options for additional support and equipment and meeting with the FRDC. **Compensation:** • CGG advised they were dealing with internal management sign off of the Fisheries Displacement Mitigation Plan, and the effect of displacement on catch. They would like to put them forward as separate documents to SAC and then feed suggestions back to CGG. Timing for this was end of next week and a draft to be distributed to SAC by mid-late January 2019. **Status of EP:** • CGG advised they were responding to additional queries from NOPSEMA, including clarification on the SAC and its processes. Specifically, they want to know the scope and frequency of future meetings. Since the EP was submitted before the last meeting CGG weren't able to provide NOPSEMA the minutes. **Other:** • Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG advised they plan to go ahead regardless. CGG and Relevant Stakeholder ID 2510 agreed to catch up when returned from leave to discuss the need for extra equipment up to three months before available. • CGG noted their preference was to survey from Zones 1 to 6 and it was noted that zone numbers should be used and not 'north-south' to avoid confusion. CGG noted at the next meeting the compensation proposals and funding information should be available and CGG would be in a better position to make commitments with regard to funding the studies.	CGG has assessed this concern as having merit since it is important that the studies are properly planned and executed to get reliable data. CGG stated regardless of funding they would proceed with the studies anyway. No further action required. 12. UTas raised concern about planning aspects and timing of the octopus study and the seismic survey (i.e. tough to organize vessels as currently in peak charter time and they are booked out, also noted some operators are in the prawn season, which will also take some time to sort out). CGG has assessed this concern as having merit since it is important that data is collected prior to the survey commencing. **Action:** CGG to discuss planning and logistics for the octopus survey in more detail with Relevant Stakeholder ID 2510 , in terms of getting equipment on time to support execution of the study before the seismic survey commences.	
	21/01/19	Meeting (Scientific Advisory Committee)	The fourth SAC meeting was held on 21 January 2019 however the minutes are not available for summary and inclusion in this EP update. The following items were discussed: • update on research projects • compensation • survey communications protocols update on study on zone order.	Objections and claims will be identified and assessed when the minutes have been drafted and reviewed.	NA
	Ongoing consultation: CGG will provide a full information package to SSFA that contains all information requested by the SSFA to date. The package has been prepared, is currently being reviewed by CGG and will be sent to SSFA ASAP (week beginning 21 January 2019). CGG will continue to consult with the SSFA on the activity and SSFA is a member of the Scientific Advisory Committee which will play a major role in resolving objections and claims from the fishing industry for the duration of the activity.				
Victorian Abalone Council Key contact: Sue Alcock	28/05/18 04/09/18 12/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: CGG will continue to update the Victorian Abalone Council on the activity and as per the comment above for the Abalone Council Australia will make further reasonable attempts to obtain feedback from them for input to the SIMOPs Plan to mitigate the potential risks to divers.				
Victorian Abalone Divers Association	28/05/18 04/09/18 12/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: CGG will continue to update the Victorian Abalone Divers Association on the activity and as per the comment above for the Abalone Council Australia will make further reasonable attempts to obtain feedback from them for input to the SIMOPs Plan to mitigate the potential risks to divers.				
Victorian Rock Lobster Association	28/05/18 28/05/18 29/05/18 29/05/18	1st formal notification Rev 0 Email incoming Email outgoing Email incoming	Via email incoming 28/05/18: In response to the first stakeholder consultation letter, the VRLA stated that consultation for Victorian Fisheries should be channelled through SIV and if the proposed seismic survey is in Tasmanian waters, CGG would need to contact the Tasmanian Seafood Industry Council (TSIC). They noted that both organisations have a joint policy on consultation that covers their fishery.	No objections or claims raised however the VRLA requested consultation be conducted via SIV. **Action:** CGG to direct consultation on potential impacts of the survey on the Victorian rock lobster fishery via SIV.	Via email outgoing 29/05/18: CGG replied noting they sent the email to SIV and had not heard back just yet. They stated the seismic activity is not expected to affect any Tasmanian fisheries. CGG noted they would have a look at the consultation policy referred to and continue to consult with SIV. CGG asked VRLA if they wanted to receive any further information on the activity, or if they were happy for SIV to represent the VRLA's interests. Via email incoming 29/05/18: The VRLA replied that the consultation process needs to start with SIV. They noted they had copied SIV CEO in the email and that he would no doubt be in touch.
	04/09/18 04/09/18 04/09/18 04/09/18 04/09/18	2nd formal notification fishers and fisheries Email incoming Email outgoing Email incoming Email outgoing	Via email incoming 04/09/18: In response to the second stakeholder consultation letter, the VRLA stated that consultation with impacted stakeholders is a compulsory requirement of the EP process. They noted that their association is run by volunteers has been overwhelmed by the collective requests for consultation with the oil and gas industry on seismic surveys and the environmental and economic impact of the data collection process using seismic air-guns on our fishing grounds. They claimed that seismic activity was sub-lethal to rock lobster and mortal to scallops and zooplankton (including early stages rock lobster). As such, they requested proper restitution as a liability of this activity under 571(2) of the OPGGS Act. The VRLA stated that SIV was their peak body and funded from all Victorian licence and quota holders including all VRLA members. They requested further consultation with VRLA on the provided information is conducted in a coordinated and structured manner under the SIV/TSIC consultation policy and that SIV is funded appropriately for this activity to review the complexities of this report for our sector. They noted that they understand that their response will form part of the consultation provided to NOPSEMA.	The VRLA represent the views and interests of Victorian rock lobster licence holders. The VRLA claimed that seismic activity was sub-lethal to rock lobster and mortal to scallops and zooplankton (including early stages rock lobster), which is relevant to their interests and activities. They requested restitution as a liability of this activity under 571(2) of the OPGGS Act. CGG understands that "liabilities" in reference to regulation 571(2) of the OPGGS Act are taken to include reasonably estimable costs associated with the escape of petroleum during an activity. Therefore, CGG does not consider that this request has merit. **Action:** CGG to respond to VRLA's claim that seismic activity was sub-lethal to rock lobster and mortal to scallops and zooplankton (including early stages rock lobster). The VRLA also requested that consultation on potential impacts of the survey on the Victorian rock lobster fishery be conducted via SIV under the SIV/TSIC consultation policy. **Action:** CGG to continue to direct consultation on potential impacts of the survey on the Victorian rock lobster fishery via SIV.	Via email outgoing 04/09/18: CGG acknowledged the VRLA's feedback and noted that engagement has been undertaken with SIV on the activity. They explained that SIV has raised issues on behalf of the fisheries that they represent including VRLA such as: • the number of seismic surveys already conducted in the Gippsland region and concerns that they have cumulatively impacted catch and contributed to scallop stock collapses • location of the survey area overlapping fishing areas • the potential for noise impacts on fisheries species and food chains, in particular scallops, which haven't recovered in the region since 2010 • the 'selectivity of science' used by proponents in their impact assessment • the inadequate consultation conducted for the CarbonNet and Spectrum proposals. CGG stated they were continuing its engagement with SIV on these issues raised. They noted they would continue to keep the VRLA informed about the proposed survey and asked if they no longer wanted to receive project updates about the survey. Via email incoming 04/09/18: The VRLA reiterated that the complex report CGG provided needs to be assessed and that SIV needs to be funded for that, which should include an independent peer review. They stated they expected to be kept informed.
	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.	NA	NA
	22/11/18 23/11/18 08/12/18	3rd formal notification Rev 0 Email outgoing Email outgoing	Via email outgoing 23/11/18: CGG emailed the VRLA to confirm they received the third stakeholder consultation letter and asked if they could forward it to their members.	The VRLA made the following objections and claims in their response to CGG's request:	Via email outgoing 08/12/18: CGG replied to the VRLA's email apologising for the delay and misunderstanding about their role in distributing information to their

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Via email incoming 25/11/18: The VRLA stated they were not funded to provide free services to the oil and gas industry and do not have the resources to do mail outs or assess all the impacts of individual environmental plans. They requested again that consultation is conducted through SIV in accordance with SIVs consultation policy so that a thorough evaluation of the impacts on their industry could be completed. The VRLA stated they do not support the use of seismic air-guns while the extent of the uncertainty of their impacts remains unknown. They claimed that southern rock lobsters are significantly permanently damaged, cited McCauley et al (2016) and noted the findings found mortality did not occur post exposure when kept in an ideal controlled environment, but questioned survival in the wild. They also claimed seismic sound results in significant mortality to zooplankton including rock lobster eggs (McCauley et al 2017). They stated there remains uncertainty on the cumulative impacts that lack of scientific certainty should not be used to avoid using lower impact technologies. The VRLA noted that if the survey did go ahead, control measures that should be adopted include retirement of the seasons catch of southern rock lobster in the year of the survey with fishers (and co-ops) being remunerated for lost catch and business revenue. They expected funds to be contributed (proportional to the area surveyed) towards a rock lobster re-seeding program to assist environmental rehabilitation following the survey. The VRLA finished by stating that these controls were all negotiated and accepted by both NOPSEMA and the fishing industry as part of the EP for the Crowes Foot survey in 2016 and that this has set a precedent for outcomes that while not ideal have been deemed acceptable by fishing industry stakeholders.	1. claimed they were not resourced to assess information on the project and that consultation must be directed via SIV 2. objected to the use of seismic air-guns while the extent of the uncertainty of their impacts remains unknown, and that lack of scientific certainty should not be used to avoid using lower impact technologies 3. claimed that southern rock lobsters are significantly permanently damaged citing McCauley et al (2016) 4. claimed seismic sound results in significant mortality to zooplankton including rock lobster eggs citing McCauley et al 2017 5. claimed that if the survey went ahead CGG should compensate fishers for lost catch and contribute funding towards a rock lobster re-seeding program 6. claimed that compensation arrangements were negotiated (with Origin) for the Crowes Foot survey in 2016 and accepted by NOPSEMA and the fishing industry and that this has set a precedent.	members. CGG noted there were updates being made to the impact assessment in response to NOPSEMA comments and further stakeholder feedback, and that they would respond to VRLA's concerns in writing ASAP. CGG reiterated that SIV has been consulted and they would continue to request feedback from SIV on the assessment of impacts and risks. CGG also noted they would keep sending the VRLA project updates. As per CGG's email summarised above, they propose to respond to the VRLA's objections and claims in writing as soon as possible.
	Ongoing consultation: CGG proposes to respond to the objections and claims raised VRLA's email ASAP. CGG will continue to consult with SIV on the activity and provide the VRLA with project updates.				
Victorian Scallop Fisherman's Association	28/05/18 12/06/18 16/08/18	1st formal notification Rev 0 Email incoming Phone call outgoing	Via email incoming 12/06/18: VSFA responded to the first stakeholder consultation letter thanking them for the contact and asked for the dates of visits to Lakes Entrance, so they could prepare for the meeting. VSFA also noted they were preparing a formal response to the planned activity.	No objections or claims were raised, however CGG will respond to VSFA query about Lakes Entrance meeting dates.	Via phone call outgoing 30/08/18: CGG phoned VSFA and apologised for not getting back to him about the Lakes Entrance meeting dates and that it had slipped through the cracks. Asked if he was available for a meeting. VSFA said that he would not be available until after 1st Sept and that he would get 'Gary' to contact CGG to arrange time. He informed CGG that SIV and SETFIA do not represent scallop fishers.
	30/08/18	Email outgoing	Via email outgoing 30/08/18: CGG followed up with VSFA with a heads up that meetings in Lakes Entrance were planned for September. CGG also noted they were finalising the next stakeholder consultation letter that will be sent out soon. No response received.	NA	NA
	04/09/18	2nd formal notification fishers and fisheries	No feedback received in response to the second stakeholder consultation letter.	NA	NA
	21/09/18	Email outgoing	CGG provided advance notification of plans to meet with fishers in Lakes Entrance on 25th Sept and would provide final details when a venue was arranged. Asked if VSFA could pass this on to his members who may be interested or affected by the project and those who attended the first meeting.	NA	NA
	23/09/18	Email outgoing	CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made.	NA	NA
	25/09/18	Meeting	CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1	The Victorian Scallop Fisherman's Association represents the views and interests of scallop licence holders in Victoria.	CGG provided the following responses to VSFA objections and claims: 1. **potentially important scallop grounds within the survey area:** This was noted in the meeting and CGG have since revised the operational area to avoid almost all the important scallop bed that was

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the meeting CGG responded to stakeholder queries and concerns that were voiced. Specific stakeholder concerns are summarised under their respective rows in this table. The concerns and queries raised by VSFA were: • **important scallop grounds**: VSFA noted a private vessel the Anne B, identified a scallop bed; but the scallop survey work associated with the CarbonNet project could not find them. VSFA claimed there were a lot of scallops in parts of the survey area and that another scallop survey was needed with an observer on the survey boat • **claimed that seismic surveys damage fishing grounds** • **financial impact:** stated the impact on their industry financially was not acceptable and CGG should compensate fishers. Stated that Western Australia (WA) had paid fishers millions of dollars not to fish and asked what CGG would do about it. He said claimed it was a conspiracy and that fishers were paid $250 million in WA, and that seismic surveys had been banned in the USA, North Sea, WA and Darwin. • **impacts on larvae:** stated there was a much broader effect of seismic noise on spat • **issues with consultation:** claimed the meeting was just a tick the box exercise. • **Impacts after the survey:** VSFA asked if CGG would be here in 6 months, alluding to concern about impacts following the completion of the survey VSFA also asked how close to the beach the survey would be to which CGG replied 12 NM and added they were on the beach during the CarbonNet survey which was much closer and there was no noticeable effect.	They raised the following objections and claims all of which are relevant to their interests and activities: 1. potentially important scallop grounds within the survey area 2. claimed that seismic surveys damage fishing grounds and there would be financial impacts associated with this 3. claimed that seismic sound impacts larvae 4. claimed the purpose of the meeting was inauthentic ('tick the box') 5. impacts on their fishery after the survey.	subsequently identified following further consultation. This change was communicated to VSFA via the third stakeholder consultation letter. 2. **claim that seismic surveys damage fishing grounds and there would be financial impacts associated with this:** CGG acknowledged VSFA concern and apologised he was upset about this. He reiterated that CGG were relying on the evidence of potential impacts and that the regulator makes the decision about allowing the survey to go ahead (if impacts were not deemed to be ALARP and acceptable *[sic.]*) 3. **claim that seismic sound impacts larvae:** CGG responded that the CGG proposal relied on scientific information to inform potential effects and that the regulator has to weigh fisheries concerns with the peer reviewed scientific knowledge and the broader context of issues and impacts, including whales and national energy needs. 4. **claimed the purpose of the meeting was inauthentic ('tick the box'):** CGG responded explaining that they were listening to fishers and (as an example) had excluded the SE Reef from the survey area and amended the survey design to acquisition zones in response to stakeholder feedback. 5. **impacts on their fishery after the survey:** CGG noted that it is difficult to validate the medium to long-term effects, and that it would be useful to be able to compare data 10 years before and after as well as conducting targeted studies on species. The second stakeholder consultation letter contained a summary of the impact assessment, which had considered the available science on the impacts of seismic sound on invertebrates including scallops.
	22/11/18 22/11/18	3rd formal notification Rev 0 Email outgoing	Email outgoing 22/11/18: CGG emailed VSFA to confirm he received the third stakeholder consultation letter and asked if they could forward it to their members. No feedback or response received.	NA	NA
	26/11/18 26/11/18	Phone call outgoing Email outgoing	Via phone call outgoing 26/11/18: FLO contacted VSFA after missing a call from him. VSFA was interested to learn what the current status of the survey was and the association of the survey over the emerging scallop bed. FLO informed VSFA of the current status of the project and stated that he would follow with high resolution maps to be sent to VSFA to see the overlay of the survey and the emerging scallop bed. No feedback or response received.	No objections or claims. VSFA requested he is kept updated on the survey.	Via email 27/11/18: CGG provided VSFA with updated maps of the survey area including the emerging scallop bed and its proximity to the proposed survey.
	Ongoing consultation: CGG will continue to update the Victorian Scallop Fisherman's Association on the activity and address any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
VRFish Key contact: Mike Burgess	28/05/18 03/09/18	1st formal notification Rev 0 Phone call outgoing	No feedback or response received. CGG followed up with a phone call. There was no answer, so they left a message to return the call.	NA	NA
	04/09/18 04/09/18	2nd formal notification fishers and fisheries Email outgoing	No feedback or response received. Via email outgoing 04/09/18: CGG emailed VRFish to confirm they received the second stakeholder consultation letter and asked if they could forward it to their members. No feedback or response received.	NA	NA
	22/11/18 22/11/18	3rd formal notification Rev 0 Email outgoing	Email outgoing 22/11/18: CGG emailed VRFish to confirm they received the third stakeholder consultation letter and asked if they could forward it to their members.	NA	NA

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			No feedback or response received.		
	Ongoing consultation: CGG will continue to update the VRFish on the activity and address any objections or claims raised in accordance with the ongoing consultation process described in Section 9.0 of this EP.				
Commercial fishing companies and fishers					
Relevant Stakeholder ID 763	26/07/18	Meeting	Via meeting at Lakes Entrance 26/07/18 (attended by LEFCOL and commercial/charter fishers): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Relevant Stakeholder raised the following claim at the meeting: Relevant Stakeholder asked whether Relevant Stakeholder ID 2515 had been contacted about scallops. Relevant Stakeholder stated that there were still concerns about the collapse after the 2010 seismic survey.	This stakeholders' concerns surrounding the collapse of the scallop fishery post 2010 seismic survey has limited merit. The scallop industry's concerns over the collapse of the scallop fishery are acknowledge, however there is no direct link between the 2010 seismic survey and Scallop mortality Przeslawski et al. 2018 paper investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established.	CGG has provided with Relevant Stakeholder with a detailed consultation package sent on the 4th of September. The consultation package included sections of the assessment of the potential impacts of seismic noise on scallops.
	08/08/18 04/09/18 23/09/18	Email outgoing 2nd formal notification fishers and fisheries Email outgoing	No response was received in response to the email outgoing, second consultation letter and email outgoing sent to Relevant Stakeholder on the 8th August, 4th September and 23rd September respectively.	No objections **or claims.**	Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made.
	25/09/18	Meeting	Meeting with Lakes Entrance fishers, representing both Commonwealth and Victorian fisheries: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. The issues and queries raised by Relevant Stakeholder were: • a lot of the ground in the shallower areas of the survey were potential scallop ground • stated that the bed of juvenile scallops previously identified seemed to be just outside of zone 1. The scallops seemed to have survived since then and it seems to be a long narrow strip. Its precise location needs to be identified with observers on board so that the survey plan can be adjusted to avoid it.	The following objections and claims were raised by Relevant Stakeholder and are considered relevant to his interests and activities: 1. A lot of the ground in the shallower areas of the survey were potential scallop ground 2. Stated that the bed of juvenile scallops previously identified seemed to be just outside of zone 1. The scallops seemed to have survived since then and it seems to be a long narrow strip. Its precise location needs to be identified with observers on board so that the survey plan can be adjusted to avoid it **Action:** CGG to address the concerns above and respond to Relevant Stakeholder stating how they have been addressed, including any changes or control measures adopted.	CGG responded to Relevant Stakeholder objections and claims as follows: 1. **A lot of the grounds in the shallower areas are potential scallop ground:** CGG have communicated the alterations to the survey design in the third consultation letter posted to fishers on the 22 November. The survey now avoids this new established scallop ground identified by Relevant Stakeholder ID 2739and other fishers. 2. **Bed of juvenile scallops are just outside of zone 1:** See response above. CGG have responded to stakeholder feedback regarding an emerging scallop bed to the north of the survey area. The survey had been reduced in size to reduce overlap with this scallop bed.

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	19/10/18	Email outgoing	No response was received in response to the email outgoing on the 19th October regarding the status of the survey.	No objections or claims.	NA
	26/10/18 29/10/18 30/10/18	Phone call outgoing Phone call outgoing Phone call incoming	No response to first two outgoing phone calls. Via phone call 30/10/18: Relevant Stakeholder provided the polygon co-ordinates of the area where the scallops had been observed.	No objections or claims.	NA
	26/10/18	Email outgoing	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received.	NA	NA
	02/11/18	Meeting	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 1. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	02/11/18 10/11/18	Phone call incoming Phone call incoming	Via Phone call 02/11/18: Relevant Stakeholder affirmed that the location of the scallops was well known to Danish seiners and that they were generally in the larger polygon identified in the last VFA scallop assessment	No objections or claims.	NA
	12/11/18 18/11/18 22/11/18 28/11/18	Email outgoing Email outgoing 3rd formal notification Rev 0 3rd formal notification Rev 0	No response was received in response to the emails outgoing on 12th and 18th November and the third consultation letter sent to Relevant Stakeholder on the 22nd and 28th November.	NA	NA
	23/11/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the first SAC meeting: • **Item 1: Study projects:**	The following objections and claims were raised and discussed at the meeting:	14. **impacts on LEFCOL's business activities**: CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			◦ Stage 1: to develop 2 explicit projects as pre-proposal to be put to CGG. These being: 1.Octopus study – experimental review of physiology and wellbeing and analysis of catch data before and after the marine seismic survey (MSS). UTas to provide a pre-proposal by 30 November. 2.Analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery pre the MSS and a non-commercial pre-determined sampling program after the MSS. Fishwell to provide a proposal before 14 December. ◦ Stage 2. CGG will consider these projects and make a determination on the scope and funding of these projects. • **Item 2: Zoning sequence:** Committee has agreed that it will be necessary for sectors to identify the timing for the sequence of surveying the zones that minimizes the impact on the commercial fishing industry. • **Item 3: Compensation:** ◦ Stage 1: A model for an appeals process for compensation is to be developed for consideration by CGG. CGG to provide this by December 7. ◦ Stage 2: CGG to consider this proposal. • **Item 4: Process for Committee:** deal with pre-proposal and appeals model as an out-of-session action via phone/email. The following is a summary of general notes from the meeting: **<u>Octopus:</u>** • support for a study, UTas to provide proposal and contact FRDC about funding • importance of catch rates as the fishery may move to quota management and that whilst analysis of catch rates is typically difficult, that a change in catch rate signal can be seen if planned (can also see signal in normal catch and effort data for the GAB trawl fishery) **<u>Scallops:</u>** • change to survey away from scallop bed will protect adults as is greater than 2 km away from most significant bed. However, recruitment may be impacted since it is localised (spawning late summer/early autumn, and settlement generally early autumn). There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks • UTas noted he was involved with 2015 before and after scallop survey but it was not designed properly (too short-term) so results questionable. **<u>Danish seine:</u>** • UTas noted an issue is the ability to detect change given 'noise' in catch rate data and the way it is done is different for each fishery. He suggested there were two options: ◦ before/after program: identify power to detect specified change, proper experimental design ◦ utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. • displacement of fish and fishers was expected but some fisheries and species are more impacted than others. Focus is on those that are more mobile – which Danish seine and octopus are the two sectors with least ability to move. • noted that use of noise loggers important in understanding impacts on octopus and would also inform study on impacts to Danish seiners.	16. **impacts on LEFCOL's business activities:** LEFCOL claimed that the trawl sector is mobile but if fishers must operate too far away then may impact LEFCOL if product is unloaded elsewhere. That Christmas time is important. CGG have assessed this concern as having merit. Similar claims to this have been discussed previously with LEFCOL during meetings on 26 July 2018 and 2 November 2018 and responses provided (refer to events above for summary of CGG's responses). 17. **impacts on recruitment of scallops:** that whilst the scallop bed was removed from the survey area, that recruitment may be impacted CGG has assessed this concern as having merit and requires resolution if possible. 18. **concern about use of 1981 noise modelling and broader scale impacts on food web** CGG has assessed this concern as having merit. A response is being drafted to be sent to SSFA regarding his concerns around the sound modelling week starting 21st January. 19. **impacts of the zoning system on octopus fishery:** five-hour fishing cycle (time period for picking up pots before survey vessel comes through every ~14 hours). Removing surface floats requires VFA approval. CGG has assessed this concern as having merit since it has been raised previously by Relevant Stakeholder ID 2510 and requires resolution if possible. **Action:** CGG to discuss zoning plan with in an additional meeting in January 2019 20. **compensation for lost catch:** committee members wanted CGG to confirm they will compensate (for lost catch *[sic.]*). This concern was assessed as having merit since it was within the remit of the SAC to progress a solution to this issue. **Action:** It was identified in the meeting that CGG would draft an appeals process (compensation plan) for review by the SAC. **SSFA raised** that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. The unpredictable	The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible. 15. **impacts on recruitment of scallops:** There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks. 16. **concern about use of 1981 noise modelling and broader scale impacts on food web:** In selecting the propagation model for the impact assessment used within this EP, CGG considered various factors, including range dependant bathymetry, frequency dependence (relevant for all marine faunal groups assessed), the seismic source characteristics, and balancing errors / uncertainties across factors. In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang et al. (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, the seismic source will contain a significant amount of energy above this frequency. the suitable frequency range for parabolic equation models would not cover any of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals, as well as those animals (fish and invertebrates) that hear above 1 kHz (e.g. fish with swim bladders which respond to higher frequencies of 200 Hz to 3kHz (Carroll et al. 2017), and lobsters up to 5 kHz (Pye and Watson 2004 in: Carroll et al. 2017). Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchRelevant Stakeholder ID 2491ed against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been peer reviewed and benchRelevant Stakeholder ID 2491ed, with good agreement, against other transmission loss models (e.g. Toso et al., 2014; Etter 2013; Schulkin and Mercer 1985). RPS has carried out additional benchRelevant Stakeholder ID 2491ing tests using the extended Rogers propagation model in comparison to other propagation models and found generally very good agreement with the other models (i.e. Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model). 17. **impacts of zoning system on octopus fishery:** Relevant Stakeholder ID 2510 has agreed to meet with CGG regarding the octopus study and fishery. CGG to discuss planning and logistics

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• LEFCOL raised that trawl sector is mobile but if fishers have to operate too far away then may impact LEFCOL if product is unloaded elsewhere. Also noted that Christmas time is important. SIV – part of broader study on economic impacts **Zoning system:** • SSFA believes that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. He also noted the unpredictable arrival of South Australian fishers adds to the competition. He also expressed concern about use of 1981 noise modelling and broader scale impacts on food web • Relevant Stakeholder ID 2510 said with regard to octopus and zoning that the best fishing is during day. He was concerned about five-hour fishing cycle (time period for picking up pots before survey vessel comes through (every ~14 hrs)). Removing surface floats requires VFA approval. • discussion regarding the order in which they should be done varies between fishery. It was stated that this should have been dealt with through consultation previously. CGG stated that it had been presented at the last two stakeholder meetings at Lakes Entrance. **Compensation:** • committee should consider a safety net in place in case impacts are identified • CGG suggested a revenue neutral situation was required, using catch and effort data of individual fishers, which requires fishers' permission to access data committee members wanted CGG to confirm they will compensate. CGG will generate a draft appeals process for discussion based on other models used.	arrival of South Australian fishers adds to competition. This claim was assessed as not having merit since (a) the zoning system was introduced in response to consultation with the fishing industry to enable them to forward plan their activities and many have expressed support for the approach, (b) the order of the zones being surveyed is also being planned in consultation with the fishing industry to reduce impacts on the fishing industry associated with certain areas/zones and timing (e.g. avoiding nearshore areas during summer/Christmas period), (c) CGG cannot control the activities of South Australian fishermen and can only reduce the impacts of their own activities, (d) no alternative approach was/has been suggested by SSFA who raised the claim. (e) the percentage o fhte acitvley fished area of the fishery that overlaps the survey area is relatively small and being highly mobile fishers, it is expected that they will spread out and not congregate in a small area within the survey area.	for the octopus regarding the zoning schedule. This meeting is planned to occur in January. **compensation for lost catch:** It was agreed during the meeting that CGG would generate a draft appeals process (compensation plan) based on other models used, for review by the SAC. A Fisheries Displacement Mitigation Plan has been drafted and reviewed by the SAC and CGG is seeking internal approval. Further notes on this are summarised below for the SAC meeting dated 3 January 2019.
	17/12/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the second SAC meeting: **Octopus study** • discussed proposal scope and costs, considering outside/industry funding and CGG asked if the scope could be scaled back. Cost mostly due to vessel costs. Could be reduced by reducing time. UTas to look at options to reduce costs and follow up with FRDC. **Danish seine study** • there were concerns about the timing of the survey starting in January/February and that the Danish seine proposal would be provided in January. Would need to start surveying before survey start date. • it was suggested that log book data could be used for C&E for analysis if necessary but would need cooperation from individual fishers to use their data. UTas noted if they wanted to get the fishers to participate in a proper BACI study, can't rely on their data as they may be fishing in a totally different area. • UTas stressed that if the experimental study was not properly planned and executed it would be a waste of time. **Zoning system** • UTas completing analysis on zoning order. Currently indicates there is not a lot of difference between zones in terms of timing of catch. • CGG noted that from an operational perspective they propose to start deep (southern) and move to shallow. Plan to do Zone 4 in March/April. **Fisheries Displacement Mitigation Plan** • draft Plan provided to SAC members prior to meeting. CGG asked how it would work if there is a bad fishing season in general – would the proposed Danish seine study be useful? It was noted that	The following concerns were raised and discussed at the meeting: 7. that the timing of the survey didn't allow adequate time for planning Danish seine study and collecting data before the survey start date (starting in January/February and the Danish seine proposal would be provided in January). 8. concern about the ability to detect change given 'noise' in catch rate data.	CGG has responded to the two objections and claims as follows: 7. **timing of the survey start date and the Danish seine study:** this concern was discussed in more detail in the SAC meeting on 3 January 2019 (refer to event summarised below). CGG stated that they need to remain flexible and that the 'go ahead' for studies will depend on EP approval. Once approved, they will decide timing and other operational details. Planning is ongoing, proposals have been received and SAC members will advise on the timing for studies during future meetings. 8. **ability to detect changes in catch and effort data:** UTas explained that using log book data for C&E for analysis would need cooperation from individual fishers and you can't rely on their data as they may be fishing in a totally different area. He suggested there were two options: • before/after program: identify power to detect specified change, proper experimental design • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. Per minutes of SAC meeting on 23 November 2018, UTas was in process of conducting an analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery (pre-survey) and was to provide a proposal for a non-commercial pre-determined sampling program (after the survey). Since this meeting, two approaches have been adopted (refer to Section 8.3.3.2 of the EP): (1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and (2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			the Danish seine study would be another piece of evidence for identifying any changes to fishing data as a consequence of the proposed survey. CGG requested the relationship between the sampling plan and how it feeds into the Mitigation Plan. **Update on EP** submitted last Monday and response will be available from NOPSEMA 9 January 2019. CGG noted the zones have been renumbered and changed (which SAC members were notified of in the lead up to the meeting).		level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.
	03/01/19	Meeting (Scientific Advisory Committee)	The following items were discussed and agreed during the third SAC meeting: **Danish seine study**: • UTas explained that the seasonality analysis report as expected, has shown that there is not a big seasonal component for separate zones and that based on analysis he wouldn't say any one zone is better than another. Results were therefore as expected with Danish seine summer catch (Dec-Feb) being higher and more variable, and Otterboard trawl tending to build up towards winter. • With regard to peak catches in Zone 6, SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". It was clarified that the area being referred to was South East reef, for which a smaller gun will be used. • CGG requested a recommendation as to which direction to begin surveying in, based on the data. UTas noted it was different for different fisheries, but he could combine values and analyse on combined worth, providing figures with values in zones and see which way would minimise cost. CGG agreed to this. • SSFA expressed concern that the GHaT data will be lost within the aggregated data (once that data is overlaid with Danish seine fishery). UTas explained you can see gap values in individual analysis. • There was further discussion about technical aspects of the study and a proposed survey design would be available for the SAC to review to understand the impact of events. • CGG stated they had been in touch with the FRDC and WAFIC regarding funding and/or involvement in the study. **Octopus study:** • UTas advised he had reviewed the quote but couldn't reduce the cost much, due to cost of vessels required. Noted that FRDC funding would be useful as their involvement then changes it to a category 1 study and certain costs would be removed. Also, easiest way for FRDC to be involved in terms of timing. • CGG asked if the study was ready to start sampling in February 2019. UTas advised he was waiting for CGG to provide funding to get extra equipment, and they will need 3 months to get mesh bags/extra lines. Also noted it was tough to organize as currently in peak charter time and vessels are booked out. Also noted some operators are in the prawn season, which will also take some time to sort out. However, from a scientific perspective they could be ready to go in February 2019. • CGG stated they were exploring options for additional support and equipment and meeting with the FRDC. **Compensation:** • CGG (CGG) advised they were dealing with internal management sign off of the Fisheries Displacement Mitigation Plan, and the effect of displacement on catch. They would like to put them forward as separate documents to SAC and then feed suggestions back to CGG. Timing for this was end of next week and a draft to be distributed to SAC by mid-late January 2019.	The following concerns were discussed at the meeting: 13. SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". This concern was assessed as not having merit since it was clarified during the meeting that the area being referred to in the discussion was South East reef, for which control measures have been adopted to mitigate impacts in this area (i.e. reducing power setting of the airguns including a 500 m buffer zone around the reef to avoid TTS injury to fish (including sharks). 14. SSFA also expressed concern that the GHaT data will be lost within the aggregated data analysis performed by UTas (once that data is overlaid with Danish seine fishery). This concern was assessed as not having merit since it was clarified by UTas during the meeting that you can see gap values in the individual analysis. No further control measures or changes are warranted. 15. There was some concern expressed with regard to reducing costs of the research studies. Difficulties included cost of vessels blowing out the quote for octopus study, the need for funding (FRDC or other). Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG has assessed this concern as having merit since it is important that the studies are properly planned and executed to get reliable data. CGG stated regardless of funding they would proceed with the studies anyway. No further action required. 16. UTas raised concern about planning aspects and timing of the octopus study and the seismic survey (i.e. tough to organize vessels as currently in peak charter time and they are booked out, also noted some operators are in the prawn season, which will also take some time to sort out).	In response to the fourth concern (that required action), CGG and Relevant Stakeholder ID 2510 agreed to meet to discuss the need for extra equipment up to three months prior to survey commencement. These discussions are in progress.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Status of EP: • CGG advised they were responding to additional queries from NOPSEMA, including clarification on the SAC and its processes. Specifically, they want to know the scope and frequency of future meetings. Since the EP was submitted before the last meeting CGG weren't able to provide NOPSEMA the minutes. **Other:** • Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG advised they plan to go ahead regardless. CGG and Relevant Stakeholder ID 2510 agreed to catch up when returned from leave to discuss the need for extra equipment up to three months before available. • CGG noted their preference was to survey from Zones 1 to 6 and it was noted that zone numbers should be used and not 'north-south' to avoid confusion. CGG noted at the next meeting the compensation proposals and funding information should be available and CGG would be in a better position to make commitments with regard to funding the studies.	CGG has assessed this concern as having merit since it is important that data is collected prior to the survey commencing. **Action:** CGG to discuss planning and logistics for the octopus survey in more detail with Relevant Stakeholder ID 2510 , in terms of getting equipment on time to support execution of the study before the seismic survey commences.	
	21/01/19	Meeting (Scientific Advisory Committee)	The fourth SAC meeting was held on 21 January 2019 however the minutes are not available for summary and inclusion in this EP update. The following items were discussed: • update on research projects • compensation • survey communications protocols update on study on zone order.	Objections and claims will be identified and assessed when the minutes have been drafted and reviewed.	NA
	Ongoing consultation: Relevant Stakeholder ID 763is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 3293	08/08/18 10/08/18 15/08/18 04/09/18 23/09/18 26/10/18 22/11/18	Phone call outgoing 1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification Rev 0	Via phone call 08/08/18: Relevant Stakeholder ID 3293 stated that he had not looked at any information passed through to him however is actively fishing within the survey and would like to be kept up to date with the survey. Relevant Stakeholder stated he would be in touch with SETFIA if he had any issues regarding the survey. No response was received in response to the first stakeholder consultation letter sent to Relevant Stakeholder ID 3293 on the 10th August. Via phone call on 15/08/18: Relevant Stakeholder ID 3293 confirmed he is actively fishing in the proposed survey area and requested to be kept up to date with information regarding the proposed survey. No response was received in response to the second consultation letter, emails outgoing and third consultation letter sent to Relevant Stakeholder ID 3293 on the 4th and 23rd September, 26th October and 22nd November respectively.	The request by Relevant Stakeholder ID 3293 to remain informed regarding the survey is merited. **Action**: CGG will continue to keep stakeholder up to date with consultation material.	Via phone call 08/08/18: CGG confirmed with Relevant Stakeholder ID 3293 that he would continue to be consulted regarding the proposed survey. Via phone call 15/08/18: CGG confirmed with Relevant Stakeholder ID 3293 that he would continue to be consulted regarding the proposed seismic survey. Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Relevant Stakeholder ID 3293 is a relevant stakeholder and CGG will continue to consult with him as part of the ongoing consultation process
	Ongoing consultation: Relevant Stakeholder ID 3293 . is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 1735	10/08/18 16/08/18 04/09/18 22/11/18	1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback or response received.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 1735 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2396	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing	No response was received in response to the first consultation letter sent to Relevant Stakeholder on 6th August 2018. Via phone call outgoing 16/08/18: Relevant Stakeholder answered the phone call from CGG stating that they had not looked at the information distributed to them and they would respond if they think they would be affected.	The request by Relevant Stakeholder to remain informed regarding the survey is merited. **Action**: CGG will continue to keep stakeholder up to date with consultation material.	Via Phone call outgoing 16/08/18: CGG informed Relevant Stakeholder that consultation material will continue to be sent through as it is composed. CGG will continue to consult with Relevant Stakeholder as a relevant stakeholder, as part of the ongoing consultation process

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
		3rd formal notification	No response was received in response to the second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder on the 4th September, 26th October and 22nd November respectively.		
	Ongoing consultation: Relevant Stakeholder ID 2396 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2514	29/05/18 26/10/18 22/11/18	1st formal notification Rev 0 Email outgoing 3rd formal notification Rev 0	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2514 is a relevant stakeholder and will therefore continue to receive project updates from CGG				
Relevant Stakeholder ID 2132	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2132 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2497	17/08/18	Phone call outgoing	Via phone call 17/08/18: Relevant Stakeholder ID 2497 stated that he had been made aware of the survey through his associations EO. Relevant Stakeholder stated that he was happy to move out of the way of the vessel if they paid the $80k/month turnover he would lose by being locked out of the fishing area Relevant Stakeholder raised the following additional issues: • Questioned whether CGG would be looking at the international evidence against seismic as it has not occurred in Australia as long • Stated that the scallop fishery used to be booming in the area but since a seismic survey came through in recent years the industry has not recovered.	The claims raised in Relevant Stakeholder ID 2497's feedback are as follows: • International evidence should be looked at regarding negative impacts of seismic surveys has limited merit. • Scallop fishery decline after a seismic survey has limited merit. The scallop industry's concerns over the decline of the scallop fishery are acknowledged, however there is no direct link between seismic surveys and Scallop mortality Przeslawski et al. (2018) investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established.	CGG responded to the concerns raised by Relevant Stakeholder ID 2497 via the second consultation letter distributed on the 04/09/18. The second consultation package has included international science to contribute to a robust assessment on the potential impacts on marine biota from seismic noise. The international science has been reviewed and included in the impact assessment for the proposal. The second consultation package included the impact assessment on scallops, stating the following: • Impacts of the proposed survey on scallops are expected to be minor and limited to short term effects within 625m of the seismic source (to which the survey is 2 km away from the emerging scallop bed to the north.) • No mortality of scallops is predicted as a result of exposure to single pulses of seismic sound • Repeated exposure during normal survey operations is unlikely given that adjacent lines will be acquired more than 24 hours apart and biota can recover between exposures which will diminish as the vessel moves to further lines.
	04/09/18 23/09/18	2nd formal notification fishers and fisheries Email outgoing	No response was received in response to the second consultation letter and emails outgoing sent to Relevant Stakeholder ID 2497 on 4th and 23rd September 2018.	NA	NA
	26/10/18 02/11/18	Email outgoing Meeting	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received. Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 1. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.		developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see rows below). Once meeting minutes are finalised, they will be distributed to all attendees.
	02/11/18 16/11/18	Phone call incoming Email incoming	Via phone call 02/11/18: Relevant Stakeholder reiterated the anxiety being felt by fishers and the need for better information on the effects of seismic acoustics to allay these concerns. Via email incoming 16/11/18: Relevant Stakeholder ID 2497 raised the following issues in his email: • Catch rates decline in the wake of seismic surveys • Effects not only targeted species but also the food chain • Understand the importance of the information being acquired however it should not be at the expense of the fishermen.	Relevant Stakeholder raised two claims: • Declining catch rates, which affects target species and food chains • Claims the survey should not be undertaken at the expense of fishermen.	CGG responded to Relevant Stakeholder claims as follows: • **Declining catch rates, which affects target species and food chains:** refer to Item #3 in the row above. • **Impacts on fishing industry activities:** responses have been summarised in the rows above. The third consultation letter provided feedback on the changes CGG has made in response to stakeholder input, including reducing the survey area by ~20% and removed almost all of zones 1 and 2 to reduce impacts on fishing in nearshore areas (where Danish seine fishers are active). It also described the Scientific Advisory Committee that has been established and is tasked with developing a research study on the impacts of seismic sound on the Danish seine fishery.
	22/11/18	3rd formal notification	No response has been received in response to the third consultation letter sent to Relevant Stakeholder ID 2497 on 22nd November.	NA	NA
	22/11/18 27/11/18	Email outgoing Letter outgoing	No response has been received in response to the email outgoing and letter outgoing sent to Relevant Stakeholder ID 2497 on 22nd November and 27 November respectively.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2497 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2755	26/09/18	Meeting	Meeting with Lakes Entrance fishers, representing both Commonwealth and Victorian fisheries: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. During the meeting, Relevant Stakeholder 2755 wanted to know the name of the seismic vessel that would be used in the survey.	No objections or claims.	Via meeting on 26/09/18: In response to his query raised in the meeting CGG informed Relevant Stakeholder that the vessel being used in the survey is called the Geo Coral.
	19/10/18 19/10/18 07/11/18	Email outgoing Email incoming Email outgoing	Via email incoming 19/10/18: In response to CGG's email outgoing regarding the status of the project, Relevant Stakeholder ID 2755 stated that there had only been one meeting with fishers and that NOPSEMA needed to be present at subsequent meetings.	The stakeholder raised concern regarding NOPSEMA's attendance at the meetings between	CGG responded via email on 07/11/18 regarding Relevant Stakeholder claims that NOPSEMA must attend the next meeting. CGG informed Relevant Stakeholder that other fishers had requested NOPSEMA's attendance at meetings however it is not their role nor function to be there in attendance.
	12/11/18 22/11/18	Email outgoing 3rd formal notification	No response has been received in response to the email outgoing and third consultation letter sent to Relevant Stakeholder on 12th and 22nd November respectively.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: Relevant Stakeholder ID 2755 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2212	23/08/18 26/10/18 22/11/18	Phone call outgoing Email outgoing 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2212 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2142	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2142is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2143	06/08/18 17/08/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing Email outgoing 3rd formal notifications	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2143 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2133	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 WM 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation Relevant Stakeholder ID 2133 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Corporate Alliance Enterprises	10/08/18 16/08/18	1st formal Notification Rev 1 WM Phone call outgoing	No response has been received in response to the first consultation letter and phone call outgoing to Corporate Alliance Enterprises on 10th and 16th August respectively.	NA	NA
	04/09/18 06/09/18 26/10/18 12/11/18	2nd formal notification fishers and fisheries Email incoming Email outgoing Email outgoing	In response to the second consultation letter sent by CGG on 04/09/18, in an email incoming on 06/09/18 Corporate Alliance Enterprises raised several key issues they had with the proposal: • The effect of seismic surveys on the catchability of fish becomes extremely vast • The size and scope of the survey is extremely large and almost completely covers the local fishing grounds • Split the survey into six smaller areas and only complete one each year • The effects on the local economy will be irreversible.	The following objections and claims have been raised by Corporate Alliance Enterprises: 1. The effect of seismic surveys on the catchability of fish becomes extremely vast 2. The size and scope of the survey is extremely large and almost completely covers the local fishing grounds 3. Split the survey into six smaller areas and only complete one each year 4. The effects on the local economy will be irreversible.	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. No response received. Via email outgoing 12/11/18: CGG has responded to each of Corporate Alliance Enterprises objections and claims as follows: 1. The impacts assessment has been based on the best available literature which, in general, indicated little impacts on catchability of target species. E.g. paper by Bruce et al 2018, found there to be no clear or consistent relationship between consistent behavioural or catch rate change due to the seismic survey. 2. CGG has reduced the size of the survey in response to stakeholder feedback. The exact changes will be projected in the upcoming stakeholder package (third stakeholder consultation letter). The survey is still broken into different zones to indicate to fishers the vessel will only be transiting in the one zone as to avoid interactions with other marine users. No long-term displacement or significant disruption is expected. The seismic vessel will only be occupying one zone at a time for a maximum of one month, 3. CGG is unable to reduce the survey into smaller zones and complete these one year at a time as this would lead to a disjunct survey and not achieve the overall objectives of conducting this survey. 4. CGG has devised a zoning scheme breaking the survey into smaller blocks were uses will only be excluded for shorter periods of time. This will enable fishers and other marine users to plan their activities around the location and forward plan of the seismic vessel. No long-term

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					displacement or significant disruption to fishing activities in the area is expected. The vessel will only occupy one zone at a time for a maximum of one month. A Notice to Mariners will provide official notifications of the exclusion zone, and relevant fishers will be kept informed of survey activities so that their fishing activities can be planned to avoid the area where the survey vessels are active.
	13/11/18 22/11/18	Meeting 3rd formal notification Rev 0	Via meeting 13/11/18 (SETFIA invited CGG representative to attend their meeting): The following were summarised by SETFIA from the meeting: • SETFIA wants to work with CGG to find a way the survey can occur with minimal effects on commercial fishing within the survey area • attendees at the meeting today were a third of the Commonwealth trawl quota ownership (within the survey area), all fish Relevant Stakeholder ID 2491et sales, some catching effort and some retail and secondary users • fishers with 125 years of experience explained that they were concerned about short term displacement of the fishing industry and then medium-term declines in catch rates • SETFIA is particularly affected by the CGG survey given its size, long duration and the importance of catches from the survey area. The following were also noted: 5. RPS in Perth is the new point of contact for consultation on the survey. SETFIA noted they requested CGG be the point of contact 6. CGG to consider appointing UTas as a member of the Scientific Advisory Committee. This would be a remunerated position. The first meeting date for the Committee is to be confirmed. The Committee would consider items 3 and 4 below. 7. there was in principle agreement to discuss a study that involves monitoring pre-survey catch rates against post-survey catch rates. any proposal for compensation that is not open-ended would be considered by CGG. The maximum time for negative effects proposed by SETFIA is 6 months. Long term recruitment would be excluded from the proposal.	SETFIA represents the views and interests of licence holders, fishers and businesses with a commercial interest in the Southern and Eastern Scalefish and Shark Fishery, specifically the Commonwealth Trawl Fishery, Shark Gillnet Hook and Trap and Scalefish Hook sectors. The following objections and claims were raised, and all are relevant to their functions, interests and activities: 5. SETFIA members are primarily concerned about short term displacement of the fishing industry from the survey area, and then medium-term declines in catch rates 6. SETFIA members are particularly affected by the survey given its size, long duration and the importance of catches from the survey area 7. SETFIA believe there should be a compensation agreement in place in the event there are impacts on catch as a result of the survey. **Action:** CGG to address and respond to SETFIA's objections and claims listed above, noting any change or control measures adopted in response to the feedback. SETFIA also recommended CGG consider inviting Dr UTas onto the Scientific Advisory Committee. **Action:** CGG to invite Dr UTas onto the Scientific Advisory Committee.	Via meeting 13/11/18: CGG provided the following responses to the objections and concerns raised during the meeting: 5. **short-term displacement of fishers from survey area:** CGG noted that changes have been made to the survey area in response to stakeholder feedback to date, including reducing the area in size, trimming it to avoid habitat important to fishers and implementing a zoning system, and adopting a notification schedule before the survey, and communications measures during the survey to reduce short-term impacts to fishing operations. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). **medium-term declines in catch rates:** CGG has assessed the impacts of seismic operations on the fisheries species that are relevant to the organisations that Simon represents. A summary of the assessment (citing current research available on medium to long-term impacts on catch rates) was provided in the second stakeholder consultation letter. CGG also noted the uncertainty associated with measuring longer-term impacts attributable to seismic activities in the letter. 6. **size, location and duration of the survey:** CGG noted that changes have been made to the survey area and timing. The survey area has been reduced in size by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removes overlap with the nationally important 'Big Horseshoe Canyon' – an area of high ecological value – to the northeast of the survey area and with fishing habitat in this area, particularly grounds that are targeted by Danish seiners and an important nearshore scallop bed. The timing has been shifted from January to end of July in response to concerns raised by charter fishers and seafood suppliers about shore-term impacts over the Christmas period. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 7. **compensation for impacts to catch that are attributable to survey:** CGG explained that the SAC will be tasked to discuss compensation arrangements for the survey to identify a potential solution. CGG have appointed Dr UTas a member of the Scientific Advisory Committee. The first SAC meeting was held on 23rd November 2018.
	Ongoing consultation: Corporate Alliance Enterprises is a relevant stakeholder and will therefore continue to receive project updates from CGG				
Relevant Stakeholder ID 868, 2433, 2273 ***Refer also to Relevant Stakeholder ID 2434***	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback received in response to the first, second or third consultation letters. Via phone call outgoing 16/08/18: Relevant Stakeholder answered the phone call from CGG stating that Relevant Stakeholder ID 2434 will be representing them regarding this proposal. Requested for information to continue to be sent through them. No response to the email outgoing on 26/10/18.	No objections or claims. Relevant Stakeholder requested that consultation be conducted via Relevant Stakeholder ID 2434 **Action**: CGG will continue to keep stakeholder up to date with consultation material, and conduct consultation on specific objections and claims via Relevant Stakeholder ID 2434	Via phone call outgoing 16/08/18: CGG informed Relevant Stakeholder that consultation material will continue to be sent through as it is composed, as well as continuing to engage with them.
	Ongoing consultation: Relevant Stakeholder ID 868, 2433, 2273 is a relevant stakeholder and will therefore continue to receive project updates from CGG. Consultation on objections and claims relevant to the interests and will be conducted via Relevant Stakeholder ID 2434.				

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Relevant Stakeholder ID 868, 2273 ***Refer also to Relevant Stakeholder ID 2434**	28/05/18 13/08/18 04/09/18 23/09/18 26/10/18 22/11/18	1st formal notification Rev 0 1st formal notification Rev 1 2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification Rev 0	No feedback received in response to the first, second or third consultation letters.	NA	CGG is aware that Relevant Stakeholder ID 868, 2273 are directing consultation via Relevant Stakeholder ID 2434 , therefore CGG will continue to keep stakeholder up to date with consultation material, and conduct consultation on specific objections and claims via Relevant Stakeholder ID 2434 .
	Ongoing consultation: Relevant Stakeholder ID 868, 2273 is a relevant stakeholder and will therefore continue to receive project updates from CGG. Consultation on objections and claims relevant to the interests and activities of Relevant Stakeholder ID 868, 2273 will be conducted via Relevant Stakeholder ID 2434 .				
Relevant Stakeholder ID 2145	06/08/18 15/08/18	1st formal notification Rev 0 Phone call outgoing	No response was received in response to the first consultation letter. Via phone call outgoing 15/08/18: Relevant Stakeholder answered the phone call from CGG stating that he doesn't personally fish his quota however people fish it for him and they are fishing in the Gippsland Basin area and would need to be kept informed on the project.	The request by Relevant Stakeholder to remain informed regarding the survey is merited. **Action**: CGG will continue to keep stakeholder up to date with consultation material.	CGG will continue to keep Relevant Stakeholder informed with information regarding the survey.
	04/09/18 23/09/18	2nd formal notification fishers and fisheries Email outgoing	No feedback received in response to the second consultation letter sent to Relevant Stakeholder on 4th September 2018. Email outgoing 23/09/18: CGG sent invitation to attend meeting on 26 July.	NA	NA
	26/09/18	Meeting	Meeting with Lakes Entrance fishers, representing both Commonwealth and Victorian fisheries: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. Relevant Stakeholder raised the following issues at the meeting: • Relevant Stakeholder asked what the likely downtime would be as his experience with a previous survey conducted by the Geco Beta was bad weather could easily blow out at times • Suggested that NOPSEMA should be present at these meetings as fishers and proponents wee in oppositional lockstep which stalled discussions, this needed to be done as soon as possible • Also, that the source vessel needed to have officers that were competent in their knowledge of fishing operations • Geco Beta survey 2001-2002 where downtime was mostly due to whales and bad weather • Contingency funding to conduct relevant studies would help. That he had attended at least 10 similar meetings and they were always in lockstep and NOPSEMA are never there. Determining what type of research was appropriate was a challenge • Reiterated the importance of a fishing savvy officer on watch Relevant Stakeholder referred to Notices to Mariners and the implications of precautionary exclusion zones which were sometimes excessive and the badly handled by officers who had a poor understanding of fishing practices. Stated that the nationality of the bridge crew could sometimes lead to miscommunication.	The following objections and claims were raised by Relevant Stakeholder and are considered relevant to his interests and activities: 1. claimed that NOPSEMA should be present at these meetings as fishers and proponents wee in oppositional lockstep which stalled discussions, this needed to be done as soon as possible. 2. that the source vessel needed to have officers that were competent in their knowledge of fishing operations. 3. the importance of a fishing savvy officer being on watch 4. the implications of exclusion zones, and the nationality of the bridge crew could sometimes lead to miscommunication.	Response to Relevant Stakeholder claims raised in the Meeting held on the 25/09/18 are as follows: 1. Fishers have previously requested NOPSEMA's attendance at these meetings however it is not in their function to attend. 2. CGG stated they would consider having a fisher on board the vessel to help with these potential conflicts. 3. Refer to response to claim 2 above. 4. CGG assured that crews would primarily be Australian, that the chase boats would be locally sourced, and this would avoid this potential problem.
	19/10/18	Email outgoing	CGG informed stakeholders via email on the 19/10/18 of the status of the project and NOPSEMA decision to reject the EP.	NA	NA
	26/10/18	Email outgoing	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			made in response to feedback, overview of technical aspects of seismic surveys.		
	02/11/18	Meeting	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 4. reducing impacts on charter operators targeting snapper during the Christmas period 5. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 6. impacts to target species and catches of other fisheries.	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 4. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 5. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 6. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see rows below). Once meeting minutes are finalised, they will be distributed to all attendees.
	12/11/18 13/11/18 22/11/18	Email outgoing Email outgoing 3rd formal notification Rev 0	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25th Sept to attendees for review. No feedback received from Relevant Stakeholder. Via Email outgoing 13/11/18: CGG resent the email sent on the 12/11/18 to an additional address for Relevant Stakeholder. No response has been received in response to the third consultation letter sent to Relevant Stakeholder on the 22nd November 2018.	NA	NA
	Ongoing consultation: Relevant Stakeholder 2145 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2398	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response to any outgoing communication.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2398 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2294	06/08/18 14/08/18 04/09/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries	No response to any outgoing communication.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	26/10/18 22/11/18	Email outgoing 3rd formal notification Rev 0			
	Ongoing consultation: Relevant Stakeholder ID 2294 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2496	17/08/18 17/08/18 24/09/18 13/11/18 13/11/18	Phone call outgoing SMS outgoing SMS outgoing Phone call outgoing Letter outgoing	No response was received in response to phone call outgoing and SMS' sent to Relevant Stakeholder ID 2496 on 17th August and 24th September 2018. Via phone call outgoing 13/11/18: Relevant Stakeholder ID 2496 answered the phone call outgoing from CGG and mentioned the following issues and queries regarding the survey: • There are significant drops in catch post seismic surveys • Asked why the survey is being undertaken when nobody wants it done • Fishermen all over the world report drops in catch and note that fish and invertebrates (scallops and crayfish) die because of seismic • There is no science to prove that there is no impact • Indicated South East Reef was previously a blue warehou hotspot.	The following objections and claims are relevant to Relevant Stakeholder interests and activities: 1. Claimed there are significant drops in catch post seismic surveys 2. Claimed nobody wants the survey to go ahead 3. Claimed fishermen all over the world report drops in catch and note that fish and invertebrates (scallops and crayfish) die because of seismic 4. Claimed there is no science to prove that there is no impact 5. Claimed that South East Reef is an important area for blue warehou.	Via letter outgoing 13/11/18: CGG responded to the claims raised by Relevant Stakeholder ID 2496 in a letter posted on 13/11/18. The letter attached the second stakeholder letter prepared for fishers and fisheries. 1. **drops in catch rates:** The impacts assessment has been based on the best available literature which, in general, indicated little impacts on catchability of target species. E.g. paper by Bruce et al 2018, found there to be no clear or consistent relationship between consistent behavioural or catch rate change due to the seismic survey. 2. **justification for the survey:** CGG has identified several issues with previous surveys that prevent a comprehensive regional geological evaluation of the Gippsland Basin. This survey is intended to resolve these issues by achieving a basin-wide coverage of seismic data to accurately map the extent of geological structures within the basin with confidence. Discovery of further hydrocarbon reserves could extend the working life of the existing petroleum industry in the region. 3. **Fishermen all over the world report drops in catch and note that fish and invertebrates die because of seismic**: The impacts assessment has been based on the best available literature which, in general, indicated little impacts on catchability of target species. The impact assessment has reviewed the best available international science which too, in general has indicated little impacts on catchability of fish. Behavioural changes such as swimming behaviour and orientation are expected while the sound source is active however researchers have observed that once the acoustic disturbances are removed, fish return to normal behaviour within about an hour (Pearson et al. 1992; McCauley et al. 2000; Wardle et al. 2001; Hassel et al. 2004). There is no physical international evidence of fishers claiming loss of catch due to seismic, claims are anecdotal. 4. **no science to prove there is no impact:** This is covered in response to item 1 and 3 above. 5. In response to Relevant Stakeholder comments regarding **South East Reef**, the survey is avoiding intensive undershooting activities in the vicinity of South East Reef, which is also expected to be important lobster habitat.
	13/11/18 22/11/18	2nd formal notification fishers and fisheries 3rd formal notification	No response was received in response to the second and third consultation letters sent to Relevant Stakeholder ID 2496 on the 13th and 22nd November respectively.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2496 is a relevant stakeholder and will therefore continue to receive project updates from CGG				
Relevant Stakeholder ID 2214	17/08/18 23/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing 1st formal notification Rev 2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback or response received to any communications from CGG.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2214 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2502	25/06/18 17/07/18 19/07/18 19/07/18 26/07/18	Phone call incoming Phone call outgoing Email incoming Email outgoing Email incoming	Via phone call incoming on 25/06/18: Relevant Stakeholder ID 2502 informed CGG that he operates a fishing charter in the Bass Canyon area and requested further information on impacts to fishing. Relevant Stakeholdestated he is not against MSS and has a vessel that he would be interested in supplying for support vessel works. Via phone call outgoing on 17/07/18:	No objections or claims.	CGG responded to Relevant Stakeholder ID 2502 's phone call requesting further information via phone call outgoing on 17/07/18. CGG and Relevant Stakeholdeagreed on a time and date for a meeting in Lakes Entrance to discuss the key issues of interference with fishing areas and the possibility of supplying a support vessel for the survey. CGG distributed an invitation to the lakes entrance meeting for the 26/07/18 via email on the 19/07/18.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Relevant Stakeholdeagreed to a meeting with CGG on the 26/07/18. The agenda of the meeting was to cover interference with fishing areas and the possibility of supplying a support vessel for the survey. Via email incoming 19/07/18: Relevant Stakeholderesponded to an email from CGG confirming his availability for the meeting on the 26/07/18. Via Email incoming 26/07/18: Relevant Stakeholdeemailed informing CGG that he would be in attendance of the meeting today however he does not want to discuss the possibility of using his boat as a support vessel during the meeting with the other fishers.		
	26/07/18	Meeting	Via meeting at Lakes Entrance 26/07/18 (attended by LEFCOL and commercial/charter fishers): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Relevant Stakeholder raised the following specific comments: • Relevant Stakeholder stated that the timing of the survey was during prime snapper catching period. • Relevant Stakeholder stated that the spawning period for snapper was November through to March • Relevant Stakeholder asked whether the survey would affect snapper spawning • Relevant Stakeholder asked about the impacts on whales • Relevant Stakeholder stated that he relied on snapper catches and that catches had been the best for years at Lakes Entrance. Additional comments made by Relevant Stakeholder included: • Stated that he had hooked snapper with a seismic vessel nearby • Stated that the recreational swordfish fishery has grown significantly over the last few years with up to 80 boats a day in good weather (less than 10kts). The vessels used are up to 60ft long and travel up to 80km/h. They travel out to the shelf and often have an inexperienced crew. • Relevant Stakeholder stated that there had been a $2 million study in Port Philip Bay on snapper recruitment, but nothing had been spent at Lakes Entrance • Relevant Stakeholder stated there is a problem with the lack of investment in science.	Relevant Stakeholder raised nine concerns about timing of the survey, impacts on spawning fish and impacts to whales. CGG considers the comments regarding the timing of the survey and impacts to spawning relevant to Relevant Stakeholder 's functions, interest and activities. These are addressed in the right-hand column. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback. CGG considers the comments made by Relevant Stakeholder regarding impacts to whales are not relevant to his functions, interests or activities as a fishing charter operator, as well as the studies undertaken by the government on snapper stocks in Victoria and the lack of investment in science. It should be noted however that the second stakeholder consultation letter provided to Relevant Stakeholder does cover impacts to whales (in terms of survey timing and location).	Via meeting on 26/07/18: During the meeting (and following) CGG responded to Relevant Stakeholder's objections and claims as follows: 1. CGG have provided information on survey timing in the third consultation package distributed to Relevant Stakeholder ID 2502 on the 22nd November 2018. CGG have responded to stakeholder concerns regarding the timing of the survey and have adjusted the survey timing to avoid the holiday period and important months as identified by charter operator such as Relevant Stakeholder ID 2502 . 2. See response to issue 1 above. The survey start time has been pushed back to begin in January in response to stakeholder feedback. 3. The second consultation package distributed on the 4th November included information on the impacts of seismic noise on spawning fish. Majority of the commercially important fish species within the survey area are broadcast spawners (Including snapper) therefore the risk of impacts on numbers are relatively low. 4. CGG responded to Relevant Stakeholder 's concerns regarding the impacts on whales by stating that the EPBC Act policy guidelines would be applied for whales. Whales are not regarded as Relevant Stakeholder ID 2502 's Interests, activities or functions; therefore, no further information has been provided to him on this matter. However, it should be noted however that the second stakeholder consultation letter provided to Relevant Stakeholder does cover impacts to whales (in terms of survey timing and location). 5. CGG appreciate the feedback provided by Relevant Stakeholder in regard to the importance of the species on his business. CGG have adjusted the survey timing in response to stakeholder feedback and have reiterated this in the third consultation package distributed in November. 6. CGG acknowledge the feedback provided by Relevant Stakeholder regarding his claim that he has been able to catch snapper while near a seismic vessel. This anecdotal evidence supports the research conducted by Bruce et al. 2018 which has been used in the impact assessment, concluding that there is no clear linkage between lower catch rates and seismic surveys. 7. CGG stated that in the FLO's experience Swordfish do not appear to affect by seismic. 8. Item 8 does not have merit as it is not relevant to Relevant Stakeholder 's functions, interests and activities. 9. Item 9 does not have merit as it is not relevant to Relevant Stakeholder 's functions, interests and activities.
	08/08/18	Email outgoing	CGG sent the meeting minutes to all attendees for review on the 08/08/18.	No objections or claims.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	17/08/18 17/08/18 20/08/18 20/08/18 20/08/18 20/08/18 04/09/18	Phone call outgoing SMS outgoing Email incoming Phone call incoming Phone call outgoing Phone call incoming 2nd formal notification fishers and fisheries	No response received in response to phone call outgoing on 17th August. In response to an SMS outgoing from CGG sent on the 17/08/18 Relevant Stakeholder ID 2502 responded via email on the 20/08/18 stating that he is operating within the proposed survey area and will need to be kept informed regarding the proposed survey. Via phone calls (x3) 20/08/18: Missed calls.		
	23/09/18	Email outgoing	CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made.	NA	NA
	25/09/18	Meeting	CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. The issues raised by Relevant Stakeholder ID 2502 were: • Relevant Stakeholder repeated his concerns about survey timing in Zone 1 as December was a key time for snapper • Recent information had indicated the East Gippsland snapper stocks were separate from the Port Philip/ Westernport Bay and NSW populations • Relevant Stakeholder referred to recent information saying that snapper spawning was localised to zone 1 and was concerned that seismic would affect spawning during the months of November and December (with some secondary spawning in March) • Relevant Stakeholder stated that the deep areas (600 m) of zones 2,3,4,5,6 and 7 were showing much promise as swordfish areas, potentially world class and that he was concerned that the baitfish which appear at about 300 m depth on the echo sounder would be killed. • Concerned about the after effects and needed reassurance as to how CGG would mitigate them.	The following objections and claims were made by Relevant Stakeholder during the meeting: 1. Concern about timing of activity in zone 1 2. Concern about impacts on snapper, particularly spawning in zone 1 3. Concern about impacts on swordfish and batfish 4. Concern about impacts following completion of the survey.	Via meeting on 25/07/18: During the meeting (and following) CGG responded to Relevant Stakeholder 's objections and claims as follows: 1. **Timing of activity in zone 1:** CGG asked Relevant Stakeholder when he thought the best time to survey the area to minimise impacts on snapper and Relevant Stakeholder responded "Now". CGG later removed Zone 1 from the survey area and adjusted the proposed start date to January 2019. These changes were described in the third stakeholder consultation letter. 2. **Impacts on snapper, including spawning in zone 1:** CGG investigated the claim about separate snapper populations (response is in the row below). There is no scientific evidence to support this claim that the snapper stocks are biologically different. CGG have adjusted the survey timing, further explained in the third consultation package and in response to item 1 from the meeting held on the 26/07/18. 3. **Impacts on fish species, snapper, swordfish and batfish:** The second stakeholder consultation letter summarised the impact assessment on fish species. No mortality of fish species is expected. As stated in the letter, the effects of underwater noise on fish within the vicinity of the Gippsland MSS may either be physiological injury (no fish mortality is expected) or behavioural disturbance. Behavioural changes are expected to be localised and temporary, with displacement of pelagic or migratory fish likely to have insignificant repercussions at a population level. 4. **Concern about impacts of survey following completion:** CGG responded to Relevant Stakeholder 's concern in the meeting stating that if it were obvious the adverse effects that were being claimed were true then the survey would not be undertaken.
	03/10/18 03/10/18	Email outgoing Email incoming	Email outgoing on the 03/10/18 from the FLO requesting further information on the comment made by Relevant Stakeholder regarding the separate population of snapper in East Gippsland to Port Philip/ Westernport Bay and NSW. Email to Relevant Stakeholder to find associated literature to support his claims. Email incoming 03/10/18: Relevant Stakeholder ID 2502 responded to the email incoming from the FLO regarding further information to the comments made at the meeting regarding the different snapper populations in the VIC waters. Relevant Stakeholder stated that the NSW, SA and QLD governments have researched snapper stocks, as well as the VIC government in the Westernport and Port Philip bay, however not the eastern VIC stock. The stock assessments have recently discussed a separate eastern and western stock. Relevant Stakeholder stated that he was unsure that this information would be found in literature however more information could be found on the PIRSA website and the National Library of Australia.	Relevant Stakeholder provided further information to CGG on the claim that there are distinct populations of snapper. Raised the concern about the impacts on snapper spawning on his operations.	CGG provided a response to Relevant Stakeholder's concern about spawning snapper stocks via the second consultation letter. CGG noted the survey area now avoided SE Reef as a known spawning ground for several targeted commercial fish including snapper. Zone 1 has also since been removed from the survey area and this was described in the third stakeholder consultation letter.

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Relevant Stakeholder further reiterated his concern regarding whether seismic surveys kill snapper spawn because his operations solely rely on this species.		
	19/10/18	Email outgoing	No response has been received in response to the email sent to Relevant Stakeholder ID 2502 on 19th October 2018.	NA	CGG informed stakeholders via email on the 19/10/18 of the status of the project and NOPSEMA decision
	26/10/18 02/11/18	Email outgoing Meeting	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 1. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see rows below). Once meeting minutes are finalised, they will be distributed to all attendees.
	07/11/18	Email outgoing	CGG provided additional information to Relevant Stakeholder regarding his queries on snapper spawning and locations, in particular research conducted by Professor Bronwyn Gillanders. No response received.	NA	NA
	12/11/18 22/11/18	Email outgoing 3rd formal notification	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25th Sept to attendees for review. No feedback received from Relevant Stakeholder ID 2502 . No response has been received in response to the third consultation letter sent to Relevant Stakeholder ID 2502 on the 22nd November 2018.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2502 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2146	06/08/18 15/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received to any outgoing correspondence.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: Relevant Stakeholder ID 2146 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2295	06/08/18 15/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback or response received to any outgoing correspondence.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2295 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2156	01/08/18 17/08/18 04/09/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries	No response has been received in response to the first consultation letter. Via phone call outgoing 17/08/18: Relevant Stakeholder informed CGG that he is against seismic. Relevant Stakeholder stated that it is destructive and would like it to just be done once and get it over with. Is fishing in the area and needs to be kept informed. CGG told Relevant Stakeholder that he would be kept informed regarding the proposed survey.	Relevant Stakeholder made the following claims: • Seismic surveys are destructive • They should be done once so there is no need to have subsequent surveys. **Action**: CGG will continue to keep stakeholder updated on the survey and respond to the two claims and concerns above.	CGG responded to Relevant Stakeholder 's claims via the second consultation letter on the 4th September. • **Seismic surveys are destructive:** The second stakeholder consultation letter included a summary of the impact assessment for the proposal. The impact assessment summary covers the impacts of seismic sound, impacts to invertebrates (including bi-valves and cephalopods) and impacts to fish (including sharks), as well as the mitigation methods and techniques in place to minimise the predicted impacts. • **Seismic surveys should be done once:** The justification for the survey was described in the second stakeholder consultation letter, in response to feedback from fishers. CGG has identified several issues with previous surveys that prevent a comprehensive regional geological evaluation of the Gippsland Basin. This survey is intended to resolve these issues by achieving a basin-wide coverage of seismic data to accurately map the extent of geological structures within the basin with confidence. Discovery of further hydrocarbon reserves could extend the working life of the existing petroleum industry in the region.
	23/09/18 25/09/18	Email outgoing Meeting	Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Via meeting 25/09/18: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. Relevant Stakeholder raised no issues during the meeting.	No objections or claims.	NA
	19/10/18	Email outgoing	CGG informed stakeholders via email on the 19/10/18 of the status of the project and NOPSEMA decision to reject the EP. No response received.	NA	
	26/10/18 02/10/18	Email outgoing Meeting	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers)	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 1. **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	3. impacts to target species and catches of other fisheries.	target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see rows below). Once meeting minutes are finalised, they will be distributed to all attendees.
	12/11/18 22/11/18	Email outgoing 3rd formal notification Rev 0	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25th Sept to attendees for review. No feedback received from Relevant Stakeholder. No feedback received in response to the third consultation letter sent to Relevant Stakeholder on the 22nd November 2018.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2156 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2202	17/08/18 21/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing 1st formal notification Rev 2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received to any outgoing communications from CGG.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2202 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2134	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback or response received.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2134 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2135	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2135 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2335	17/08/18 13/11/18	Phone call outgoing Phone call outgoing	No feedback or response received to outgoing phone calls.	NA	NA
	Ongoing consultation: CGG will continue to contact Relevant Stakeholder ID 2335 about the project.				
Relevant Stakeholder ID 2530	23/08/18 03/09/18 24/09/18	Phone call outgoing Phone call outgoing SMS outgoing	No response received.	NA	NA
	25/09/18	Meeting	CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. Relevant Stakeholder ID 2530 raised no queries or issues.		
	02/11/18	Meeting	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: 1. reducing impacts on charter operators targeting snapper during the Christmas period 2. impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) 3. impacts to target species and catches of other fisheries.	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: 1. reducing impacts on charter operators targeting snapper during the Christmas period: CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. 2. impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers: CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. 3. impacts to target species and catches of other fisheries: CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see rows below). Once meeting minutes are finalised, they will be distributed to all attendees.
	14/11/18 22/11/18 26/11/18	Phone call outgoing 3rd formal notification Phone call outgoing	No feedback or response received.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2530 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2297	29/05/18 14/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response was received in response to the first consultation letter. Via phone call outgoing 14/08/18: Relevant Stakeholder answered the phone call from CGG stating that they had not looked at the information distributed to them. Debbie stated that all fishermen have concerns however they all have businesses to run too. CGG informed Relevant Stakeholder that consultation material will continue to be sent through to her and that any feedback she has is greatly appreciated and that all contact details can be found on the consultation packages distributed to her. No response to the second consultation letter, email outgoing on 26/10/18 and third consultation letter sent to Relevant Stakeholder ID	No objections or claims	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			2297 on the 4th September 26th October and 22nd November respectively.		
	Ongoing consultation: Relevant Stakeholder ID 2297 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2789	24/11/18	Email incoming	Via email incoming 24/11/18: Relevant Stakeholder informed CGG of her position as an octopus live trader and licence within the Victorian Ocean (general) Fishery. Relevant Stakeholder requested to be kept informed with stakeholder updates regarding the proposal.	No claims or concerns made however Relevant Stakeholder is a relevant stakeholder and has made requests to be kept informed regarding the survey and this has merit	See CGG's response in phone call outgoing in the row below
	26/11/18 26/11/18 26/11/18	Phone call outgoing Email outgoing Email outgoing	Via phone call outgoing 26/11/18: Relevant Stakeholder informed GG that she is one of the three octopus fishing families in the area (Along with Relevant Stakeholder ID 766 and Relevant Stakeholder 760). Relevant Stakeholder indicated a strained relationship with other fishers and therefore would not have been told of the survey by them. Relevant Stakeholder stated she was informed of the survey through her friend SSFA. Informed CGG that her licence holder is xxx and that she will forward on all correspondence going forward to him. Stated she has recently switched to live octopus trade to Sth Korean Relevant Stakeholder ID 2491ets. Stated that her operations are unlikely to be affected by the proposed survey. she does occasionally fish for shark In response to an update on the SAC and potential octopus monitoring program by CGG, Relevant Stakeholder noted licence holders have previously been involved in some research with the VFA in relation to catch rations for octopus fishing. Relevant Stakeholder stated it takes around 2hr to retrieve pots (if they are to be removed from the water).	No claims or concerns in Relevant Stakeholder's response however Relevant Stakeholder does detail some important information to assist CGG in designing octopus research programs and timings for pot retrieval.	Via phone call outgoing 26/11/18: CGG apologised to Relevant Stakeholder for not having included her as a relevant stakeholder. CGG explained the key consultation events that had previously occurred with fishers and stated that we would follow up with the stakeholder consultation packages as well as any additional information that Relevant Stakeholder requests. Confirmed that all consultation would be conducted directly with Relevant Stakeholder. Via Emails outgoing (x2) 26/11/18: CGG sent through to Relevant Stakeholder the 1. General project introduction (CGG_Gippsland_MSS_EP_Stakeholder_Consultation_Letter_Rev 1). This was first distributed end of May. 2. Summary of potential impacts to fisheries and fishers, and the control measures adopted to reduce impacts (CGG_Gippsland_MSS_EP_Stakeholder_Consultation_Letter_-_Fishers_and_Fisheries). This was distributed early September. 3. Update on changes to the survey area and zoning system (see also the attached map), description of the Scientific Advisory Committee (GG Gippsland MSS EP_Stakeholder Consultation Letter_181121). This was sent out to stakeholders last Thursday, 22nd November 2018. CGG informed Relevant Stakeholder that any feedback would be welcomed and in particular any control measures or changes that could be made to the proposed survey that may further reduce any impacts on her activities. Informed Relevant Stakeholder that she has been added to the distribution list for all further consultation and that she would receive communications directly from CGG in the future.
	26/11/18 26/11/18	Email incoming Email outgoing	Via email Relevant Stakeholder requested a copy of the meeting minutes from the previous two meetings with Lakes Entrance fishers to review	No claims or concerns were raised in Relevant Stakeholders email however she has requested the minutes from the previous Lakes Entrance meetings, to which has merit	Via email outgoing CGG provided Relevant Stakeholder with the meeting minutes from the previous two meetings with Lakes Entrance fishers and confirmed that additional meeting minutes would be sent on once they had been finalised.
	Ongoing consultation: Relevant Stakeholder ID 2789 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2399 ***Refer also to Relevant Stakeholder ID 2434 ***	06/08/18 16/08/18 04/09/18 04/09/18 23/09/18 26/09/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing Email outgoing 3rd formal notification Rev 0	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2399 on 6th August 2018. Via phone call outgoing 16/08/18: Relevant Stakeholder ID 2399 answered the phone call from CGG stating that Relevant Stakeholder ID 2434 will be representing them regarding this proposal. Requested for all discussions be directed to Chris CGG informed Relevant Stakeholder ID 2399 that consultation material will continue to be sent to him, and they would engage with Relevant Stakeholder ID 2434 on behalf of Relevant Stakeholder ID 2399.	Horst requested that consultation be conducted via Relevant Stakeholder ID 2434 . **Action**: CGG will continue to keep stakeholder up to date with consultation material, and conduct consultation on specific objections and claims via Relevant Stakeholder ID 2434 .	NA
	Ongoing consultation: Relevant Stakeholder ID 2399 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2130	10/08/18 16/08/18 04/09/18 26/10/18	1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing	No feedback or response received to any outgoing communications from CGG.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	22/11/18	3rd formal notification			
	Ongoing consultation: Relevant Stakeholder ID 2130 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2147	06/08/18 13/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 1st formal notification Rev1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback or response received to any outgoing communications from CGG.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2147 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2400	06/08/18 14/08/18 04/09/18 23/09/18 26/09/18 13/11/18 13/11/18 13/11/18 22/11/18	1st formal notification Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing Phone call outgoing Email outgoing Email incoming 3rd formal notification	No response was received in response to the first, second or third consultation letters, the phone call outgoing on 14/08/18 and emails outgoing on 23rd and 26th September 2018. Via phone call outgoing 13/11/18: Relevant Stakeholder ID 2400 stated that they are fishing in the area, but he raises any concerns they have directly with SIV. Relevant Stakeholder stated he was unsure if he had received any information. Note that the Consultation Manager software shows that the second stakeholder letter has been opened). CGG informed Relevant Stakeholder that SIV have been involved in consultation with us and any issues raised have been responded to and passed back through to SIV. CGG confirmed with Relevant Stakeholder that he would like to continue to receive the consultation material, to which he replied yes. Via email outgoing 13/11.18: CGG sent an email to Relevant Stakeholder documenting the phone call that had occurred earlier that day. CGG confirmed that consultation material will continue to be distributed Relevant Stakeholder. CGG informed Relevant Stakeholder that feedback is always welcome and contact details are provided on consultation materials. Via email incoming 13/11/18: In response to the email, Relevant Stakeholder stated that they would like to be kept informed on the proposal but would continue to alert SIV to any concerns not CGG.	No objections or claims.	NA
	Ongoing consultation: Relevant Stakeholder ID 2400 is a relevant stakeholder and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2434	06/08/18 14/08/18 29/08/18	1st formal notification Rev 0 Phone call outgoing Email outgoing	No response was received in response to the first consultation letter sent to Relevant Stakeholder on the 06/08/18. Via phone call outgoing 14/08/18: Relevant Stakeholder stated that they are in the process of drafting a response to the proposed survey. Relevant Stakeholder stated that the issues that will be raised are around the impacts on squid, scallops and rock lobsters. They are aware of the scientific papers that are out regarding the negative impacts of seismic on squid, scallops and rock lobsters. He will be pushing the precautionary principle to the Env Department that if there is not enough scientific evidence surrounding the impacts of seismic, then it should not be allowed to go ahead until we know the full implications of the matter at hand.	Relevant Stakeholder stated he would be raising concerns about the survey via a formal written letter. Refer to row below for summary of the letter, including merit assessment and response.	Email outgoing 29/08/18: CGG emailed Relevant Stakeholder to confirm that a response to the issues raised during the phone call was being compiled.
	30/08/18 05/09/18	Email incoming Email outgoing	Relevant Stakeholder presented his response to the proposed seismic survey on behalf of the fisheries he is representing. The following concerns were raised: • lack of knowledge on the effect of seismic surveys on the squid biomass. • there is scientific information that suggests that squid are adversely affected by seismic surveys. Squid spawn all year round at depths	Relevant Stakeholder raised the following objections and claims: • lack of knowledge on the effect of seismic surveys on the squid biomass • there is scientific information that suggests that squid are adversely affected by seismic surveys. Squid spawn all year round at depths up to	Via email outgoing 05/09/18: CGG responded to Relevant Stakeholder claims as follows: • **lack of knowledge on the effect of seismic surveys on the squid biomass.** on behalf of CGG, RPS has conducted a thorough assessment of the impacts associated with the survey and the noise modelling and the impact assessment conducted by RPS has involved a review of all currently available literature on the effects of seismic sound on marine fauna

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			up to 700 m and that the science says that squid will come to the surface to avoid the activity during seismic testing. • fishers have had issues with the oil and gas exploration industry refuting claims regarding impacts to squid and noted they had raised similar concerns about squid and squid egg damage to another operator in 2013. • there is evidence that seismic testing affects southern rock lobster and that this has been recognised by the oil and gas industry. • the three companies represented also have investment in the scallop industry and have had experience over the years with the oil and gas exploration industry refuting anecdotal evidence of the damage seismic testing has had on scallops. They referred to the following evidence that scallops are killed by seismic testing: • there has been little, if any, scientific research into the effects seismic surveys have on giant crab and suggested the decline in the fishery (and total allowable catch) over the last few years has not been due to fishing effort alone. • the location of the survey area overlapped with large areas of the squid jig, squid trawl, scallop and rock lobster fisheries. You requested the survey area be reduced to ensure that there is no impact on the squid population or squid breeding areas and probable scallop settlement areas. • stop testing until science can prove that testing does no harm. • the financial investment in the squid industry from the three companies represented was possibly equal to the total investment of all other operators in the squid fishing industry.	700 m and that the science says that squid will come to the surface to avoid the activity during seismic testing • fishers have had issues with the oil and gas exploration industry refuting claims regarding impacts to squid and noted they had raised similar concerns about squid and squid egg damage to another operator in 2013 • fishers have had issues with the oil and gas exploration industry refuting claims regarding impacts to squid and noted they had raised similar concerns about squid and squid egg damage to another operator in 2013 • there is evidence that seismic testing affects southern rock lobster and that this has been recognised by the oil and gas industry • the three companies represented also have investment in the scallop industry and have had experience over the years with the oil and gas exploration industry refuting anecdotal evidence of the damage seismic testing has had on scallops.	(including mammals, fish, squid and other invertebrates), as well as the marine plants and fauna they feed on and the habitats they depend on. Where there is uncertainty in the level of effect, conservative assumptions were made with respect to the sound levels which affect squid and the severity of the effects. The underwater sound modelling also incorporated multiple levels of conservatism to provide extra protection for environmental (and fisheries) receptors. CGG are constantly seeking new reliable technical information on the impacts of underwater sound on squid and other marine life and would welcome any such research that you are aware of to make sure we have taken it into due consideration in our assessment. • **there is scientific information that suggests that squid are adversely affected by seismic surveys. Squid spawn all year round at depths up to 700 m and that the science says that squid will come to the surface to avoid the activity during seismic testing.** The second consultation letter included information on the predicted impacts of seismic sound on invertebrates (including cephalopods). The letter also included some of the key control measures CGG has committed to in order to mitigate those impacts. For cephalopods, squid in particular, the modelled distances from the vessel at which the behaviour of squid may be affected by the seismic sound is 1.4 km from the vessel in water depths, and 2.2 km from the vessel in water depths 200-1000 m. Squid within the survey area are expected to be predominantly found in depths of Genetic studies support the hypothesis of a single biological stock of Gould’s squid throughout south-eastern Australian Waters (FRDC 2016b) which indicates broad inter-breeding across the region. No particular locations of concern (spawning aggregation areas) have been identified by any squid fishers and we are treating the entire area out to 825 m water depth as potential squid habitat. • **fishers have had issues with the oil and gas exploration industry refuting claims regarding impacts to squid and noted they had raised similar concerns about squid and squid egg damage to another operator in 2013.** Whilst CGG cannot comment on Trident’s response, we can understand your concerns with the feedback. The noise modelling and the impact assessment conducted have been completed with all currently available literature, in an objective manner, and a conservative approach was adopted where there are gaps in knowledge. • **there is evidence that seismic testing affects southern rock lobster and that this has been recognised by the oil and gas industry.** The consultation package includes detailed information on the predicted impacts to invertebrates, including southern rock lobster. The modelled distances from the vessel at which rock lobsters may be affected by the seismic sound is predicted to be 92 m in water depth No mortality of lobsters is predicted as a result of exposure to seismic sound. Repeated exposure during normal survey operations is unlikely given that adjacent lines are 100’s m apart and the area of effect is < 100 m. CGG has also revised survey plans to use a smaller seismic source and avoid intensive undershooting activities in the vicinity of South East Reef, which is expected to be important lobster habitat. No other areas in the Acquisition Area have been identified as being of particular importance for rock lobsters. • **the three companies represented also have investment in the scallop industry and have had experience over the years with the oil and gas exploration industry refuting anecdotal evidence of the damage seismic testing has had on scallops.**

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					CGG is aware of those publications and they were included in the literature review and cited in the information package distributed. The package includes information on the impacts to scallops. The modelled distances from the vessel at which scallops may be affected by the seismic sound is predicted to be 625 m in water depths • **there has been little, if any, scientific research into the effects seismic surveys have on giant crab** Our latest advice from VFA (August 2018) indicates that there are no giant crab licence holders operating in this area. Please advise if you are aware of licence holders working this area and we will assess the potential for impacts on the activities. At this stage giant crabs are not considered a relevant factor in the assessment of impacts from the Gippsland marine seismic survey. • **the location of the survey area overlapped with large areas of the squid jig, squid trawl, scallop and rock lobster fisheries. You requested the survey area be reduced to ensure that there is no impact on the squid population or squid breeding areas and probable scallop settlement areas.** The second information package contains information on the changes CGG have made in response to stakeholder feedback from the fishing industry and the controls they have committed to regarding managing interactions with marine users (shipping, fishers etc), and to reduce the potential impacts to fished species and therefore fisheries catches. The Southeast Reef has been identified as an important fishing area and therefore CGG has committed to reducing the source volume in this area and to avoiding undershooting around these platforms. No other specific areas have been identified as important habitat. CGG is committed to ongoing consultation and any further information that you or your colleagues can provide on important squid or scallop breeding areas will be taken into consideration in finalising the survey plan. For effective controls to be developed to mitigate such impacts, it is critical that we receive specific information outlining important areas and times. We await your further response on this. • **stop testing until science can prove that testing does no harm.** The noise modelling and the impact assessment conducted have been completed with all currently available literature, in an objective manner, and a conservative approach (precautionary principle) was adopted where there are gaps in knowledge. CGG considers it has reduced potential impacts to ALARP and to an acceptable level, as required by the relevant offshore petroleum regulations. The regulator NOPSEMA will determine if CGG has met the ALARP / acceptability requirements of the regulations. It is important to note that both oil and gas and fishing industry have rights to conduct their activities in Australian waters and the imperative is on the affected parties to work together to minimise any impacts on each other's activities, functions and interests. • **the financial investment in the squid industry from the three companies represented was possibly equal to the total investment of all other operators in the squid fishing industry** We acknowledge the financial contribution of these companies and value their engagement in the consultation process. CGG is firmly committed to minimising impacts on these and other fishers whilst designing and conducting a cost-effective and high-quality seismic survey. For effective controls to be developed to mitigate impacts, it is critical that we receive specific information outlining important areas and times. We await your further response on this.
	04/09/18	2nd formal notification	No response received.	NA	NA
	05/09/18	Email outgoing	Summary of CGG's email outgoing is in the row above for the event dated 30/08/18.	NA	NA
	26/10/18	Email outgoing	No response received to either communication.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	22/11/18	3rd formal notification			
	05/12/18 06/12/18 19/12/18	Email outgoing Email incoming Email outgoing	Email incoming 06/12/18 Relevant Stakeholder presented his response to the email incoming form CGG on behalf of the fishers he is representing. The following claims were made: • there are significant gaps in the information given in particular on scallops • Raised scientific papers relating scallop mortality to seismic noise • Recommend the scallop beds found in the surveys should be protected to enable reproduction • Question arguments against squid moving away form the sound source • Request for the precautionary principle be in place to ensure where there is doubt in the effect on the environment the action does not take place until proof that the actions does not cause harm • Suggest the vast majority of scallops are caught in dpeths of 30 fathoms and under. Avoid testing in 30 fathoms and under would alleviate concerns from the scallop industry.	Relevant Stakeholder made the following objections and claims; • there are significant gaps in the information given in particular on scallops • Raised scientific papers relating scallop mortality to seismic noise • Recommend the scallop beds found in the surveys should be protected to enable reproduction • Question arguments against squid moving away form the sound source • Request for the precautionary principle be in place to ensure where there is doubt in the effect on the environment the action does not take place until proof that the actions does not cause harm • Suggest the vast majority of scallops are caught in dpeths of 30 fathoms and under. Avoid testing in 30 fathoms and under would alleviate concerns from the scallop industry	Via Email outgoing 05/12/18: CGG provided Relevant Stakeholder with an update on the proposed survey. Informed Relevant Stakeholder of the changes to the size of the survey directly reducing the overlap with the squid fishery. Provided literature to support the impact assessment and informed Relevant Stakeholder or the outcomes of the assessment resulting in no expected impact from the survey on the squid fishery. Via email outgoing 19/12/18 CGG responded to Relevant Stakeholder claims as follows: • Confirmed the scientific literature Relevant Stakeholder had included in his response had been included in the impact assessment for scallops, and had been summarised in the previous stakeholder update. CGG attached an additional more recent stakeholder update which showed the survey area had been reduced to avoid the emerging scallop bed. CGG recognises that this scallop bed has regional significance given the lack of scallops in the Gippsland area, and has therefore made changes to the survey area to ensure the scallop bed will not be impacted by sound. • CGG informed Relevant Stakeholder the survey will be conducted form January to July, outside the August-November spawning period for scallops. • Regarding impacts on squid, the assessment provided in the EP is not based on tank tests but instead studies by McCayley et al. (2000) and Fewtrell and McCauley (2012). These papers refer to the behavioural responses by squid to seismic noise, to which the evidence provided in these papers is justified within the EP. GG recognises Octopus are less likely to have similar behavioural capacity to avoid the impact of sound and given the lack of information on them CGG is intending to undertake an associated study to address these gaps. • CGG agrees with the need to take a precautionary approach when considering the potential biological, ecological and social impacts of seismic noise. CGG believes this is adequately demonstrated in the impact assessment described in the ERP and summarised in the stakeholder updates.
	21/12/18 21/12/18	Email incoming Email outgoing	Via email incoming 21/12/18 Relevant Stakeholder presented his response to the email incoming from CGG on behalf of the fishers he is representing. The following claims were raised: • Understand the survey to have used a standard scallop dredge with the legal mesh allowing small scallops to pass through the mesh particularly where there is a clean bottom and no other growth to block the mesh. Therefore it is possible that the scallop survey did not establish that, in areas where no scallops were caught, there were no beds of juvenile scallops • Appreciate the change of survey area to protect the known bed • Regarding squid, we have noted previously the cage test used at a depth of 9m, to evaluate the effects on squid. Repeat of initial response that the science is not proven as to how squid are affected by seismic noise, and that the precautionary principle should be implemented as per the legislation. • Without electronic tagging and tracking of individual squid, or without observes at all depths within a radius of 2.2km from the noise source are you able to predict that squid may be affected within 1.4km from the vessel in water depths <200m and 2.2kjm form the vessel in depths between 200-1000m. • The concern is that the squid “may” be affected within 2.2km of the sound source. If they “may” be affected, then we need to prove that they are not adversely affected before continuing.	Relevant Stakeholder made the following objections and claims: • Appreciate the change of survey area to protect the known bed • Regarding squid, we have noted previously the cage test used at a depth of 9m, to evaluate the effects on squid. Repeat of initial response that the science is not proven as to how squid are affected by seismic noise, and that the precautionary principle should be implemented as per the legislation. • Without electronic tagging and tracking of individual squid, or without observes at all depths within a radius of 2.2km from the noise source are you able to predict that squid may be affected within 1.4km from the vessel in water depths <200m and 2.2kjm form the vessel in depths between 200-1000m. • The concern is that the squid “may” be affected within 2.2km of the sound source. If they “may” be affected, then	Via email outgoing 21/12/18: CGG responded to Relevant Stakeholder claims as follows: • Whilst CGG appreciates your ongoing concerns around the impacts of seismic sound on squid and scallops, aa previously brought up in your consultation, CGG is taking a conservative approach in assessing impacts on these animals that is base on the best available information which has been provided to you. • It is not feasible or ALARP to expect CGG to undertake studies as Relevant Stakeholder suggested, including electronic tagging of squid and observes at all depths. • CGG believes it has responded appropriately to all concerns to date regarding impacts on squid, scallop and rock lobster and are now at a point where we cannot further the conversation. CGG informed Relevant Stakeholder if he has any further concerns to forward these on to CGG for a response.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
				we need to prove that they are not adversely affected before continuing. The following claim did not have merit: • Understand the survey to have used a standard scallop dredge with the legal mesh allowing small scallops to pass through the mesh particularly where there is a clean bottom and no other growth to block the mesh. Therefore it is possible that the scallop survey did not establish that, in areas where no scallops were caught, there were no beds of juvenile scallops CGG considers this claim to not have merit as (a) it is an criticism of a research paper that is not associated to the potential effects of seismic sound on scallops.	
	Ongoing consultation: Relevant Stakeholder ID 2434 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2495	17/08/18 17/08/18 26/11/18	Phone call outgoing SMS outgoing Phone call outgoing	No feedback or response received	NA	NA
	Ongoing consultation: CGG will continue to attempt to contact Relevant Stakeholder ID 2495 and if contact is established, will continue to engage and distribute project updates to him.				
Relevant Stakeholder ID 2195	23/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2195 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2496	26/07/18 04/09/18 22/11/18	Meeting 2nd formal notification 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2496 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2498	17/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing 2nd formal notification Email outgoing 3rd formal notification	Via phone call 17/08/18: Relevant Stakeholder ID 2498 stated that he is actively fishing within the survey and would like to be kept up to date with the survey. Relevant Stakeholder ID 2498 raised concerns over the notification processes, requesting that fishermen be notified of the vessel's movements after a near miss with a seismic vessel 20 years ago. No feedback was received in response to the second consultation letter, email outgoing on 26/10/18 and third consultation letter.	Relevant Stakeholder ID 2498 raised concerns about maritime notifications to mitigate potential risk of vessel collision.	CGG advised Relevant Stakeholder ID 2498 that a notice would be sent out to all mariners of the impending survey starting and that CGG would send out further notifications to all stakeholders including a look ahead as to where the survey vessel is moving as well as another notification 24-48 hours prior to survey commencement. CGG explained that the consultation letter sent on 04/09/18 would further explain the risk and control measures to mitigate the displacement of other marine users from the survey area.
	Ongoing consultation: Relevant Stakeholder ID 2498 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 1748	13/08/18 23/08/18 04/09/18 13/11/18 22/11/18	1st formal notification Phone call outgoing 2nd formal notification fishers and fisheries Phone call outgoing 3rd formal notification	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 1748 on 13th August 2018. Via phone call on 23/08/18: Relevant Stakeholder ID 1748 stated that he doesn't think he would be affected by the proposed survey as the survey area is not near his normal fishing grounds. Relevant Stakeholder ID 1748 stated that he would review the information and contact CGG if he through he would be affected, in the meantime requested to be kept informed. No response was received in response to the first and second consultation letter, sent to Relevant Stakeholder ID 1748 on the 23rd August and 4th September respectively.	No objections or claims.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Via Phone call on 13/11/18: Relevant Stakeholder ID 1748 stated that he does fish in the Gippsland area but is unsure if he will be relevant as he had not looked at the information provided. John stated he would review the information provided and inform CGG if he has any concerns or is no longer relevant.		
	Ongoing consultation: Relevant Stakeholder ID 1748 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2200	21/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2200 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2477	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 WM 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2477 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2522	26/07/18	Meeting	Via meeting at Lakes Entrance 26/07/18 (attended by LEFCOL and commercial/charter fishers): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. • The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. During the meeting Relevant Stakeholder ID 2522 asked how fishermen will receive information on the location of the survey vessel.	Relevant Stakeholder ID 2522 expressed concern about interactions with the survey vessels and notifications to fishermen.	Via meeting on 26/07/18: During the meeting CGG explained that all sail lines will be made available to fishers prior to the survey, and CGG is in discussion with SETFIA and SIV to provide alerts to fishers. The second consultation letter included a summary of the control measures related to managing vessel interactions and a notification schedule is included in the EP.
	08/08/18 04/09/18 23/09/18 26/10/18 22/11/18	Email outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2522 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
	06/08/18 16/08/18	1st formal notification Rev 0 Phone call outgoing	No feedback or response received to outgoing communications.	NA	NA

RPS

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Relevant Stakeholder ID 2401	04/09/18 23/09/18 26/10/18 22/11/18	2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification Rev 0			
	Ongoing consultation: Relevant Stakeholder ID 2401 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2157	06/08/18 16/08/18 04/09/18 23/09/18 26/10/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification Rev 0	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2157 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2402	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2402 on 6th August 2018. Via phone call 16/08/18: Relevant Stakeholder ID 2402 answered the phone call from CGG stating that they had not looked at the information distributed to them however they do fish in the area and would need to remain informed on the project. No response was received in response to the second consultation letter, email outgoing on 26/10/18 and third consultation letter.	No objections or claims. Fisher confirmed they are actively fishing within the area.	NA
	13/12/18	Phone call incoming	Via phone call incoming Relevant Stakeholder ID 2402 contacted the FLO to determine if he was working on an additional survey in western Victoria. FLO stated he was not. Relevant Stakeholder ID 2402 was interested in the likely impact on scallops	Relevant Stakeholder ID 2402's claim or concern regarding the impact on scallops has merit. The claims are similar to those raised by Relevant Stakeholder ID 732 and Relevant Stakeholder ID 2152	Via phone call incoming The FLO informed Relevant Stakeholder ID 2402 of the control measures and mitigation methods CGG had put in place to reduce any impact on scallops. The FLO informed Relevant Stakeholder ID 2402 that the survey has been reduced in size to ensure the scallop bed lays outside the survey acquisition area. CGG have communicated the impact assessment on scallops in the second information package distributed in September as well as the changes to the survey area to avoid the emerging scallop bed in the third information package in November. CGG will continue to engage with Relevant Stakeholder ID 2402 regarding the survey.
	Ongoing consultation: Relevant Stakeholder ID 2402 are relevant stakeholders and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2565	30/08/18 04/09/18 23/09/18 26/10/18 14/11/18	Phone call outgoing 2nd formal notification Email outgoing Email outgoing Phone call outgoing	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2565 is a relevant stakeholder and attempts to contact will therefore continue for the stakeholder to receive project updates from CGG.				
Relevant Stakeholder ID 766	28/05/18 28/05/18 28/05/18 28/05/18 29/05/18	1st formal notification Rev 0 Phone call outgoing Phone call incoming Phone call outgoing Email outgoing	Via phone call outgoing 28/05/18: FLO responded to missed call from Relevant Stakeholder (octopus and charter vessel owner/operator and a former oil and gas support vessel master). He expressed concern about the CGG survey which was across the grounds that supported octopus harvesting. He said he has 10 longlines of traps floated at either end in the area, each longline with 1000 traps and that shifting to another area will take him a week. FLO asked Relevant Stakeholder to document his concerns in an email which Relevant Stakeholder ID 766 agreed to do. Via phone call incoming 28/05/18: Phone call incoming from Relevant Stakeholder ID 2510 , no answer. Left message saying that they have fishing gear in area and wanted to talk with CGG.	The Relevant Stakeholders are licence holders within the Victorian Ocean (General) Fishery, their target species being octopus and charter operators. They actively fish within the survey area (identified in SETFIA 2018). The following two objections and concerns were raised, and both are relevant to their interests and activities: • overlap of the survey area with their fishing grounds and the possibility of being excluded from fishing around the Barracouta field during the survey.	CGG has responded to the objections and claims raised by the Relevant Stakeholder's as follows: • **overlap of the survey area with their fishing grounds**: during the phone call and documented in the subsequent email, CGG explained that the Barracouta field was one of the primary target areas, but that they are still in the planning phase of the seismic program and there is flexibility in the timing of activities. Noted that CGG could investigate scheduling the survey to avoid that area until after mid-February. CGG asked for bounding coordinates (WGS84) for the important areas to help review avoiding these areas. • **interference of seismic activities with their fishing gear:** and potentially having to shift lines and traps to another location. This issue was discussed in greater detail in the meeting held with octopus fishers on 25th Sept (refer to event below).

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Via phone call outgoing 28/05/18: CGG phoned Relevant Stakeholder to discuss the proposal and any questions he had. He noted he has concerns about the survey overlapping their octopus fishing grounds and potential impact on their operations and on the species. CGG followed up with email documenting the conversation. Via email outgoing 29/05/18: CGG followed up phone call with email summarising the discussion on 28/05/18. Stated they undertake commercial octopus fishing in waters 50–60 m deep between Marlo and the Barracouta field from Oct/Nov to mid-Feb, with most of the effort concentrated around the Barracouta field (approximately 10 lines). The fishing lines are set for the season and comprise several traps at the bottom, connected by ropes/cables, with surface floats attached at either end of the 4-6 km lines (i.e. about 20 surface floats). Two of the lines are set either side of the pipeline between Barracouta and Tarwhine. The lines may be set in any direction. Relevant Stakeholder ID 2510 stated they are planning to increase effort in this region in the coming season and that there is one other active fisher in the octopus fishery in the region. CGG asked if he could provide details of this fisher. CGG noted the Relevant Stakeholder's concerns relate to potential interference with surface gear and the possibility of being excluded from fishing around the Barracouta field while the seismic survey takes place. Relevant Stakeholder ID 2510 also stated he would like to have face-to-face meetings with CGG to discuss these issues. CGG stated they were keen to meet and were planning meetings for mid-July in Lakes Entrance. Asked if Relevant Stakeholder ID 2510 was available and what time would be best. CGG noted that as discussed via phone, one of the primary targets for CGG's seismic program is the Barracouta field, but that they are still in the planning phase of the seismic program and there is flexibility in the timing of survey activities in that area. CGG stated that if he could provide some bounding coordinates (WGS84) for the important areas then CGG could look at planning to avoid those areas until after mid-February.	• interference of seismic activities with their surface gear and potentially having to shift lines and traps to another location. **Action:** CGG to address the two concerns above and respond to the Relevant Stakeholder's stating how they have been addressed, including any changes or control measures adopted. Relevant Stakeholder ID 2510 also requested a meeting with CGG to discuss their concerns. **Action:** CGG to arrange face-to-face meeting with Relevant Stakeholder ID 2510 .	CGG have had stakeholder meetings in Lakes Entrance that the Relevant Stakeholder's have attended on 26th July, 25th Sept and 2nd Nov (see events below).
	25/06/18 04/07/18 05/07/18 10/07/18 10/07/18 11/07/18 11/07/18 19/07/18 19/07/18	Phone call outgoing Email incoming Email outgoing Email outgoing Email incoming Email incoming Email outgoing Email incoming Email outgoing	Via phone call outgoing 25/06/18: Phone call to Tony. No answer, left message to call back. Via email incoming 04/07/18: Relevant Stakeholder ID 2510 requested a meeting with CGG, CGG responded with a suitable time and date.	No objections or claims.	Via emails between 05/07/18 and 19/07/18: Back and forth emails to arrange meeting in Lakes Entrance end of July, and the Relevant Stakeholder's attendance.
	26/07/18	Meeting	Via meeting 26/07/18 (with CGG and Lakes Entrance fishers (commercial and charter) and LEFCOL): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey	The Relevant Stakeholder's raised four objections or claims (listed in left hand column) and all are considered relevant to their interests and activities. **Action:** CGG to address each objection and claim and respond with the outcome, including any changes or control measures adopted.	CGG has responded to the five objections and claims as follows: 1. **claims that octopus are site attached and won't move away from seismic pulses and query about impacts to octopus directly under the array:** CGG replied they would be reviewing all the available scientific literature on impacts of seismic sound on fisheries species and do understand that it is not easy to prove whether seismic has an effect or not. 2. **request for financial assurance if catches decline 1-2 years after the survey**: financial assurance or compensation was not discussed during the meeting, however, there have been subsequent discussions on this topic. The issue is being discussed by the Scientific Advisory Committee, which Relevant Stakeholder ID 2510 is a member of. 3. **claims there are difficulties moving octopus fishing gear and fishing in new territory**: CGG responded during the meeting they

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Issues and queries that were directly raised by Relevant Stakeholder ID 766 and Relevant Stakeholder ID 2510 were: 1. claimed that octopus are site attached and won't move away from seismic pulses and asked about impacts to octopus directly under the array 2. requested financial assurance if catches decline 1-2 years after the survey 3. claimed there are difficulties moving octopus fishing gear and fishing in new territory 4. problems with managing vessel interactions particularly during bad weather.		were interested in whether spatial and/or time exclusions would be effective and asked if they see this working. CGG stated they wanted to understand the impacts and costs of moving or sinking gear and added they were not imposing anything at this point and wanted to work towards agreement with fishers 4. **concerns about managing vessel interactions particularly during bad weather**: CGG agreed during the meeting that the survey vessel could not go where the octopus gear was set because of the entanglement risks, so a strategy was needed to manage this.
	07/08/18 07/08/18 08/08/18 08/08/18	Email incoming Email outgoing Phone call incoming Phone call outgoing	Via email incoming 07/08/18: Relevant Stakeholder ID 2510 asked how CGG was progressing following the July meeting and if there would be another meeting. He explained they had discussed options with fisheries dept about sinking their buoys and they would need to apply for exemptions, which would take time and would not necessarily be approved. Noted if the survey went ahead, they would need more information on location and dates in order to apply. He stated the other option is moving them out of the seismic testing area, but that presents complications as it's about 3 hrs travel time one-way. They can only move one line at a time, so it takes 3 hrs to haul (good weather provided) and 1 hr to deploy, so all things working in our favour it will take roughly 10 hrs to relocate one line. And that's to get out of the area to grounds we have never fished before. Via phone call incoming 08/08/18: Phone call from Relevant Stakeholder ID 2510 left message requesting call back. Via phone call outgoing 08/08/18: CGG phoned Relevant Stakeholder ID 2510 to discuss moving/sinking lines. Relevant Stakeholder ID 2510 said they were holding off on installing 3 extra lines and said that they have only been out for one day in the last three weeks due to bad weather. Said they would need plenty of notice for them to move/sink lines. Relevant Stakeholder ID 2510 said he would get a cost estimate for the sinking of the lines and reiterated his concerns about potential impacts on octopus. Relevant Stakeholder ID 2510 asked about further meetings.	Regarding the concern about interference with their fishing gear, Relevant Stakeholder ID 2510 had investigated potential solutions – either sinking their buoys or relocating them. The following concerns were raised regarding the options: • sinking the buoys – requires exemption which would take time and may not be approved • moving their gear – significant process to haul and deploy each line and would mean having to move to grounds they haven't fished before. **Action:** CGG to address the two concerns above and respond to Relevant Stakeholder ID 2510 stating how they have been addressed, including any changes or control measures adopted.	Via email outgoing 07/08/18: CGG replied they were happy to discuss the options. Noted that it seems that sinking the buoys would be the easiest option. Asked what the process is for getting exemptions, how long it takes and if CGG could assist. Stated they would check when CGG would be around Barracouta. Via phone call outgoing 08/08/18: During phone call in response to Relevant Stakeholder ID 2510's concern about moving/sinking lines, CGG said they would be able to provide detailed plans of where and when they would be. Relevant Stakeholder ID 2510 said he would get a cost estimate for the sinking of the lines and reiterated his concerns about potential impacts on octopus. CGG advised them to go ahead with their plans and if the lines need to be sunk later then CGG would support this. Relevant Stakeholder ID 2510 asked about further meetings and CGG responded they were happy to meet and discuss further. CGG's response to Relevant Stakeholder ID 2510's comment about the potential impacts on octopus are summarised below.
	08/08/18	Email outgoing	CGG sent the meeting minutes from the meeting held on 26th July to attendees for review. No response received from the Relevant Stakeholder's.	NA	NA
	17/08/18	Phone call outgoing	Phone call to Relevant Stakeholder ID 766 regarding the proposed survey and to check email address for sending stakeholder letters with him. No answer, left message to call back.	NA	NA
	30/08/18	Email outgoing	Via email outgoing 30/08/18:	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			CGG emailed Relevant Stakeholder ID 2510 to follow up since the phone call on 08/08/18 discussing moving/sinking lines. Gave a heads up that CGG were making some changes to the proposed survey, particularly regarding location and timing of the survey. Noted that a consultation letter was being finalised with information on this and would be sent to him soon. CGG ended the email notifying Relevant Stakeholder ID 2510 that CGG would be in Lakes Entrance to meet again face to face with fishers. Asked if Relevant Stakeholder ID 2510 was still keen to meet up with them again. No response received.		
	04/09/18 06/09/18 06/09/18	2nd formal notification fishers and fisheries Email outgoing Email incoming	Via email outgoing 06/09/18: CGG contacted the Relevant Stakeholder's to confirm they had received the second stakeholder consultation letter and with written responses to concerns they have raised during consultation to date. Provided a short summary of the content in the letter as it applies to the Relevant Stakeholder's octopus and charter fishing activities. This included brief summary of the zoning system adopted following stakeholder feedback and the timing of operations in each zone. Summarised notification and communications control measures that had been adopted to help fishers plan their activities. The email also summarised the information in the letter about the impacts of seismic sound on invertebrates, including octopus citing some of the research considered in the impact assessment. CGG again invited them to respond if they wished to meet with CGG representatives at next stakeholder meetings in Lakes Entrance. Via email incoming 06/09/18: Relevant Stakeholder ID 2510 responded stating that he had previously discussed setting new lines (via phone call 08/08/18) and that CGG had told them to go ahead and deploy them. He requested further conversations be communicated via email. He noted they had feedback on the letter that they wanted to raise as he claimed there were several wrong and contradicting "facts" in it.	Relevant Stakeholder ID 2510 raised the following objections and claims in his email on 06/09/18: • asked for future consultation to be in writing • claimed there were inaccuracies in the second stakeholder consultation letter he wished to raise. **Action:** CGG to address the two concerns above and respond to Relevant Stakeholder ID 2510 stating how they have been addressed, including any changes or control measures adopted.	CGG responded to Relevant Stakeholder ID 2510 in writing on 07/11/18 (refer to event below for a summary of the response).
	21/09/18 23/09/18	Email outgoing Email outgoing	Via email outgoing 21/09/18: CGG emailed to give the Relevant Stakeholder's a heads up about meeting planned with octopus fishers in Lakes Entrance on 25th September. Noted there were meetings being held earlier in the day with LEFCOL and SSFI, however CGG would like to meet with the Relevant Stakeholder ID 760 and Relevant Stakeholder ID 2510 separately to discuss effects on the octopus fishery. Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. No response to either email.	NA	NA
	25/09/18	Meeting (general fishers)	Meeting with Lakes Entrance fishers, representing both Commonwealth and Victorian fisheries: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. The issues and queries raised by Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510 were:	The following objections and claims were raised by the Relevant Stakeholder's and are considered relevant to their interests and activities: 1. concern about the adverse impacts of low frequency sound on octopus 2. justification for the survey given the area had already been surveyed 3. concern about the uncertainty on the potential impacts of seismic sound on octopus in the short-term and potential irreversible damage after the survey was completed	CGG responded to Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510's objections and claims as follows: 1. **concern about the adverse impacts of low frequency sound on octopus:** This concern was responded to in the following meeting with octopus fishers (see row below). 2. **justification for the survey given the area had already been surveyed:** this concern was not directly addressed in the meeting. An explanation of the drivers for the survey were summarised in the second consultation letter 3. **concern about the uncertainty on the potential impacts of seismic sound on octopus in the short-term and potential irreversible damage after the survey was completed:** CGG responded that the complexity of the marine environment species, fishing patterns and

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• Relevant Stakeholder ID 766asked what the capacity of the source was and what it implied in Kilohertz. CGG explained aspects of sound and directionality from the acoustic source and that capacity of the source (cc's) and the frequency of sound (kHz) were two different measures. Relevant Stakeholder ID 2510 said he was concerned about low frequency noise as it appeared to be the most damaging. • Relevant Stakeholder ID 766referred to a paper by Jason Semmens that indicated damage to plankton within 1.2 km of the source • Relevant Stakeholder ID 2510 asked why the survey was necessary given the area had been surveyed before • Relevant Stakeholder ID 2510 asked about adverse impacts following the completion of the survey and whether fishers were expected to sustain the impacts of this on their businesses • They expressed fear for their future given the uncertainty of the impacts of the survey and stated that CGG needs to take responsibility for any post survey effects on fisheries • Relevant Stakeholder ID 2510 asked if they would see the EP and CGG responded that an EP summary would be made available.	4. concern about the financial impacts following completion of the survey and the requirement for compensation. **Action:** CGG to address the concerns above and respond to Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510 stating how they have been addressed, including any changes or control measures adopted.	natural fluctuations make it difficult to weigh the overall significance of the evidence that does exist. They noted they were working to identify evidence about environmental effects and that if it was obvious the adverse effects that were being claimed were true, that CGG would not do the survey. This concern was also discussed in the following meeting with octopus fishers (see row below). 4. **concern about the financial impacts following completion of the survey and the requirement for compensation:** This concern was responded to in the following meeting with octopus fishers (see row below).
	25/09/18	Meeting 2 (octopus fishers)	Meeting with octopus fishers (Relevant Stakeholder ID 760, Relevant Stakeholder ID 766, Relevant Stakeholder ID 2510): CGG apologised for the short notice and that a further meeting would be held mid-October. Similar to the previous meeting, CGG explained the zoning system and timeframes and the rest of the meeting was for discussing specific issues and concerns for the octopus fishery. The issues and queries raised by Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510 were: • stated they had concerns about low frequency noise and referred publication by Michel Andre' et al (2011) that exposed octopus and squid to low frequency noise • expressed concern about the survey area covering their fishing grounds, and the difficulty in moving their gear from the area. They Relevant Stakeholder ID 2491ed out the octopus fishing area on the map displayed and explained the area had too many snags to be fished by Danish seine fishers. Explained that moving their gear from the survey area as it involved thousands of pots, kilometres of rope and multiple trips to a destination distant from their usual area of operation. They discussed the way gear is hauled and deployed and potential methods of sinking surface floats to avoid having to move gear out of the area. • concerned that the survey would cause irreversible damage to the fishery • they noted their catches had been consistent during the last 3 years and asked if CGG would financially mitigate any verifiable damage to gear. CGG stated they would • asked CGG if they will rehabilitate the fishing grounds if there is an impact from the survey, and if they would be compensated if there were no octopus following the survey and they must move fishing grounds • to determine potential impacts, they discussed the need to have follow ups with a trusted observer on their vessels the first time that they hauled their pots after the survey to inspect potential impacts and then if needed conduct follow up inspections at 3 monthly intervals across a 1-year period, even longer if necessary. Noted they trusted CGG (FLO) as an honest observer. • concerned about the uncertainty on impacts of the survey on octopus and financial stability and family wellbeing	The following objections and claims were raised by the Relevant Stakeholder's and are considered relevant to their interests and activities: 1. concern about the uncertainty on the potential impacts of seismic sound on octopus in the short-term and potential irreversible damage after the survey was completed 2. concern about interference with fishing gear and having to move their lines out of the survey area 3. concern about compensation for damage to fishing gear 4. concern about the impacts of lost catch on financial stability 5. concern about impacts on charter operations during Jan and Feb.	CGG responded to Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510's objections and claims as follows: 1. **concern about the uncertain impacts of seismic sound on octopus in the short-term and potential irreversible damage after the survey was completed**: regarding the Andre et al (2011) paper, CGG noted the study had attracted strong criticism within the scientific community because it did not replicate a seismic survey. They noted it was difficult to determine impacts to octopus because their soft body would allow them to be rapidly consumed by other predators such as fish and crabs. CGG stated they would rely on available scientific literature and that any conclusion about impacts following the survey would have to also consider natural fluctuations. The second stakeholder consultation letter sent to fishers summarised the impact assessment outcomes for octopus, including the literature review and modelling undertaken. 2. **concern about interference with fishing gear and having to move their lines out of the survey area:** CGG and the fishers discussed the option of sinking lines to avoid having to move to new fishing grounds, which Relevant Stakeholder ID 2510 said was possible and would prevent entanglements. 3. **concern about compensation for damage to fishing gear:** CGG responded they would compensate fishers for damage to fishing gear attributable to the survey. 4. **concern about the impacts of lost catch on financial stability:** in response to queries about rehabilitating damaged fishing grounds, CGG noted they would have to make sure they did not breach laws on inducements. Regarding compensating fishers for lost catch, CGG replied that they were not sure. Relevant Stakeholder ID 2510 is a member of the Scientific Advisory Committee, which is tasked with discussing potential compensation arrangements with fishers. The first Committee meeting was held on 23rd Nov (see below). 5. **concern about impacts on charter operations during Jan and Feb:** CGG noted this request during the meeting and have since adjusted the order that each zone will be shot in, to reduce impacts to charter operations in nearshore areas during the Christmas period. This change was described in the third stakeholder consultation letter.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• discussed the sound levels of different sources and asked if it was as loud as a shotgun. CGG noted that seismic was about the same level as lightening striking water. • asked if the timing of acquisition per zone was flexible and suggested an order that would reduce impacts during Jan and Feb, which were important months for fishing charters.		
	10/10/18 11/10/18	Phone call incoming Email outgoing	Via phone call incoming 10/10/18: Relevant Stakeholder ID 766asked CGG about seismic noise characteristics and CGG replied they he would send him some information about it.	No objections or claims. Relevant Stakeholder ID 766asked CGG for additional information that would help him better understand the impacts of the activity on his interests and activities. **Action:** CGG to provide information that was requested to Tony.	Via email outgoing 11/10/18: CGG followed up on phone call with Relevant Stakeholder ID 766and attached McCauley (2006) 'Characteristics of underwater explosions and air guns: explosive signals measured in Tasmania'. Noted the paper is quite valuable to the discussion where the term "blast" is often used. Noted it was one of the peculiarities of English usage — you can have a wintery blast from the southern latitudes, or a bomb blast, or a seismic blast as the green NGOs would have it. All with vastly different characteristics. Also attached a table of different underwater sound sources, with their corresponding sound intensity/pressure and frequency for comparison with seismic noise. Source of the table was APPEA's 2016 submission to the Federal Government Senate Inquiry regarding O&G in the GAB.
	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.	NA	NA
	21/10/18 22/10/18	Email incoming Email outgoing	Via email incoming 21/10/18: Relevant Stakeholder ID 2510 followed up on not receiving a reply about meetings planned at Lakes Entrance (mentioned in email CGG sent 19/10/18). He stated he would like CGG to touch base with SETFIA and octopus fishers in relation to impacts on their operations as they are currently getting no information from CGG in relation to the revised EP and how it would affect them.	Relevant Stakeholder ID 2510 claimed he had missed information about planned meetings and was not getting any information from CGG about how the revised EP would affect them. **Action:** CGG to reply and clarify Relevant Stakeholder ID 2510 had not missed any meetings and provide information on the next steps in the approvals process.	Via email outgoing 22/10/18: CGG apologised for confusion and clarified there had not been any stakeholder meetings since NOPSEMA's decision was handed down, so he had not missed any. Stated the meeting referred to in the email on 19/10/18 was the 25 September 2018 meeting, which Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510 attended. CGG noted they were planning meetings in Lakes Entrance in the next fortnight and would be in touch with him to arrange it.
	26/10/18	Email outgoing	CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys.	NA	NA
	31/10/18	Email outgoing	CGG emailed with invitation to octopus specific meeting on 2nd Nov and provided details (meeting time and location). Stated the objective of the meeting is to discuss a field-based assessment of the impacts of a typical 3D seismic survey on the octopus fishery. This would consider for example, injury to the animal, dispersal from traps, area fished, practical field work to enable the experiment. CGG noted they were proposing a collaborative study with fishers and the results would be made public. No response received.	NA	NA
	02/11/18	Meeting	Meeting held 2nd November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows:	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback.	CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period • impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries.	operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	07/11/18	Email outgoing	CGG followed up on email Relevant Stakeholder ID 2510 sent on 06/09/18 (see event above). Apologised for delay responding, clarified that previous RPS contact was no longer on the project and that all future correspondence would be in writing. CGG noted they were following up to check if Relevant Stakeholder ID 2510's concerns about the inaccurate information in the second stakeholder consultation letter were addressed at the meetings on either 25th Sept or 2nd Nov. CGG stated that if they haven't been addressed to send them through in writing and they will be responded to. CGG also notified Relevant Stakeholder ID 2510 about the Scientific Advisory Committee that they were planning to establish. Stated the Committee would consist of an independent chairperson, independent scientists, fishing industry representatives and titleholder representative. Explained that a key function of the Committee will be to develop a research program in consultation with octopus fishers, to assess potential impacts of seismic surveys on octopus and associated fishery. No response received. Relevant Stakeholder ID 2510 is now a member of the Committee, representing the interests of octopus fishers and charter operators. The first meeting was held on 23rd Nov (see below).	NA	NA
	12/11/18 12/11/18 13/11/18 13/11/18	Email outgoing Email outgoing Email incoming Email outgoing	Via emails outgoing (x2) 12/11/18: CGG sent draft meeting minutes to the Relevant Stakeholder's for both meetings held in Lakes Entrance on 2nd November (with general fishers and octopus fishers) Via email incoming 13/11/18: Relevant Stakeholder ID 766replied with a correction of the dimensions of their octopus' lines. He noted their lines are each 6000 m long not 1000 m and have approximately 1000 pots per line. Stated they currently have 10 lines deployed in the area that CGG are proposing to acquire for seismic survey.	No objections or claims, however Relevant Stakeholder ID 766suggested correction to the draft meeting minutes. **Action:** CGG to update the minutes and resend to meeting attendees.	Via email outgoing 13/11/18: CGG corrected the meeting notes, specifically that the length of the octopus' lines has been corrected to say 6 km.
	22/11/18	3rd formal notification	No feedback received in response to the third stakeholder consultation letter.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response

	23/11/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the first SAC meeting:
			• **Item 1: Study projects:**
			  • Stage 1: to develop 2 explicit projects as pre-proposal to be put to CGG. These being:
			  1.Octopus study – experimental review of physiology and wellbeing and analysis of catch data before and after the marine seismic survey (MSS). UTas to provide a pre-proposal by 30 November.
			  2.Analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery pre the MSS and a non-commercial pre-determined sampling program after the MSS. Fishwell to provide a proposal before 14 December.
			  • Stage 2. CGG will consider these projects and make a determination on the scope and funding of these projects.
			• **Item 2: Zoning sequence:** Committee has agreed that it will be necessary for sectors to identify the timing for the sequence of surveying the zones that minimizes the impact on the commercial fishing industry.
			• **Item 3: Compensation:**
			  • Stage 1: A model for an appeals process for compensation is to be developed for consideration by CGG. CGG to provide this by December 7.
			  • Stage 2: CGG to consider this proposal.
			• **Item 4: Process for Committee:** deal with pre-proposal and appeals model as an out-of-session action via phone/email.
			The following is a summary of general notes from the meeting:
			<u>Octopus:</u>
			• support for a study, UTas to provide proposal and contact FRDC about funding
			• importance of catch rates as the fishery may move to quota management and that whilst analysis of catch rates is typically difficult, that a change in catch rate signal can be seen if planned (can also see signal in normal catch and effort data for the GAB trawl fishery)
			<u>Scallops:</u>
			• change to survey away from scallop bed will protect adults as is greater than 2 km away from most significant bed. However, recruitment may be impacted since it is localised (spawning late summer/early autumn, and settlement generally early autumn). There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks
			• UTas noted he was involved with 2015 before and after scallop survey but it was not designed properly (too short-term) so results questionable.
			<u>Danish seine:</u>
			• UTas noted an issue is the ability to detect change given 'noise' in catch rate data and the way it is done is different for each fishery. He suggested there were two options:
			  • before/after program: identify power to detect specified change, proper experimental design
			  • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared.
			• displacement of fish and fishers was expected but some fisheries and species are more impacted than others. Focus is on those that are more mobile – which Danish seine and octopus are the two sectors with least ability to move.
				The following objections and claims were raised and discussed at the meeting:
				21. **impacts on LEFCOL's business activities:** LEFCOL claimed that the trawl sector is mobile but if fishers must operate too far away then may impact LEFCOL if product is unloaded elsewhere. That Christmas time is important.
				CGG have assessed this concern as having merit. Similar claims to this have been discussed previously with LEFCOL during meetings on 26 July 2018 and 2 November 2018 and responses provided (refer to events above for summary of CGG's responses).
				22. **impacts on recruitment of scallops:** that whilst the scallop bed was removed from the survey area, that recruitment may be impacted
				CGG has assessed this concern as having merit and requires resolution if possible.
				23. **concern about use of 1981 noise modelling and broader scale impacts on food web**
				CGG has assessed this concern as having merit. A response is being drafted to be sent to David regarding his concerns around the sound modelling week starting 21st January.
				24. **impacts of the zoning system on octopus fishery:** five-hour fishing cycle (time period for picking up pots before survey vessel comes through every ~14 hours). Removing surface floats requires VFA approval.
				CGG has assessed this concern as having merit since it has been raised previously by Relevant Stakeholder ID 2510 and requires resolution if possible.
				Action: CGG to discuss zoning plan with Relevant Stakeholder ID 2510 in an additional meeting in January 2019
				25. **compensation for lost catch:** committee members wanted CGG to confirm they will compensate (for lost catch *[sic.]*).
				This concern was assessed as having merit since it was within the remit of the SAC to progress a solution to this issue.
				Action: It was identified in the meeting that CGG would draft an appeals process (compensation plan) for review by the SAC.
				
				SSFA raised that the concept of moving between zones doesn't work as it results in increased competition
					18. **impacts on LEFCOL's business activities**:
					CGG has informed stakeholders on the outcomes of the impact assessment, and the expected impacts on fishing operations to be low. The survey vessel will not be occupying the whole survey area, rather it will occupy one of the six zones as per the zoning map included in the second stakeholder letter distributed in September. Thus meaning the other zones that the vessel is not occupying will be open to fishing activities. No medium or long-term effects are predicted for fish species as a result of seismic operations. No effects on key biological process, e.g. spawning, feeding, breeding, migration, are predicted for commercially important species. Therefore the flow on effects to the community and region are expected to be negligible.
					19. **impacts on recruitment of scallops:** There is no understanding of longer-term population scale impacts but that it is very difficult to measure impacts on larvae and knock-on impact to benthic stocks.
					20. **concern about use of 1981 noise modelling and broader scale impacts on food web:**
					In selecting the propagation model for the impact assessment used within this EP, CGG considered various factors, including range dependant bathymetry, frequency dependence (relevant for all marine faunal groups assessed), the seismic source characteristics, and balancing errors / uncertainties across factors.
					In the past, acoustic propagation modelling has often been based solely on a parabolic equation methodology based on the assumption that seismic sound energy is primarily low frequency in content. According to Wang et al. (2014) parabolic equation models are useful for frequencies up to approximately 1 kHz. However, the seismic source will contain a significant amount of energy above this frequency. the suitable frequency range for parabolic equation models would not cover any of the sound energy within the most sensitive regions of the high and mid frequency cetacean weighting curves. Consequently, the use of parabolic equation modelling would fail to assess the energy content most applicable to the majority of marine mammals, as well as those animals (fish and invertebrates) that hear above 1 kHz (e.g. fish with swim bladders which respond to higher frequencies of 200 Hz to 3kHz (Carroll et al. 2017), and lobsters up to 5 kHz (Pye and Watson 2004 in: Carroll et al. 2017).
					Sound propagation modelling for this assessment was therefore based on an established, peer reviewed, range dependent sound propagation model which utilises the semi-empirical model developed by Rogers (1981). The model provides a robust balance between complexity and technical rigour over a wide range of frequencies, has been validated by numerous field studies, has been benchRelevant Stakeholder ID 2491ed against a range of other models and has been subjected to the scrutiny of UK and European regulators over a large number of projects. The Rogers sound propagation model used in this assessment is based on a combination of theoretical considerations and extensive experimental data. Consequently, unlike purely theoretical sound propagation models, the calibration for the propagation model is built into the model itself. Furthermore, the Rogers model has been peer reviewed and benchRelevant Stakeholder ID 2491ed, with good agreement, against other transmission loss models (e.g. Toso et al., 2014; Etter 2013; Schulkin and Mercer 1985). RPS has carried out additional benchRelevant Stakeholder ID 2491ing tests using the extended Rogers propagation model in comparison to other propagation models and found generally very good agreement with the other models (i.e. Weston Energy Flux model, a simple spherical propagation model (20 log R) and a combined Normal Mode and Ray Tracing model).
					21. **impacts of zoning system on octopus fishery:**

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• noted that use of noise loggers important in understanding impacts on octopus and would also inform study on impacts to Danish seiners. • LEFCOL raised that trawl sector is mobile but if fishers have to operate too far away then may impact LEFCOL if product is unloaded elsewhere. Also noted that Christmas time is important. SIV – part of broader study on economic impacts **Zoning system:** • SSFA believes that the concept of moving between zones doesn't work as it results in increased competition between fishers, and gummy sharks get skittish and won't net. He also noted the unpredictable arrival of South Australian fishers adds to the competition. He also expressed concern about use of 1981 noise modelling and broader scale impacts on food web • Relevant Stakeholder ID 2510 said with regard to octopus and zoning that the best fishing is during day. He was concerned about five-hour fishing cycle (time period for picking up pots before survey vessel comes through (every ~14 hrs)). Removing surface floats requires VFA approval. • discussion regarding the order in which they should be done varies between fishery. It was stated that this should have been dealt with through consultation previously. CGG stated that it had been presented at the last two stakeholder meetings at Lakes Entrance. **Compensation:** • committee should consider a safety net in place in case impacts are identified • CGG suggested a revenue neutral situation was required, using catch and effort data of individual fishers, which requires fishers' permission to access data committee members wanted CGG to confirm they will compensate. CGG will generate a draft appeals process for discussion based on other models used.	between fishers, and gummy sharks get skittish and won't net. The unpredictable arrival of South Australian fishers adds to competition. This claim was assessed as not having merit since (a) the zoning system was introduced in response to consultation with the fishing industry to enable them to forward plan their activities and many have expressed support for the approach, (b) the order of the zones being surveyed is also being planned in consultation with the fishing industry to reduce impacts on the fishing industry associated with certain areas/zones and timing (e.g. avoiding nearshore areas during summer/Christmas period), (c) CGG cannot control the activities of South Australian fishermen and can only reduce the impacts of their own activities, (d) no alternative approach was/has been suggested by SSFA who raised the claim. (e) the percentage o fhte acitvley fished area of the fishery that overlaps the survey area is relatively small and being highly mobile fishers, it is expected that they will spread out and not congregate in a small area within the survey area.	Relevant Stakeholder ID 2510 has agreed to meet with CGG regarding the octopus study and fishery. CGG to discuss planning and logistics for the octopus regarding the zoning schedule. This meeting is planned to occur in January. **compensation for lost catch:** It was agreed during the meeting that CGG would generate a draft appeals process (compensation plan) based on other models used, for review by the SAC. A Fisheries Displacement Mitigation Plan has been drafted and reviewed by the SAC and CGG is seeking internal approval. Further notes on this are summarised below for the SAC meeting dated 3 January 2019.
	17/12/18	Meeting (Scientific Advisory Committee)	The following recommendations were agreed during the second SAC meeting: **Octopus study** • discussed proposal scope and costs, considering outside/industry funding and CGG asked if the scope could be scaled back. Cost mostly due to vessel costs. Could be reduced by reducing time. UTas to look at options to reduce costs and follow up with FRDC. **Danish seine study** • there were concerns about the timing of the survey starting in January/February and that the Danish seine proposal would be provided in January. Would need to start surveying before survey start date. • it was suggested that log book data could be used for C&E for analysis if necessary but would need cooperation from individual fishers to use their data. UTas noted if they wanted to get the fishers to participate in a proper BACI study, can't rely on their data as they may be fishing in a totally different area. • UTas stressed that if the experimental study was not properly planned and executed it would be a waste of time. **Zoning system** • UTas completing analysis on zoning order. Currently indicates there is not a lot of difference between zones in terms of timing of catch. • CGG noted that from an operational perspective they propose to start deep (southern) and move to shallow. Plan to do Zone 4 in March/April. **Fisheries Displacement Mitigation Plan**	The following concerns were raised and discussed at the meeting: 9. that the timing of the survey didn't allow adequate time for planning Danish seine study and collecting data before the survey start date (starting in January/February and the Danish seine proposal would be provided in January). 10. concern about the ability to detect change given 'noise' in catch rate data.	CGG has responded to the two objections and claims as follows: 9. **timing of the survey start date and the Danish seine study:** this concern was discussed in more detail in the SAC meeting on 3 January 2019 (refer to event summarised below). CGG stated that they need to remain flexible and that the 'go ahead' for studies will depend on EP approval. Once approved, they will decide timing and other operational details. Planning is ongoing, proposals have been received and SAC members will advise on the timing for studies during future meetings. 10. **ability to detect changes in catch and effort data:** UTas explained that using log book data for C&E for analysis would need cooperation from individual fishers and you can't rely on their data as they may be fishing in a totally different area. He suggested there were two options: • before/after program: identify power to detect specified change, proper experimental design • utilise current spatial/temporal data to develop standardised catch rate against which rates after survey is compared. Per minutes of SAC meeting on 23 November 2018, UTas was in process of conducting an analysis of shark and finfish CPUE data from the Commonwealth Danish seine fishery (pre-survey) and was to provide a proposal for a non-commercial pre-determined sampling program (after the survey). Since this meeting, two approaches have been adopted (refer to Section 8.3.3.2 of the EP): (1) a desktop analysis of data extracted from the Australian Fisheries Management Authority (AFMA) Commonwealth logbook database (as used for similar analysis by Bruce et al. 2018), and

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			• draft Plan provided to SAC members prior to meeting. CGG asked how it would work if there is a bad fishing season in general – would the proposed Danish seine study be useful? It was noted that the Danish seine study would be another piece of evidence for identifying any changes to fishing data as a consequence of the proposed survey. CGG requested the relationship between the sampling plan and how it feeds into the Mitigation Plan. **Update on EP** submitted last Monday and response will be available from NOPSEMA 9 January 2019. CGG noted the zones have been renumbered and changed (which SAC members were notified of in the lead up to the meeting).		22. (2) a dedicated field-based sampling program to evaluate catches using a Before-After Control-Impact (BACI) statistical design. CGG subsequently contracted Fishwell Consulting to undertake preliminary statistical power analysis of catch and effort for the Danish seine fleet to determine what level of field-based sampling was required to detect specific impacts, and hence the ultimate design and cost of the field-based sampling program. The outcomes of this analysis will enable CGG to determine which of the approaches discussed by the SAC is feasible, with funding assistance from other organisations also being investigated.
	03/01/19	Meeting (Scientific Advisory Committee)	The following items were discussed and agreed during the third SAC meeting: **Danish seine study**: • UTas explained that the seasonality analysis report as expected, has shown that there is not a big seasonal component for separate zones and that based on analysis he wouldn't say any one zone is better than another. Results were therefore as expected with Danish seine summer catch (Dec-Feb) being higher and more variable, and Otterboard trawl tending to build up towards winter. • With regard to peak catches in Zone 6, SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". It was clarified that the area being referred to was South East reef, for which a smaller gun will be used. • CGG requested a recommendation as to which direction to begin surveying in, based on the data. UTas noted it was different for different fisheries, but he could combine values and analyse on combined worth, providing figures with values in zones and see which way would minimise cost. CGG agreed to this. • SSFA expressed concern that the GHaT data will be lost within the aggregated data (once that data is overlaid with Danish seine fishery). UTas explained you can see gap values in individual analysis. • There was further discussion about technical aspects of the study and a proposed survey design would be available for the SAC to review to understand the impact of events. • CGG stated they had been in touch with the FRDC and WAFIC regarding funding and/or involvement in the study. **Octopus study:** • UTas advised he had reviewed the quote but couldn't reduce the cost much, due to cost of vessels required. Noted that FRDC funding would be useful as their involvement then changes it to a category 1 study and certain costs would be removed. Also, easiest way for FRDC to be involved in terms of timing. • CGG asked if the study was ready to start sampling in February 2019. UTas advised he was waiting for CGG to provide funding to get extra equipment, and they will need 3 months to get mesh bags/extra lines. Also noted it was tough to organize as currently in peak charter time and vessels are booked out. Also noted some operators are in the prawn season, which will also take some time to sort out. However, from a scientific perspective they could be ready to go in February 2019. • CGG stated they were exploring options for additional support and equipment and meeting with the FRDC. **Compensation:** • CGG (CGG) advised they were dealing with internal management sign off of the Fisheries Displacement Mitigation Plan, and the effect of displacement on catch. They would like to put them	The following concerns were discussed at the meeting: 17. SSFA expressed concern at impacts on a "reef wiped out but beginning to come back". This concern was assessed as not having merit since it was clarified during the meeting that the area being referred to in the discussion was South East reef, for which control measures have been adopted to mitigate impacts in this area (i.e. reducing power setting of the airguns including a 500 m buffer zone around the reef to avoid TTS injury to fish (including sharks). 18. SSFA also expressed concern that the GHaT data will be lost within the aggregated data analysis performed by UTas (once that data is overlaid with Danish seine fishery). This concern was assessed as not having merit since it was clarified by UTas during the meeting that you can see gap values in the individual analysis. No further control measures or changes are warranted. 19. There was some concern expressed with regard to reducing costs of the research studies. Difficulties included cost of vessels blowing out the quote for octopus study, the need for funding (FRDC or other). Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG has assessed this concern as having merit since it is important that the studies are properly planned and executed to get reliable data. CGG stated regardless of funding they would proceed with the studies anyway. No further action required. 20. UTas raised concern about planning aspects and timing of the octopus study and the seismic survey (i.e. tough to organize vessels as currently in peak charter time and they are booked out, also noted some operators are in the	In response to the fourth concern (that required action), CGG and Relevant Stakeholder ID 2510 agreed to meet to discuss the need for extra equipment up to three months prior to survey commencement. These discussions are in progress.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			forward as separate documents to SAC and then feed suggestions back to CGG. Timing for this was end of next week and a draft to be distributed to SAC by mid-late January 2019. **Status of EP:** • CGG advised they were responding to additional queries from NOPSEMA, including clarification on the SAC and its processes. Specifically, they want to know the scope and frequency of future meetings. Since the EP was submitted before the last meeting CGG weren't able to provide NOPSEMA the minutes. **Other:** • Relevant Stakeholder ID 2510 asked what if FRDC were not involved in the studies. CGG advised they plan to go ahead regardless. CGG and Relevant Stakeholder ID 2510 agreed to catch up when returned from leave to discuss the need for extra equipment up to three months before available. • CGG noted their preference was to survey from Zones 1 to 6 and it was noted that zone numbers should be used and not 'north-south' to avoid confusion. CGG noted at the next meeting the compensation proposals and funding information should be available and CGG would be in a better position to make commitments with regard to funding the studies.	prawn season, which will also take some time to sort out). CGG has assessed this concern as having merit since it is important that data is collected prior to the survey commencing. **Action:** CGG to discuss planning and logistics for the octopus survey in more detail with Relevant Stakeholder ID 2510 , in terms of getting equipment on time to support execution of the study before the seismic survey commences.	
	21/01/19	Meeting (Scientific Advisory Committee)	The fourth SAC meeting was held on 21 January 2019 however the minutes are not available for summary and inclusion in this EP update. The following items were discussed: • update on research projects • compensation • survey communications protocols update on study on zone order.	Objections and claims will be identified and assessed when the minutes have been drafted and reviewed.	NA
	Ongoing consultation: Consultation with Relevant Stakeholder ID 766and Relevant Stakeholder ID 2510 will be ongoing throughout the activity. Relevant Stakeholder ID 2510 is a member of the Scientific Advisory Committee, which will play a major role in resolving objections and claims from the fishing industry for the duration of the activity, and of particular relevance to the Relevant Stakeholder's, involved in developing a specific research study on the impacts of seismic activities on the octopus fishery near Lakes Entrance.				
Relevant Stakeholder ID 2718	03/08/18 17/08/18 22/11/18	Email incoming Email outgoing 3rd formal notification Rev 0	Via email incoming 03/08/18: Relevant Stakeholder ID 2718 emailed CGG expressing his disapproval for seismic surveys along with the following issues: • Recent studies on the effect of seismic impact on scallops have shown that seismic survey dramatically increase the mortality of mature scallops and studies are currently being undertaken to show the impact of seismic surveys on larva and spat in the water column. • The proposed area is extremely large and is a ground that has traditionally produced large volumes of scallops. • The previous seismic activity has almost eradicated scallop industry in the Lakes Entrance Zone. • There has been very little notice of the survey. Therefore, there has not been sufficient time to respond. • The medium to long terms affects will impact of the local fishermen's' livelihood. This will have an add on affect to all associated business and in the end the consumer. No response received in response to the third consultation letter sent to Steve Mantzaris on the 22nd November 2018.	The following five objections and claims were raised by Relevant Stakeholder ID 2718 and are considered relevant to his interests and activities: 1. concerns about impacts of seismic on scallops and larvae in the water column 2. claim that size of the survey area is too large and overlaps with scallop fishing grounds 3. claim that past seismic activity has almost eradicated scallop industry in the Lakes Entrance Zone 4. claim there has been very little notice of the survey and therefore no time to respond 5. claims the medium to long term impacts will affect local fishermen's' livelihood, which will have knock-on effects in the community.	Via email outgoing 17/08/18: CGG provided a response to Relevant Stakeholder ID 2718 via email as follows: **Seismic surveys increase the mortality of mature scallops:** Impacts of the proposed survey on scallops are expected to be minor and limited to short term effects. No mortality of scallops is predicted as a result of exposure to single pulses of seismic sound. Repeated exposure during normal survey operations is unlikely given that adjacent lines will be acquired more than 24 hours apart and biota can recover between exposures which will diminish as the vessel moves to further lines. There is no direct link between seismic surveys and scallop mortality. Przeslawski et al. 2018 paper investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established. **The area of the survey is extremely large and covers scallop grounds:** The area the survey covers does include the Bass Strait Central Zone Scallop Fishery and the Victorian Scallop Fishery, however historical data shows low to no effort over the area of the survey. In response to stakeholder feedback regarding an emerging scallop bed to the north of the survey, CGG have since revised the operational area to avoid almost all the important scallop bed that was subsequently identified following further consultation. This was communicated in the third consultation letter. **The previous seismic survey has almost eradicated the scallop industry from Lakes Entrance:** As stated above there is direct link between seismic surveys and scallop mortality. Przeslawski et al. 2018 paper investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established.

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					Harrington et al 2010 found no short-term impacts on scallops immediately after a seismic survey had been conducted in Bass Strait. Furthermore, a field study conducted by Day et al. 2016, found that exposure to seismic sound did not cause mass mortality of adult scallops, and overall mortality rates were at the low end of naturally occurring mortality rates. **There has been very little notice of the survey and therefore not been sufficient time to respond:** CGG have worked alongside VFA to ensure all relevant Victorian licence holders were sent information regarding the proposed survey on the 21st June 2018. CGG believes this provides sufficient time to respond with stakeholder concerns, as Steve has done. CGG ensured further updates would be communicated to him in future. **The medium to long term effects will impact the local fishermen as well as local business and economy:** As stated, the impacts of the proposed survey on scallops are expected to be minor and limited to short term effects. No mortality of scallops is predicted as a result of exposure to single pulses of seismic sound. The emerging scallop ground has been avoided due to stakeholder feedback and therefore there is no negative influence on the fishermen nor local economy expected because of this survey.
	Ongoing consultation: Relevant Stakeholder ID 2718 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2491	17/08/18 17/08/18 24/09/18 24/09/18	Phone call outgoing SMS outgoing SMS outgoing Email incoming	No response received to phone call outgoing and SMS's outgoing. Email incoming 24/09/18: Relevant Stakeholder ID 2491 informed the FLO of his desire to be included in stakeholder engagement. Stated to the FLO that he had major concerns about the project.	Relevant Stakeholder ID 2491 requested to be kept updated on the survey. **Action**: CGG to keep stakeholder up to date on the survey.	NA
	25/09/18	Meeting	CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. Relevant Stakeholder ID 2491 did not raise any queries or issues.	NA	NA
	19/10/18 12/11/18 13/11/18 26/11/18	Email outgoing Email outgoing Phone call outgoing Phone call outgoing	No feedback or response received from any outgoing communications from CGG.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2491 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2138	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 WM 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2138 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2739	23/08/18 10/09/18 22/11/18	Email incoming Email outgoing 3rd formal notification Rev 0	Via email incoming 23/08/18: Relevant Stakeholder ID 2739 emailed CGG airing his concerns about the project. His concerns were as follows: The survey area is too large and will completely decimate the industry if the supply from this area is interrupted for too long.	Relevant Stakeholder ID 2739made three claims as follows: • claims the survey is too large and will decimate the industry if seafood supply is cut off • claims the fishing industry and the post-harvest sector are sceptical and	Via email outgoing 10/09/18: CGG responded to the claims raised by Relevant Stakeholder ID 2739 as follows: • **the survey area is too large and will decimate the industry if supply is cut off:** CGG noted that fishers will not be excluded from the entire Acquisition Area (where the seismic sound source will be used) for the duration of

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Industry and the post-harvest sector are very sceptical and unhappy about the insufficient notice that has been given for reasonable debate and concerns to be aired. This is a public resource and the public have every right to be fully informed of the drastic affect that we believe this type of survey will have on their food source. No response received to the second or third stakeholder consultation letters.	unhappy about the insufficient notice that has been given for a response • concerned it is a public resource and the public have a right to be fully informed. **Action**: CGG to respond to each objection and claim stating how they have been addressed, including any control measures adopted in response to the feedback.	the survey. Explained the zoning system devised in consultation with fishers, and that the seismic vessel will operate within each zone for about a month. Fishers will be notified in advance of vessel location throughout the survey. Noted that fishers observing the required stand-off distances will be able to work around the vessel within the zone it is operating in as well, and effective communications will be maintained with any marine vessels in the area. The third stakeholder consultation letter updated stakeholders to explain that the survey area had been reduced by ~20% in response to feedback from the fishing industry. • **fishing industry and the post-harvest sector are unhappy about the insufficient notice that has been given for a response:** CGG explained they had been consulting with fishing associations and fishers since May and received very useful feedback (e.g. the importance of South East Reef and the recommendation to split the survey area into zones). Noted that concerns about noise and displacement replicate the issues Relevant Stakeholder ID 2739raised, so CGG are aware of these concerns. Stated that they have provided consultation letters to several associations for distribution since May 2018, including LEFCOL and the VFA. • **this is a public resource and the public have a right to be fully informed:** CGG explained they have consulted with fishing industry associations, individual fishers from state and Commonwealth fisheries, government bodies, titleholders, charter operators and researchers via a wide variety of methods including emails, letters, meetings, media releases and information packages. There have been articles in local media and CGG have also published an advertisement in the Gippsland Times to reach a broader cross-section of potentially relevant people. CGG noted they had endeavoured to inform all members of the local community as well as those with direct functions, interests or activities that may be affected by the proposed survey.
	Ongoing consultation: Relevant Stakeholder ID 2739 Consolidated Fishermen Ltd are relevant stakeholders and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2403	06/08/18 14/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 1 WM Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response was received in response to the first consultation letter sent Relevant Stakeholder ID 2403 on 6th August 2018. Via phone call on 14/08/18: Relevant Stakeholder ID 2403 stated that he had not reviewed the information distributed however he and his father are fishing in the Gippsland area and would need to stay informed with any updates to the project. Relevant Stakeholder ID 2403 further stated that if they had any concerns or queries regarding the project, they would be in touch. No response was received in response to the second consultation letter, email outgoing on 26/10/18 or third consultation letter.	No objections or claims.	NA
	Ongoing consultation: Relevant Stakeholder ID 2403 are relevant stakeholders and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 596	28/05/18 14/07/18 17/07/18 19/07/18 19/07/18	1st formal notification Rev 0 Email incoming Email outgoing Email outgoing Email incoming	No feedback received in response to the first stakeholder consultation letter. Via email incoming 14/07/18: Relevant Stakeholder ID 596 contacted CGG, said they were active octopus fishers with traps currently set within the survey area. Requested they be involved in the stakeholder consultation process and a meeting.	No objections or claims. Relevant Stakeholder ID 596 requested involvement in the consultation process and a meeting with CGG. **Action:** CGG to arrange face to face meeting with Relevant Stakeholder ID 596 and continue to include them in the consultation process.	Via email outgoing 19/07/18: I received your request for a meeting about CGG's proposed seismic survey. We'll be in Lakes Entrance on 26 July and are happy to meet with you then. Are you available? If so, what time would suit you? Via email outgoing 19/07/18: CGG sent invitation and details for meeting in Lakes Entrance on 26th July. Via email incoming 14/07/18: Relevant Stakeholder ID 596 confirmed they would attend.
	26/07/18	Meeting	Via meeting 26/07/18 (with CGG and Lakes Entrance fishers (commercial and charter) and LEFCOL):	Relevant Stakeholder ID 596 hold licences for the Victorian Ocean (General) Fishery,	CGG has responded to the three objections and claims as follows:

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			CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Issues and queries that were raised by Relevant Stakeholder ID 596 representatives were: • discussed research on octopus and said that over their last few trips they had been observing that 50% of their pots had eggs in them. Noted that octopus are short-lived and die after spawning. • asked what the impacts would be on octopus eggs (and recruitment) • asked to tape record the meeting and CGG agreed • asked what areas were most important to CGG for data acquisition. CGG explained the core areas are where there was already production such as the Kingfish and Barracouta fields and new sites being listed for exploration by the government, in the context of the looming energy shortage in Eastern Australia • noted they had not caught a fish in the area of the CarbonNet survey earlier this year and asked if this would happen at the Barracouta field after CGG's survey. CGG noted the accounts he was aware of indicated fishing had been good in the area. Relevant Stakeholder ID 596 pointed out they were referring to pilchards, not recreational species. CGG asked if they had raised the issue with CarbonNet. Advised them to lodge a complaint with CarbonNet, and if that wasn't resolved satisfactorily, then to lodge the claim with DEDJTR (Victorian regulator) and/or NOPSEMA (Commonwealth regulator). • asked about issues with interactions with octopus fishing gear, explaining they operate out of Lakes Entrance and leave gear in the water for about a month at a time. CGG stated they were happy to discuss this issue further, including specific areas and times. Relevant Stakeholder ID 596 agreed with the Relevant Stakeholder's that arrangements need to be made for the sinking of octopus gear. Discussed the issues with manoeuvrability of the seismic boat and their octopus gear. CGG agreed since the survey vessel could not go where the octopus gear was set because of entanglement risks that a strategy would be needed to manage the risk • Relevant Stakeholder ID 596 asked if CGG planned to contribute funds or compensate the industry. CGG responded they would not unless there was good science to support claims.	Victorian Purse Seine (Ocean) Fishery and Victorian Inshore Trawl Fishery. They are active within the survey area and their primary interest for this survey is octopus. They raised the following three objections or claims that are considered relevant to their interests and activities: 1. claimed the CarbonNet survey influenced their catch of pilchards 2. interference with octopus fishing gear due to overlap of the survey area with their fishing grounds 3. compensation or funding for potential impacts associated with the survey. **Action:** CGG to address each objection and claim and respond with the outcome, including any changes or control measures adopted.	1. **claimed the CarbonNet survey influenced their catch of pilchards:** CGG stated the accounts of fishing they were aware of indicated fishing had been good in the area. Relevant Stakeholder ID 596 pointed out they were referring to pilchards, not recreational species. CGG asked if they had raised the issue with CarbonNet and advised them to lodge a complaint with CarbonNet, and if that wasn't resolved satisfactorily, then to lodge the claim with DEDJTR (Victorian regulator) and/or NOPSEMA (Commonwealth regulator). 2. **interference with octopus fishing gear due to overlap of the survey area with their fishing grounds:** CGG responded during the meeting they were interested in whether spatial and/or time exclusions would be effective and asked if they see this working. CGG stated they wanted to understand the impacts and costs of moving or sinking gear and added they were not imposing anything at this point and wanted to work towards agreement with fishers. CGG agreed during the meeting that the survey vessel could not go where the octopus gear was set because of the entanglement risks, so a strategy was needed to manage this. 3. **compensation or funding for potential impacts associated with the survey:** financial assurance or compensation was not discussed during the meeting, except to say such arrangements would have to be supported by science. However, there have been subsequent discussions on this topic and the issue is being discussed by the Scientific Advisory Committee, which is tasked with progressing a compensation agreement and overseeing research on the impacts of seismic sound on octopus.

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	08/08/18	Email outgoing	CGG emailed meeting minutes to attendees of the meeting held on 26th July for review. No comments received back from Relevant Stakeholder ID 596.	NA	NA
	17/08/18	Phone call outgoing	CGG phone Relevant Stakeholder ID 698 to confirm her contact details and that she had been included in the consultation process. She replied that they had been receiving information on the project and were involved in consultation. CGG confirmed they would continue to engage with them.	NA	NA
	04/09/18	2nd formal notification fishers and fisheries	No feedback received in response to the second stakeholder consultation letter.	NA	NA
	21/09/18 23/09/18	Email outgoing Email outgoing	Via email outgoing 21/09/18: CGG emailed to give Relevant Stakeholder ID 596 a heads up about meeting planned with octopus fishers in Lakes Entrance on 25th September. Noted there were meetings being held earlier in the day with LEFCOL and SSFI, however CGG would like to meet with the Relevant Stakeholder's separately to discuss effects on the octopus fishery. Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. No response to either email.	NA	NA
	25/09/18	Meeting 1 (general fishers)	Meeting with Lakes Entrance fishers, representing both Commonwealth and Victorian fisheries: CGG displayed a map showing updates made to the survey area in response to feedback from fishers. Explained they had split the area into 7 zones and that each zone would be occupied for approximately 1 month. Noted that they had excluded South East Reef from the survey as it was a known spawning area. For the rest of the CGG responded to stakeholder queries and concerns that were voiced. Each stakeholder specific stakeholders are summarised under their respective rows in this table. Relevant Stakeholder ID 596 did not raise any issues or have any queries during this meeting.	No objections or claims.	NA
	25/09/18	Meeting 2 (octopus fishers)	Meeting with octopus fishers: CGG apologised for the short notice and that a further meeting would be held mid-October. Similar to the previous meeting, CGG explained the zoning system and timeframes and the rest of the meeting was for discussing specific issues and concerns for the octopus fishery. The issues and queries raised by Relevant Stakeholder ID 596 were: • they indicated their intention to tape the meeting and discussed the roles of the CGG representatives for the survey • asked why two meetings were being held today (the general meeting and octopus specific one). CGG replied that octopus fishery gear was fixed and so presented a specific set of problems compared to mobile fisheries • asked the FLO if he was aware of arrangements that Origin Energy had made with lobster fishers for the Crowes Foot Survey. FLO said yes and while not directly involved understood it had involved buying out quota and later a better interest donation to assist work on re-siting lobster peurulus collected during Tasmanian aquaculture operations. Relevant Stakeholder ID 596 asked what would happen for CGG's survey. CGG replied that they were not sure • Relevant Stakeholder ID 596 and the Relevant Stakeholder's discussed the need to have follow ups with a trusted observer on their vessels the first time that they hauled their pots after the	The following objections and claims were raised by Relevant Stakeholder ID 596 and are considered relevant to their interests and activities: 1. concern about the potential impacts of seismic sound on octopus after the survey was completed 2. concern about interference with fishing gear and having to move their lines out of the survey area 3. concern about financial compensation arrangements.	CGG responded to Relevant Stakeholder ID 596 objections and claims as follows: 1. **concern about the potential impacts of seismic sound after the survey was completed:** it was discussed during the meeting that it was difficult to determine impacts on octopus because their soft body would allow them to be rapidly consumed by other predators such as fish and crabs. CGG stated they would rely on available scientific literature and that any conclusion about impacts following the survey would have to also consider natural fluctuations. There was discussion about how impacts could be validated, including the suggestion of having a trusted observer. The second stakeholder consultation letter sent to fishers summarised the impact assessment outcomes for octopus, including the literature review and modelling undertaken. The Scientific Advisory Committee is tasked with overseeing a study on the impacts of seismic sound on octopus, in consultation with octopus fishers. The first Committee meeting was held on 23rd Nov (see below). 2. **concern about interference with fishing gear and having to move their lines out of the survey area:** CGG and the fishers discussed the option of sinking lines to avoid having to move to new fishing grounds and to prevent entanglements. 3. **concern about financial compensation arrangements:** in response to queries about rehabilitating damaged fishing grounds, CGG noted

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			survey to inspect potential impacts and then if needed conduct follow up inspections at 3 monthly intervals across a 1-year period, even longer if necessary. Noted they trusted CGG (FLO) as an honest observer • they referred to the second stakeholder consultation letter provided to fishers on 04/09/18, which said impacts on octopus would be limited, but there is no literature about this on octopus. They asked for a literature list and if CGG had a backup plan (if things go wrong and there are adverse effects). CGG replied that any conclusion about impacts would have to have also considered other factors such as natural fluctuations. • Relevant Stakeholder ID 596 asked about progress of the EP and if it was too late to make submissions. CGG replied that the EP had been lodged with NOPSEMA and that CGG did not expect it to be accepted in the first instance, but that submissions can be made by fishers now and after EP acceptance.		they would have to make sure they did not breach laws on inducements. Regarding compensating fishers for lost catch, CGG replied that they were not sure. The Scientific Advisory Committee is tasked with discussing potential compensation arrangements with fishers. The first Committee meeting was held on 23rd Nov (see below).
	19/10/18	Email outgoing	CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests.	NA	NA
	26/10/18	Email outgoing	CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys.	NA	NA
	31/10/18	Email outgoing	CGG emailed with invitation to octopus specific meeting on 2nd Nov and provided details (meeting time and location). Stated the objective of the meeting is to discuss a field-based assessment of the impacts of a typical 3D seismic survey on the octopus fishery. This would consider for example, injury to the animal, dispersal from traps, area fished, practical field work to enable the experiment. CGG noted they were proposing a collaborative study with fishers and the results would be made public. No response received.	NA	NA
	02/11/18	Meeting	Meeting held 2nd November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period • impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries.	CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to

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			As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.		avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	12/11/18 12/11/18 13/11/18	Email outgoing Email outgoing Email outgoing	Via emails outgoing (x2) 12/11/18: CGG sent draft meeting minutes to Relevant Stakeholder ID 596 for both meetings held in Lakes Entrance on 2nd November (with general fishers and octopus fishers). No comments received from Relevant Stakeholder ID 596. Via email outgoing 13/11/18: CGG updated the meeting notes in response to a comment from Relevant Stakeholder ID 2510 , specifically that the length of the octopus' lines has been corrected to say 6 km. Updated minutes were re-sent to attendees.	NA	NA
	22/11/18	3rd formal notification	No feedback received in response to the third stakeholder consultation letter.	NA	NA
	Ongoing consultation: Consultation with Relevant Stakeholder ID 596 will be ongoing throughout the activity, particularly regarding the moving/sinking of lines and the proposed research study on the impacts of seismic sound on octopus, which are being progressed via the Scientific Advisory Committee.				
Relevant Stakeholder ID 1743	10/08/18 15/08/18 04/09/18 26/08/18 22/11/18	1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback or response received to any outgoing communication.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 1743is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 870	28/05/18 04/09/18	1st formal notification Rev0 2nd formal notification fishers and fisheries	No response was received in response to the first and second consultation letters.	NA	NA
	23/09/18 23/09/18	Email outgoing Email incoming	Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Via email incoming 23/09/18: In response to the email sent by the FLO inviting fishers to a meeting with CGG, Relevant Stakeholder ID 870 responded thanking the FLO for the short notice.	No objections or claims.	NA
	02/11/18	Meeting	Meeting held 2nd November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period	CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution

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			be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	• impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries.	of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	13/11/18	Meeting	Via meeting 13/11/18 (SETFIA invited CGG representative to attend their meeting): The following were summarised by SETFIA from the meeting: • SETFIA wants to work with CGG to find a way the survey can occur with minimal effects on commercial fishing within the survey area • attendees at the meeting today were a third of the Commonwealth trawl quota ownership (within the survey area), all fish Relevant Stakeholder ID 2491et sales, some catching effort and some retail and secondary users • fishers with 125 years of experience explained that they were concerned about short term displacement of the fishing industry and then medium-term declines in catch rates • SETFIA is particularly affected by the CGG survey given its size, long duration and the importance of catches from the survey area. The following were also noted: • RPS in Perth is the new point of contact for consultation on the survey. SETFIA noted they requested CGG be the point of contact • CGG to consider appointing Dr UTas as a member of the Scientific Advisory Committee. This would be a remunerated position. The first meeting date for the Committee is to be confirmed. The Committee would consider items 3 and 4 below. • there was in principle agreement to discuss a study that involves monitoring pre-survey catch rates against post-survey catch rates. any proposal for compensation that is not open-ended would be considered by CGG. The maximum time for negative effects proposed by SETFIA is 6 months. Long term recruitment would be excluded from the proposal.	SETFIA represents the views and interests of licence holders, fishers and businesses with a commercial interest in the Southern and Eastern Scalefish and Shark Fishery, specifically the Commonwealth Trawl Fishery, Shark Gillnet Hook and Trap and Scalefish Hook sectors. The following objections and claims were raised, and all are relevant to their functions, interests and activities: 1. SETFIA members are primarily concerned about short term displacement of the fishing industry from the survey area, and then medium-term declines in catch rates 2. SETFIA members are particularly affected by the survey given its size, long duration and the importance of catches from the survey area 3. SETFIA believe there should be a compensation agreement in place in the event there are impacts on catch as a result of the survey. **Action:** CGG to address and respond to SETFIA's objections and claims listed above, noting any change or control measures adopted in response to the feedback. SETFIA also recommended CGG consider inviting Dr UTas onto the Scientific Advisory Committee. **Action:** CGG to invite Dr UTas onto the Scientific Advisory Committee.	Via meeting 13/11/18: CGG provided the following responses to the objections and concerns raised during the meeting: 1. **short-term displacement of fishers from survey area:** CGG noted that changes have been made to the survey area in response to stakeholder feedback to date, including reducing the area in size, trimming it to avoid habitat important to fishers and implementing a zoning system, and adopting a notification schedule before the survey, and communications measures during the survey to reduce short-term impacts to fishing operations. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). **medium-term declines in catch rates:** CGG has assessed the impacts of seismic operations on the fisheries species that are relevant to the organisations that Simon represents. A summary of the assessment (citing current research available on medium to long-term impacts on catch rates) was provided in the second stakeholder consultation letter. CGG also noted the uncertainty associated with measuring longer-term impacts attributable to seismic activities in the letter. 2. **size, location and duration of the survey:** CGG noted that changes have been made to the survey area and timing. The survey area has been reduced in size by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removes overlap with the nationally important 'Big Horseshoe Canyon' – an area of high ecological value – to the northeast of the survey area and with fishing habitat in this area, particularly grounds that are targeted by Danish seiners and an important nearshore scallop bed. The timing has been shifted from January to end of July in response to concerns raised by charter fishers and seafood suppliers about shore-term impacts over the Christmas period. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update. 3. **compensation for impacts to catch that are attributable to survey:** CGG explained that the SAC will be tasked to discuss compensation arrangements for the survey to identify a potential solution. CGG have appointed Dr UTas a member of the Scientific Advisory Committee. The first SAC meeting was held on 23rd November 2018.

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	22/11/18 26/11/18 26/11/18	3rd formal notification Email outgoing Email incoming	No response has been received in response to the third consultation letter sent to Relevant Stakeholder ID 870 on 22nd November 2018. Via email incoming 26/11/18: In response to the email incoming, Nathan responded that he appreciated the update.	NA	Via email outgoing 26/11/18: CGG apologised to the meeting yesterday for the short notice which was driven by the availability of their executive staff. Nonetheless the meeting was constructive; looking at problems, solutions whole of industry issues, and the wider social context of fishing and oil and gas production. The anxiety of fishers was well noted and CGG are working to minimise impacts to as low as they can. CGG have indicated a further meeting is planned mid next month to update all on their planning proposal and will aim at a time when most fishers are in port.
	Ongoing consultation: Relevant Stakeholder ID 870 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 710	24/09/18 24/09/18 25/09/18	SMS outgoing Email outgoing Meeting	No response received in response to SMS outgoing to Relevant Stakeholder ID 710 on 24th September CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made Via meeting at Lakes Entrance 26/07/18 (attended by LEFCOL and commercial/charter fishers): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements) • impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Relevant Stakeholder ID 710 raised the following specific comments, queries and concerns: • stated there were other spawning areas not just South East Reef. CGG noted they hadn't been advised of any other important areas to date. • asked why the survey was planned in a north-west south-east direction. Stated that if the survey was planned in a north-east south-west direction, the ground they fish could be done in a month. CGG responded that the geological structure influenced the survey direction. • was interested to know the depth of the seismic source. CGG responded the seismic source will be towed at depth of 6 m • referred to zone 1 being an important scalloping ground and that his Danish Seining fishing operation was taking a by-catch of scallops. Their abundance indicated recovery from previous years. Fishers were distressed about the survey proposal because they thought it would kill the scallops • stated that their Danish seining has indicated many juvenile blue warehou although few adults had been observed in preceding	Most of Relevant Stakeholder ID 710's queries and comments were addressed in the meeting. CGG determined that Relevant Stakeholder ID 710 raised four concerns relevant to his functions, interest and activities: 1. claims there were other spawning areas not just South East Reef 2. claims zone 1 is an important scalloping ground and fishers were concerned about impacts on scallops 3. concerns that if abundance drops after the survey fishers will be blamed 4. concerned about impacts of seismic noise on plankton and juvenile species. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback.	Via meeting on 26/07/18: During the meeting (and following) CGG responded to Relevant Stakeholder ID 710's objections and claims as follows: 1. Other important spawning grounds: CGG explained they have included South East Reef as a biologically important area for spawning fish as it has been identified by multiple fishermen. No other fishers have identified other areas as important spawning grounds to CGG. Later, an important scallop bed in zone 1 was identified by fishers and the survey area was reduced to avoid almost all of it. 2. See response to item 1. In addition, the second stakeholder consultation letter summarised the impact assessment for scallops indicating impacts are expected to be minor and limited to short term effects. No mortality of scallops is predicted. Przeslawski et al. 2018 investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established. 3. Regarding uncertainty with impacts and impacts following completion of the survey, the second consultation letter noted that there are many confounding factors to drops in catch rates, environmental variability such as changes in temperature and variability in natural recruitment rates as well as catch volumes. It is therefore difficult to attribute impacts to any one stressor. CGG were relying on the available research to inform the assessment of potential impacts. 4. the second consultation letter summarised the impact assessment for plankton and larvae for fished species.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			years since their abundance dropped. Relevant Stakeholder ID 710 asked if fishers get the blame if the species abundance drops again after seismic survey • noted he would be happy to be onboard the survey vessel to help with interaction with fishers for $300 a day. CGG stated that they would consider having a fisher on board the vessel • agreed with Relevant Stakeholder that NOPSEMA should be attending the meetings. CGG explained NOPSEMA are unable to attend as it is not a function of the organisation • stated his dissatisfaction with the notice given for the meeting and that it had occurred on a day that was perfect fishing weather. CGG apologised for the short notice of the meeting and stated that there is intention to meet again in October and an earlier notice will be provided • asked why zone 1 was being surveyed again and if information from previous surveys was available. CGG explained they have identified several issues with previous surveys that prevent a comprehensive regional geological evaluation of the area • asked how far around the airguns does everything get killed (meaning plankton and juveniles) • asked if the airguns were turned off when the survey ship turned across Zone 1 when doing the other lines. CGG stated the airguns are tuned off most of the time except for a gradual increase to full intensity as the vessel approached the start of each line.		
	19/10/18 21/10/18 22/10/18	Email outgoing Email incoming Email outgoing	Via email outgoing 19/10/18: CGG notified several key stakeholders that the Environment Plan had been submitted to NOPSEMA for their assessment, who subsequently determined that it was not reasonably satisfied with the Environment Plan and provided CGG with an Opportunity to Modify and Resubmit the EP. CGG stated that it had been falsely reported that this led to cancellation of the survey, and clarified this is incorrect and CGG plans to resubmit the EP. They noted there were further meetings planned in Lakes Entrance and that they will continue to actively engage with relevant stakeholders to find ways to reduce the impacts on stakeholders' activities and interests. Via email incoming 21/10/18: In response to the email sent by CGG on the 19th October, Relevant Stakeholder ID 710 discussed the following additional points regarding ongoing consultation: • asked that all future correspondence have all relevant persons cc'd in so that everyone has an idea with who and what is going on • raised that he is not aware of other meetings that have been held with fishers of Lakes Entrance and is interested in seeing the meeting minutes from these meetings.	No objections or claims. Relevant Stakeholder ID 710 requested CGG cc recipients in on email correspondence and stated he was not aware of meetings held. **Action:** CGG to respond to Relevant Stakeholder ID 710's queries.	Via email outgoing 22/10/18: In response to the email CGG responded as follows: • CGG are happy to include all relevant people in cc • CGG clarified that no stakeholder meetings have been held since NOPSEMA's decision was handed down, so Relevant Stakeholder ID 710 has not missed anything. The meeting referred to in the statement was held after our EP was originally submitted, not after NOPSEMA's decision and CGG believes Relevant Stakeholder ID 710 attended that one. CGG apologized for any confusion this had caused.
	02/11/18	Meeting	Meeting held 2nd November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period • impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries.	CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.		developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	12/11/18 13/11/18	Email outgoing Email incoming	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25th Sept to attendees for review. Via email incoming 13/11/18 Relevant Stakeholder ID 710 queried the meeting minutes, specifically a statement on page 5 regarding whether the airguns would be turned off or down.	NA	NA
	13/11/18	Meeting	Via meeting 13/11/18 (SETFIA invited CGG representative to attend their meeting): The following were summarised by SETFIA from the meeting: • SETFIA wants to work with CGG to find a way the survey can occur with minimal effects on commercial fishing within the survey area • attendees at the meeting today were a third of the Commonwealth trawl quota ownership (within the survey area), all fish Relevant Stakeholder ID 2491et sales, some catching effort and some retail and secondary users • fishers with 125 years of experience explained that they were concerned about short term displacement of the fishing industry and then medium-term declines in catch rates • SETFIA is particularly affected by the CGG survey given its size, long duration and the importance of catches from the survey area. The following were also noted: • Mike Mackie (RPS) in Perth is the new point of contact for consultation on the survey. SETFIA noted they requested CGG be the point of contact • CGG to consider appointing Dr UTas as a member of the Scientific Advisory Committee. This would be a remunerated position. The first meeting date for the Committee is to be confirmed. The Committee would consider items 3 and 4 below. • there was in principle agreement to discuss a study that involves monitoring pre-survey catch rates against post-survey catch rates. Any proposal for compensation that is not open-ended would be considered by CGG. The maximum time for negative effects proposed by SETFIA is 6 months. Long term recruitment would be excluded from the proposal.	SETFIA represents the views and interests of licence holders, fishers and businesses with a commercial interest in the Southern and Eastern Scalefish and Shark Fishery, specifically the Commonwealth Trawl Fishery, Shark Gillnet Hook and Trap and Scalefish Hook sectors. The following objections and claims were raised, and all are relevant to their functions, interests and activities: 1. SETFIA members are primarily concerned about short term displacement of the fishing industry from the survey area, and then medium-term declines in catch rates 2. SETFIA members are particularly affected by the survey given its size, long duration and the importance of catches from the survey area 3. SETFIA believe there should be a compensation agreement in place in the event there are impacts on catch as a result of the survey. **Action:** CGG to address and respond to SETFIA's objections and claims listed above, noting any change or control measures adopted in response to the feedback. SETFIA also recommended CGG consider inviting Dr UTas onto the Scientific Advisory Committee. **Action:** CGG to invite Dr UTas onto the Scientific Advisory Committee.	Via meeting 13/11/18: CGG provided the following responses to the objections and concerns raised during the meeting: 1. **short-term displacement of fishers from survey area:** CGG noted that changes have been made to the survey area in response to stakeholder feedback to date, including reducing the area in size, trimming it to avoid habitat important to fishers and implementing a zoning system, and adopting a notification schedule before the survey, and communications measures during the survey to reduce short-term impacts to fishing operations. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). **Medium-term declines in catch rates:** CGG has assessed the impacts of seismic operations on the fisheries species that are relevant to the organisations that Simon represents. A summary of the assessment (citing current research available on medium to long-term impacts on catch rates) was provided in the second stakeholder consultation letter. CGG also noted the uncertainty associated with measuring longer-term impacts attributable to seismic activities in the letter. 2. **size, location and duration of the survey:** CGG noted that changes have been made to the survey area and timing. The survey area has been reduced in size by ~20% by removing most of the nearshore and northern zones (old Zones 1 and 2). This removes overlap with the nationally important 'Big Horseshoe Canyon' – an area of high ecological value – to the northeast of the survey area and with fishing habitat in this area, particularly grounds that are targeted by Danish seiners and an important nearshore scallop bed. The timing has been shifted from January to end of July in response to concerns raised by charter fishers and seafood suppliers about shore-term impacts over the Christmas period. These changes and control measures were described in the third stakeholder consultation letter sent to SETFIA (see row below). The survey zoning is currently under review by the SAC which will be sent out in the next stakeholder update

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					3. **compensation for impacts to catch that are attributable to survey:** CGG explained that the SAC will be tasked to discuss compensation arrangements for the survey to identify a potential solution. CGG have appointed Dr UTas a member of the Scientific Advisory Committee. The first SAC meeting was held on 23rd November 2018.
	13/11/18 13/11/18 22/11/18	Email incoming Email outgoing 3rd formal notification	Via email incoming 13/11/18: Relevant Stakeholder ID 710 indicated to the FLO that one of the emails cc'd in had bounced No response has been received in response to the third consultation letter sent to Relevant Stakeholder ID 710 on the 22nd November.	No objections or claims.	Via email outgoing 13/11/18: In response to email incoming from Relevant Stakeholder ID 710 regarding an email address not receiving the meeting minutes. FLO confirmed that the recipient had received a copy.
	Ongoing consultation: Relevant Stakeholder ID 710 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2562	30/08/18 04/09/18 13/11/18 22/11/18	Letter incoming 2nd formal notification fishers and fisheries Letter outgoing 3rd formal notification	Via letter incoming 30/08/18: Relevant Stakeholder ID 2562 sent a letter to LEFCOL of LEFCOL airing his concerns regarding the proposed seismic survey. In summary his concerns raised were: 1. Excluding fishing in the area for a period of 5 months 2. The effect of banning fishing on freight movements from/to Lakes Entrance 3. Concern that banning fishing will result in reduced expenditure in Lakes Entrance and subsequent reduction in general freight for cartage, in addition to the loss of the fish cartage 4. Uncertainty on the effects on fish stocks following. No response has been received in response to the second consultation letter, letter outgoing, and third consultation letter sent to Relevant Stakeholder ID 2562 on the 4th September, 13th and 22nd November 2018 respectively.	Relevant Stakeholder ID 2562 raised the following objections and claims relevant to his functions, interest and activities: 5. Excluding fishing in the area for a period of 5 months 6. The effect of banning fishing on freight movements from/to Lakes Entrance 7. Concern that banning fishing will result in reduced expenditure in Lakes Entrance and subsequent reduction in general freight for cartage, in addition to the loss of the fish cartage 8. Uncertainty on the effects on fish stocks following. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback.	Via letter outgoing 13/11/18: CGG responded to each of Relevant Stakeholder ID 2562's claims as follows: 9. **Excluding fishing in the area for a period of 5 months** There is no ban on fishing proposed for this survey. Fishing industry stakeholders have expressed concern over the loss of access to fishing grounds during the survey. In response to this feedback CGG have altered the design and execution plans for the survey so that no vessels are excluded from the operational area for the duration of the activity. CGG has divided the acquisition area into seven zones and the seismic vessel will operate in one zone at a time, for a maximum of one month. 10. **The effect of banning fishing on freight movements from/to Lakes Entrance** CGG have noted the information you provided on your activities and the contribution that fish cartage makes to your business. As described above, there will be no ban on fishing. Fishing grounds will be accessible to fishers, except for the area where the seismic vessel is operating at the time. As mentioned, in response to stakeholder feedback, CGG has adopted a zoning system and a notification schedule so that fishers are aware in advance of where the seismic vessel will be operating and can plan their activities accordingly 11. **Concern that banning fishing will result in reduced expenditure in Lakes Entrance and subsequent reduced general freight for cartage:** As described above, there will be no ban on fishing. Fishing activities will continue for the duration of the survey, with a zoning system and notification schedule in place to reduce the potential displacement of fishers. CGG does not consider that the survey will result in reduced expenditure in Lakes Entrance or the demand for general freight and fish cartage services. 12. **Uncertainty on the effects on fish sticks following completion of seismic activity:** There has been recent research conducted by the CSIRO and Geoscience Australia to quantify fish behaviour and commercial fisheries catches before and after airgun operations for a 2D seismic survey in the Gippsland Basin (Bruce et al. 2018). The study found that seismic activity did not adversely affect catches of most commercial fish species. The results of this study are directly relevant to CGG's proposed survey. Catch rates for commercially important fish and invertebrate species are expected to be unaffected or to recover rapidly following the seismic survey, with recovery beginning as soon as the loudest (most intense) sound passes overhead. Some fishing stakeholders in the Gippsland area have stated that they have observed drops in catch rates following past seismic surveys for

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					periods of 3-4 months (for example) but have not provided evidence such as catch data to support this claim. It is difficult to assess the potential long-term effects of seismic activity on fish catchability because of the confounding influence of other factors such as fishing pressure, climatic changes and variation in the natural population dynamics of fish species. However, despite the lack of evidence that short-term or long-term catch rates will decline following the Gippsland MSS, CGG has adopted multiple control measures to reduce potential impacts to as low as reasonably practicable (ALARP).
	Ongoing consultation: Relevant Stakeholder ID 2562 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2400	06/08/18 08/08/18 15/08/18 16/08/18 04/09/18 23/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing Phone call outgoing Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing Email outgoing 3rd formal notification Rev 0	Via phone call 08/08/18: Relevant Stakeholder ID 2400 stated that he had received the stakeholder letter however didn't read it. He stated that he is dead against seismic, however it will go ahead no matter what they say. Relevant Stakeholder ID 2400 made the following comments: • stated that he had seen impacts form seismic surveys occur 6-8 months later • stated that following the 2010 seismic survey all the young scallop shells were dead 12-18 months later • suggested that CGG buy out all the licences • noted that he had been told not to comment by a Victorian organisation • stated that fishermen don't get heard, that they have managed to delay surveys however they still go ahead. No response has been received in response to phone calls outgoing, the second consultation letter, emails outgoing and third consultation letter sent to Relevant Stakeholder ID 2400 on the 15th and 16th August, 4th and 23rd September, 26th October and 22nd November 2018 respectively.	Relevant Stakeholder ID 2400 raised the following objections and claims relevant to his interests and activities: • Claimed there have been impacts from seismic 6-8 months after the survey and that following CarbonNet in 2010 young scallop shells were dead 12-18 months later • Suggested CGG compensate fishers • Claims their feedback is not listened to.	CGG responded to these objections and claims as follows: **Impacts on fisheries after the CG survey is finished:** The second stakeholder consultation letter contained a summary of the impact assessment on impacts of seismic sound on fisheries species, including scallops. No mortality of scallops is predicted as a result of exposure to single pulses of seismic sound. Repeated exposure during normal survey operations is unlikely given that adjacent lines will be acquired more than 24 hours apart and biota can recover between exposures which will diminish as the vessel moves to further lines. Przeslawski et al. 2018 investigated the potential effect of seismic noise in 2015 on scallops and no direct effect was established. Przeslawski et al 2018 concluded the 2010 scallop mortality event was the result of a thermal spike in water temperatures, which are known to cause mortality to scallops. **CGG compensate fishers by buying their licences:** See response above. There are no predicted impacts on the scallop fishery. Later described in the third consultation letter that a Scientific Advisory Group was established. This group is tasked with agreeing compensation arrangements for the survey. **Fishermen don't get heard and the surveys still go ahead:** CGG have demonstrated they have made changes in response to stakeholder feedback – particularly via the third consultation letter describing the reduction in the survey area and change to timing of the survey.
	Ongoing consultation: Relevant Stakeholder ID 2400 are a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2203	10/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev1 WM Phone call outgoing 2nd formal notification Email outgoing 3rd formal notification	No feedback or response received to outgoing communication.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2203 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2439, 2397	06/08/18 10/08/18 15/08/18 16/08/18 04/09/18 12/09/18 26/10/18 22/11/18	1st formal notification Rev 0 1st formal notification Rev1 WM Phone call outgoing Phone call outgoing 2nd formal notification fishers and fisheries 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2439, 2397 on 6th and 10th August 2018. Via phone call on 15/08/18: Relevant Stakeholder ID 710 stated that he had not reviewed the information distributed however is fishing in the Gippsland area and would need to stay informed with any updates to the project. No response was received in response to the second consultation letters, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2439, 2397 on the 4th and 12th September 26th October and 22nd November respectively.	No objections or claims. They have requested to be kept informed about the survey.	NA
	Ongoing consultation: Relevant Stakeholder ID 2439, 2397 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2405	06/08/18 16/08/18 04/09/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification	No feedback or response received to outgoing communication.	NA	NA

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	26/10/18 22/11/18	Email outgoing 3rd formal notification			
	Ongoing consultation: Relevant Stakeholder ID 2405 are a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2566	30/08/28	Phone call outgoing	Via phone call outgoing 30/08/18: Confirmed he had been notified by SETFIA about the survey and locations. Said he is retired, and his son now runs the business. Issues/concerns he raised were: • Area covered by the survey represents entire extent of their fishing grounds. • Impacts on vessel movements and daily fishing locations. • Noticed during previous seismic surveys fish were attracted to the survey location. • Fishing operations are set the night before and locations selected based on where the fish are. If they choose to fish in location the survey vessel is operating it means they must leave the area and lose the catch for the day. They cannot simply go and fish elsewhere last minute. They go where the fish go. Lost catch is not compensated. • Communications with operators to date was varied. Said there needs to be better efforts from operators to be in contact with fishers (via associations/organisations) daily advising them of the vessels location in advance so fisherman can plan accordingly. Said this had been done to mixed level of success by previous operators. • Confirmed he is happy to be engaged via SETFIA rather than individually going forward.	Relevant Stakeholder made the following objections and claims: 13. Area covered by the survey represents entire extent of their fishing grounds 14. Impacts on vessel movements and daily fishing locations 15. Noticed during previous seismic surveys fish were attracted to the survey location 16. Fishing operations are set the night before and locations selected based on where the fish are. If they choose to fish in location the survey vessel is operating it means they must leave the area and lose the catch for the day. They cannot simply go and fish elsewhere last minute. They go where the fish go. Lost catch is not compensated. 17. Communications with operators to date was varied.	The second consultation letter distributed to stakeholders on the 4th September, has been distributed to Relevant Stakeholder through his association SETFIA. Relevant Stakeholders claims have been addressed within the second consultation letter: 18. **Area covered by the survey represents entire extent of their fishing grounds:** Fishing industry stakeholders have expressed concern over the loss of access to fishing grounds during the survey. In response to this feedback CGG have altered the design and execution plans for the survey so that no vessels are excluded from the operational area for the duration of the activity. CGG has divided the acquisition area into seven zones and the seismic vessel will operate in one zone at a time, for a maximum of one month. 19. **Impacts on vessel movements and daily fishing locations:** The second consultation package included information regarding displacement to other marine users. CGG have committed to keeping relevant fishers informed of survey activities so that fishing operations can be planned to avoid the area in which the survey vessels are active. Furthermore, a Notice to Mariners will provide official notification of the exclusion zones. Notification commitments have been included in this EP. 20. **Noticed during previous seismic surveys fish were attracted to the survey location:** This claim aligns with recent research undertaken by Bruce et al. 2018, which concluded that catch rates of 9 out of 15 commercially targeted fish species increased in areas where a seismic survey was being conducted. Further information regarding this research is included in the second consultation package. 21. **Fishing operations are set the night before and locations are selected based on where the fish are:** See response to concern regarding impacts on vessel movements and daily fishing locations above. Fishing stakeholders will have access to the sail lines and projected survey order. Notifications will be sent to fishers to plan fishing activities around the surveys location. 22. **Communications with operators to date was varied:** CGG has established notification commitments to be followed when notifying mariners of the vessels locations. Consultation is ongoing and CGG endeavour to respond to all stakeholder concerns as quickly as practicable.
	23/09/18 24/09/18 24/09/18	Email outgoing Email incoming Email outgoing	Via email incoming 24/09/18: In response to the email sent by the FLO inviting fishers to a meeting with CGG, Relevant Stakeholder noted he would not be at the meeting and neither would most the LE fleet. Relevant Stakeholder was disappointed at the short notice given for the meeting. Relevant Stakeholder noted from his experience with seismic surveys, little knowledge of the effects on the fishery have been achieved. Restrictions to fishing grounds will have a significant impact on profitability. Relevant Stakeholders experience with seismic surveys hasn't been good.	Relevant Stakeholder claimed that in his experience with seismic surveys, little knowledge of the effects on the fishery have been achieved and that restrictions on access to fishing grounds will have a significant impact on profitability.	Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Via email outgoing 24/09/18: FLO thanked Relevant Stakeholder for his concerns and informed him that CGG will be asked to respond to his comments at the meeting. CGG has responded to these claims as follows: **Little knowledge of the effects on the fishery.** • CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. • The impact assessment within the second consultation package states that the effects of underwater noise on fish (and sharks) within the vicinity of the Gippsland MSS may wither be physiological injury (no fish mortality is expected) or behavioural disturbance. There are many confounding factors to drops in catch rates, in particular environmental variability such as changes in temperature and variability in natural recruitment rates as well as catch volumes **Restrictions to fishing grounds will have a significant effect on profitability.** • CGG explained in the second and third stakeholder consultation letters that there is no ban on fishing for this survey. CGG have altered the design and execution plans for the survey so that vessels are not excluded from the operational area for the duration of the activity. • CGG has divided the acquisition area into zones and the seismic vessel will operate in one zone at a time, for about one month.
	26/09/18 26/09/18	Email outgoing Email incoming	Via email outgoing 26/09/18: FLO advised Relevant Stakeholder that CGG apologise for the short notice of the meeting that was driven by the availability of executive staff. FLO informed Relevant Stakeholder that the meeting was constructive; looking at problems, solutions whole of industry issues, and the wider social context of fishing and oil and gas production. The anxiety of fishers was well noted and CGG are working to minimise impacts to as low as they can. CGG have indicated a further meeting is planned mid next month to update all on their planning proposal and will aim at a time when most fishers are in port. Via email incoming 26/09/18; Relevant Stakeholder informed the FLO that he will attempt to be at the next meeting if possible.	NA	NA
	02/11/18	Meeting	Meeting held 2nd November 2018 attended by CGG, fishing representatives (e.g. LEFCOL) and fishers. Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period • impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries.	CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed. • **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
	06/11/18 12/11/18 26/11/18	Phone call outgoing Email outgoing Phone call outgoing	Via phone call outgoing 06/11/18: CGG phoned Relevant Stakeholder to determine how long it takes to a Danish Seiner to complete a single shot. Relevant Stakeholder informed CGG around 1hr and 20 minutes. Via phone call outgoing 26/11/18: CGG phoned Relevant Stakeholder to determine if he had received the latest consultation package from SETFIA. Relevant Stakeholder stated he had received the information and was pleased to see the development of the Advisory committee. Relevant Stakeholder stated that he is happy to continue to receive information from SETFIA rather than from CGG	CGG acknowledge Relevant Stakeholders request for him to receive consultation material from SETFIA not directly from CGG.	Via email outgoing 12/11/18: CGG sent the meeting minutes for the meeting on 25th Sept to Relevant Stakeholder for review.as he was unable to attend on the day
	Ongoing consultation: Relevant Stakeholder ID 2566 is a relevant stakeholder however has stated that consultation material is distributed to him Via SETFIA and does not require it to be sent through to him additionally.				
Relevant Stakeholder ID 1744, 1774	10/08/18 15/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 1 WM Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 1744, 1774 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2435, 2353	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response has been received in response to the first consultation letter sent to Relevant Stakeholder ID 2435, 2353 on 06/08/18 Via Phone call outgoing 16/08/18: Relevant Stakeholder ID 2435 answered the phone call outgoing from CGG. Relevant Stakeholder ID 2435 stated that he does fish in the area and required to be kept informed. Relevant Stakeholder ID 2435 also asked whether a before after survey will be conducted. No response has been received in response to the second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2435, 2353 on 4th September, 26th October and 22nd November 2018 respectively.	The claim raised in Relevant Stakeholder ID 2435, 2353.'s feedback was as follows: • Relevant Stakeholder ID 2435, 2353 have requested to be kept informed. **Action**: CGG will continue to keep stakeholder up to date with consultation material Relevant Stakeholder ID 2435, 2353 also raised a query as to whether a before after survey will be conducted.	Via Phone call outgoing 16/08/18: Informed Relevant Stakeholder ID 2435 that he would be kept informed regarding the survey. In response to Relevant Stakeholder ID 2435s claim regarding the before after survey, CGG have considered scientific monitoring programs to coincide with the proposed survey however before after surveys pose large problems with various confounding factors impacting catch rates, in particular environmental variability such as changes in temperature and variability in natural recruitment rates as well as catch volumes.
	Ongoing consultation: Relevant Stakeholder ID 2435, 2353 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2333	17/08/18 21/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing 1st formal notification 2nd formal notification Email outgoing 3rd formal notification	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2333 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2198	10/08/18 16/08/18 04/09/18 22/11/18	1st formal notification Rev1 WM Phone call outgoing 2nd formal notification fishers and fisheries 3rd formal notification	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2198 on 10th August 2018. Via phone call on 16/08/18: Relevant Stakeholder ID 2198 stated that he had not reviewed the information distributed however he is fishing in the Gippsland area and would need to stay informed with any updates to the project. He further stated that if they had any concerns or queries regarding the project, he would be in touch.	No objections or claims. Relevant Stakeholder ID 2198 has asked to be kept informed on the survey.	Via phone call 16/08/18: CGG informed Relevant Stakeholder ID 2198 that he will continue to be kept up to date with consultation material.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			No response was received in response to the second consultation letter and third consultation letter sent to Relevant Stakeholder ID 2198 on the 4th September and 22nd November respectively.		
	Ongoing consultation: Relevant Stakeholder ID 2198 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2501	17/08/18 17/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing 1st formal notification Rev2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	Via phone call 17/08/18: CGG informed Relevant Stakeholder ID 2501 of the proposed seismic survey Relevant Stakeholder ID 2501 stated that he has been away for the past few months and does not remember seeing anything regarding the survey. He provided CGG with contact details for the consultation material to be sent through to. CGG suggested he review the information provided and respond if he has any issues. No response was received in response to the first and second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2501 on the 17th August, 4th September, 26th October and 22nd November respectively.	No objections or claims. He asked to be kept informed on the survey.	NA
	Ongoing consultation: Relevant Stakeholder ID 2501 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2139	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 WM 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2139 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2140	13/08/18 04/09/18 22/11/18	1st formal notification Rev 1 WM 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2140 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2494	28/05/18 18/07/18 18/07/18	1st formal notification (Rev 0) Phone call outgoing Email outgoing	No feedback received in response to the first stakeholder consultation letter. Via phone call outgoing 18/07/18: CGG phoned Relevant Stakeholder ID 2494 about the proposed survey and the upcoming meeting with LEFCOL on the 26th July 2018. CGG and Relevant Stakeholder ID 2494 discussed venue options. The discussion was documented in an email (summarised below). Via email outgoing 18/07/18: CGG followed up with an email summarising the phone conversation as follows: • Relevant Stakeholder ID 2494 confirmed he received the first stakeholder consultation letter • Relevant Stakeholder ID 2494's primary concerns were about the effects of underwater sound on fishes and food chains (i.e. the potential for longer term impacts >5 years) and the associated financial impact on fishers. He didn't think seismic activity impacted sharks, but claimed it would affect their food chain and that whilst there is no impact on shark catches in the year following a seismic survey, there are impacts 3-5 years after • Relevant Stakeholder ID 2494's other concerns and comments were: ◦ the arrogance of seismic operators who have little concern for the impacts on fishers	Relevant Stakeholder ID 2494 is a shark gillnet fisher (Table 1). The target species in this sector is primarily gummy shark, but also common school shark and elephant fish. CGG have identified the following seven objections or claims raised by Relevant Stakeholder ID 2494 that are relevant to his functions, interests and activities: 1. the effect of seismic sound on fishes and their food chain, including scallops, octopus and rock lobster 2. financial impact of reduction in catch due to impacts of seismic sound 3. inappropriate consultation undertaken by seismic operators to date 4. displacement from fishing grounds for 5 months 5. past seismic surveys have destCO2CRC ed fish habitat and blue warehou 6. timing of survey and potential impacts on Christmas supply near Lakes Entrance 7. objected to CGGs justification for the survey (that it would reduce need for future surveys).	No feedback was received in response to the email sent on 18/07/18. Note that the objections or claims raised by Relevant Stakeholder ID 2494 have been discussed extensively in subsequent meetings and email correspondence (covered in the rows below). Control measures adopted in response to Relevant Stakeholder ID 2494's feedback are also described below. CGG provided the following responses to these seven objections and claims: 1. **Long-term effect of seismic sound on fishes and their food chain**. The impacts of seismic sound on sharks were assessed and a summary of the impact assessment (citing current research and including a summary of the modelling conducted) was provided to Relevant Stakeholder ID 2494 in the second stakeholder consultation letter. The letter also covered the impact assessment for potential prey species Relevant Stakeholder ID 2494 was concerned about regarding the food chain for shark (octopus, rock lobster and scallops). Impacts on eggs and larvae were also covered in the letter. 2. **Financial impacts of reduced catch.** The impact assessment summary provided in the second stakeholder consultation letter summarised the available research on impacts to fisheries from seismic operations. It found that there are no documented accounts of drops in catch rates from fishers across the world and therefore no scientific evidence to support the claim above. The letter noted research conducted by CSIRO and Geoscience Australia in the Gippsland Basin showing seismic did not have an adverse effect on catches of most commercial fish species. Some reduction was observed for gummy shark however the authors noted this was not evidence of an impact from the seismic survey. All available literature has been considered in

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• believed he would be excluded from the survey area for 5 months and that the survey would force the SE fleet out of the area • claimed that the CarbonNet survey in 2010 had destCO2CRC ed fishing grounds and that South East Reef had been killed • claimed that blue warehou stock had been destCO2CRC ed by seismic in the 90s and was still not recovered • Relevant Stakeholder ID 2494 noted that most of his fishing is in the shallower half of CGG's Operational Area. He stated he could fish in other areas (e.g. around Flinders Island), but it is a long way away and not where he traditionally fishes • noted that around Christmas time, a lot of the fishing trips occur in the local area (around Lakes Entrance) to supply local demand • noted he had concerns about potential impacts on scallops, octopus and crayfish • claimed there was broad opposition to seismic and did not believe this would be the last seismic survey needed in the region (as claimed by CGG). CGG also confirmed time and location of the meeting with LEFCOL in the email.	**Action:** CGG to address the seven objections and claims listed above and respond with any control measures that have been adopted in response to his feedback.	the impact assessment and subsequently in determining the control measures adopted for the survey. Impacts on catch were summarised in the second stakeholder consultation letter and adopted control measures were documented in the second and third stakeholder consultation letters sent to Relevant Stakeholder ID 2494. 3. **Inappropriate consultation by seismic operators.** This concern was discussed further in subsequent meetings (see rows below). CGG adapted their consultation approach throughout the development of the EP to encourage ongoing feedback and dialogue with fishers, including Relevant Stakeholder ID 2494. Communications during the survey were responded to in subsequent consultation events (see rows below). 4. **Displacement from fishing grounds.** The displacement of fishers from their fishing grounds has been extensively discussed in subsequent meetings (e.g. on 26th July 2018) and emails (see below). This concern was also addressed in the second stakeholder consultation letter sent to Relevant Stakeholder ID 2494. 5. **Destruction of habitat.** The impact assessment conducted by CGG covered impacts to sharks, their food chain species and habitat. CGG provided a summary of the impact assessment covering impacts to habitat (citing research) in the second stakeholder consultation letter. There were further discussions with Relevant Stakeholder ID 2494 on important habitat for his fishing activities (see rows below). 6. **Impacts on Christmas seafood supply near Lakes Entrance.** There were further discussions with on impacts to the seafood supply during the Christmas period and CGG made changes to the timing of the survey to account for this (refer to rows below). This issue and the changes made by CGG were included in the third stakeholder consultation letter sent to Relevant Stakeholder ID 2494. 7. **Justification for the survey.** Justification for the survey was discussed in subsequent meeting on 26th July 2018 (see below). CGG responded with the drivers for the survey. This was also explained in the second stakeholder consultation letter sent to Relevant Stakeholder ID 2494. **Control measures:** In response to the objections and claims raised by Relevant Stakeholder ID 2494 the control measures adopted included changes to the survey area (size, zoning and avoiding areas of importance to shark fishing), the timing of the survey (to reduce impacts to spawning, and seafood supply during the Christmas period), and communication with fishers during the survey to manage displacement concerns and vessel interactions. These control measures were included in the second and third stakeholder consultation letters sent to Relevant Stakeholder ID 2494, discussed directly with him, and have been documented in this EP (refer to Section 6.0).
	26/07/18	Meeting	Via meeting at Lakes Entrance 26/07/18 (attended by LEFCOL and commercial/charter fishers): CGG, introduced themselves and confirmed everyone had received the first stakeholder consultation letter. Stated the purpose of the meeting was to understand fishers' concerns. CGG provided an overview of seismic survey operations, drivers for the survey and key areas of interest for them. They also noted the consultation requirements for the EP, which must be accepted by NOPSEMA. The following general objections and claims were raised and discussed: • displacement of fishers from the survey area/ban on fishing • financial impacts associated with displacement of fishers from fishing grounds during the survey • risk of vessel collision (notifications of vessel location during the survey, exclusion zone requirements)	Multiple objections or claims were raised by Relevant Stakeholder ID 2494 and are considered relevant to his functions, interests and activities. These are addressed in the right-hand column. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback. Relevant Stakeholder ID 2494 raised concerns about impacts to whales, flathead, sygnathids. CGG considers these are not relevant to his functions, interests or activities as a shark fisher as they do not represent target species or key prey species. CGG has consulted with stakeholders whose functions, interests or	Via meeting on 26/07/18: During the meeting (and following) CGG responded to Relevant Stakeholder ID 2494's objections and claims as follows: 1. **Long-term impacts on catch rates following seismic surveys**: CGG noted in the meeting that previous claims about the impacts of seismic on fisheries had not been supported with accurate information and that this was needed to properly assess potential impacts. Further response provided by CGG, including the control measures adopted is summarised in Item #1 the row above. 2. **Impacts on blue warehou:** CGG noted in the meeting that blue warehou had a soft gill structure and readily dropped out of nets, and unlike many other fish they sink when brought to the surface. CGG also noted that at the time large depletions of blue warehou were being observed off Lakes Entrance they were also being taken in huge quantities by demersal trawlers off Portland, and this confounds attributing the species decline to just seismic surveys.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• impacts on catch following seismic surveys (raised specifically in relation to shark, blue warehou, rock lobster, scallops) • impacts of reduced catch on broader community • timing and location of survey (in relation to spawning) • potential impacts on whales • uncertainty associated with research on the effects of seismic surveys on fisheries • potential damage to fishing gear and compensation issues. Relevant Stakeholder ID 2494 stated he was opposed to seismic surveys and made the following additional objections and claims: • claimed that over 35 years he had kept records and that catch rates decline about 12 months following a survey and do not recover for 3-5 years affecting profits • claimed that seismic activity over SE Reef in the 90s led to the collapse of blue warehou stocks and further seismic would affect their recovery • claimed that seismic activities kill the spawn and roe of blue warehou • claimed that the current decline in catches of flathead were attributable to the seismic survey in 2010 • noted fishers observed declines in scallop catches following the 2010 seismic survey and had worked with a statistician (Dr Malcolm Haddon) to try to understand what was occurring. However, as the fishers did not continue to fish in the affected area, there was insufficient data to show that catches had been affected. • stated concern about communications with fishers and described a near-collision which had occurred during a previous seismic survey near Flinders Island • that reduced catch would affect the broader community, not just fishers. Eight families relied directly on income from his business. The potential financial loss resulting from displacement from an area where fish are being tracked to and he had to cease fishing • that octopus were important not only as a fishery species but as part of the food chain and noted that there are a lot of eggs in early Spring around Flinders Shallows, but that octopus seem to disappear in some years • stated concern about uncertainty in the research and that a sensible approach to monitoring is required • did not believe this would be the last seismic survey needed in the region • stated concern that there would be two passes over the one piece of 'ground' (habitat) Relevant Stakeholder ID 2494 asked how seismic would affect: • dolphins ability to detect fishing gear (claimed that fishers have trouble with dolphins interacting with their gear) • natural movements of school and gummy sharks (migration and feeding) • breeding habitats of sharks Relevant Stakeholder ID 2494 also asked the following queries: • how CGG would measure and monitor effects on sharks noting that it takes about 12 months to affect gummy sharks? • who would be accountable if there were impacts after the survey? • how far would seismic sound travel and impacts on protected species and prey species such as prawns and octopus? • what are the potential impacts on roe and spawn of target species? • if attendees would receive a copy of the meeting minutes Relevant Stakeholder ID 2494 suggested the following:	activities are directly relevant to those species. It should be noted however that the second stakeholder consultation letter provided to Relevant Stakeholder ID 2494 does cover impacts to whales (in terms of survey timing and location) and flathead.	3. **Impacts of seismic on eggs and larvae:** To address this concern, CGG later provided a summary of the impact assessment related to fisheries species (including eggs and larvae) in the second stakeholder consultation letter. Refer also to Item #1 in the row above. 4. **Communication between CGG and other marine users during the survey:** In the meeting CGG replied they have had discussions with SETFIA and SIV on how best to communicate with fishers during the survey and welcomed suggestions from stakeholders if they hadn't been satisfied with previous methods. CGG later communicated the notifications and other control measures for managing vessel interactions that CGG had adopted in response to feedback, in the second and third formal consultation letters. 5. **Potential financial and social impacts of reduced catch from displacement from fishing grounds:** Refer to Items #2 and #4 in the row above for CGG's response to this claim. 6. **Impacts of seismic surveys on food chain species for shark (i.e. octopus):** To address this concern, CGG later provided a summary of the impact assessment related to fisheries species (including eggs and larvae) in the second stakeholder consultation letter. Refer also to Item #1 in the row above. 7. **Uncertainty in the research and potential monitoring and difficulty determining that seismic has an impact:** In the meeting CGG noted it was unlikely that the available catch data would provide a conclusive result to prove or disprove that seismic surveys have an impact. CGG said they will review all available scientific literature but do understand that it is not easy to prove whether seismic has an effect or not since there are many factors affecting the interpretation of fisheries catches, including warmer waters from climate change, and fisheries catches do vary quite widely over time. Noted also that it is difficult to replicate a seismic survey in research design. The Aguilar de Soto work on scallop larvae did not replicate the real in-field situation and has been widely rejected because of this. CGG also stated that if seismic was shown to have a significant effect then the survey wouldn't be conducted. CGG later provided a summary of the impact assessment related to fisheries species and their habitat (citing research) in the second stakeholder consultation letter. 8. **Covering same ground twice:** CGG clarified in the meeting through reference to the 600 m width of the streamer swathe and that although the footprint of the doors path overlapped as adjacent lines were acquired there was no overlap with the passage of the source which made a single pass. 9. **Need for further seismic surveys in the Gippsland Basin:** CGG replied in the meeting that reprocessing of existing data had created a lot of titleholder interest with greater visibility of strata below coal deposits. This has increased prospectively in the context of increasing demand for new gas sources in eastern Australia. Previous seismic surveys had often been done in a patchwork manner, often in the wrong direction and using outdated methods. CGG's proposed survey would provide a complete picture of the region, using the latest technology and acquired in the best directions for processing. CGG also explained that the survey area also includes newly gazetted blocks, and that the bidding process for newly gazetted blocks requires potential titleholders to commit to a program of works, which generally includes seismic exploration. Further justification for the survey was also communicated in the second stakeholder consultation letter. CGG provided the following answers to Relevant Stakeholder ID 2494 about how seismic would affect the following: 10. **dolphins ability to detect fishing gear**: review of literature did not indicate that the seismic survey would affect dolphins ability to detect

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			• splitting the survey area into four zones since they fish more than half the Operational Area mostly in the shallower parts • avoiding areas of significance, particularly SE Reef near the Halibut platform.		gear. The interference with fishing gear as a result of the seismic survey (vessel movements) was described in the second consultation letter provided to Relevant Stakeholder ID 2494. 11. **Impacts on natural movements of school and gummy sharks**: to address this concern, CGG later provided a summary of the impact assessment that briefly summarised the impacts to the movement of fishes. Bruce et al. (2018) monitored acoustically tagged species (gummy shark, swell shark, tiger flathead) before, during and after the seismic survey and found little evidence of consistent behavioural responses, except for flathead, which increased their swimming speed during the seismic survey period and changed their diel movement patterns after the survey. This was provided in the second stakeholder consultation letter. 12. **breeding habitats of sharks**: subsequent discussions were held with Relevant Stakeholder ID 2494 regarding the importance of SE Reef to his target species (refer to the rows below). CGG has responded with changes to the survey area in response to this feedback. CGG provided the following responses to Relevant Stakeholder ID 2494's other queries: 13. **how CGG would measure and monitor effects on sharks noting that it takes about 12 months to affect gummy sharks?** Refer to Item #7 above about uncertainty with research conducted and determining the impacts on fisheries species attributable to seismic surveys. Some of the current research on impacts (summarised from the impact assessment) was included in the second consultation letter sent to Relevant Stakeholder ID 2494. 14. **who would be accountable if there were impacts after the survey?** CGG noted that the difficulties ahead will be data driven (based on assessment) and depending on the outcomes, they could consider looking at an independent party to advise if needed. 15. **how far would seismic sound travel and impacts on protected species and prey species such as prawns and octopus?** CGG replied in the meeting that the spreading of sound waves is complicated in shallow waters but that CGG have commissioned underwater sound modelling for the survey. CGG later communicated the outcomes of the modelling and potential impacts on prawns and octopus in the second stakeholder consultation letter. 16. **what are the potential impacts on roe and spawn of target species?** To address this concern, CGG later provided a summary of the impact assessment related to fisheries species (including eggs and larvae) in the second stakeholder consultation letter. 17. **would attendees receive a copy of the meeting minutes?** CGG replied in the meeting they would. Meeting minutes were later sent to attendees (refer to events below). CGG adopted both of Relevant Stakeholder ID 2494's suggestions to mitigate impacts on fishers by reducing the survey area to avoid areas of significance to fishers (including SE Reef), and by dividing the area into zones. These control measures were discussed directly with Relevant Stakeholder ID 2494, communicated in the second and third formal consultation letters and discussed in subsequent meetings (refer to the rows below). Refer also to the control measures referred to in the row above.
	30/07/18 31/07/18	Email outgoing Email incoming	Via email outgoing 30/07/18: CGG followed up with Relevant Stakeholder ID 2494 to find out more about the location of SE Reef and included a map. Via email incoming 31/07/18: Relevant Stakeholder ID 2494 replied that the area identified was the main part of SE Reef and there was isolated piece outside that area.	No new objections or claims.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	08/08/18	Email outgoing (meeting minutes)	No feedback received in response to the meeting minutes from meeting held on 26th July 2018 that CGG distributed to attendees.	NA	NA
	17/08/18 17/08/18 30/08/18	Phone call outgoing Phone call incoming Phone call outgoing	Via phone calls 17/08/18 and 30/08/18: CGG were phoning to find out more information about Flinders Shallows Relevant Stakeholder ID 2494 raised during the meeting on 26th July 2018. The intention was to clarify the location so that potential impacts could be considered and addressed. Via phone call 30/08/18: Relevant Stakeholder ID 2494 stated that Flinders Shallows was near Flinders Island near Tasmania and the main importance of Flinders Shallows was octopus and their egg laying. The other objections and claims discussed during the phone call were: • impact of seismic activities on fish and fisheries. He was adamant that seismic activity has a longer-term impact on fish stocks and his catches – not an immediate impact but after a period (months/years). He has experienced this before with other surveys, notably the one in 2010 • he wished that no more seismic was needed in the Gippsland area as its been hit hard by this • he has estimated that about a third of his annual catch comes from within the area of the proposed CGG survey • displacement of fishers from the survey area. Relevant Stakeholder ID 2494 also noted: • it would be best to avoid seismic activity in shallow areas (3-6 NM from the coast) over the full moon as gummy sharks are most active then • he sets nets parallel to the coast and they are about 4 NM in length • he confirmed the importance of SE Reef as a key habitat for commercial species especially blue warehou.	Relevant Stakeholder ID 2494 raised three objections or claims were raised by Relevant Stakeholder ID 2494 and are considered relevant to his functions, interests and activities. These are addressed in the right-hand column. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback.	Via phone call 30/08/18: 1. **Importance of Flinders Shallows:** CGG stated during the phone call that given the location of Flinders Shallows near Tasmania it was not relevant to CGG's survey. Relevant Stakeholder ID 2494 also noted this. 2. **Long-term impacts on catch rates following seismic surveys:** This issue has been responded to as per Items #1 in the rows above for events dated 18/07/18 and 26/07/18. 3. **Objection to the survey in the Gippsland Basin given seismic activity already undertaken in the area:** Justification for the survey has been provided to Relevant Stakeholder ID 2494 as per Item #7 and Item #9 in the rows above for events dated 18/07/18 and 26/07/18 respectively. 4. **Displacement from the area:** This issue has been responded to as per Item #4 and Item #5 in the rows above for events dated 18/07/18 and 26/07/18 respectively. 5. **Avoiding seismic operations in shallow waters and during a full moon:** CGG revised the survey area to remove most of the nearshore zone in response to stakeholder feedback and this was communicated in the third stakeholder consultation letter provided to Relevant Stakeholder ID 2494 (see below). Regarding the full moon, seismic operations will be conducted 24 hours, and this has been communicated in the first stakeholder consultation letter. 6. **Importance of SE Reef as a habitat:** CGG stated they were planning to reduce seismic activity over SE Reef since it has been identified by Relevant Stakeholder ID 2494 as an important habitat. CGG and Relevant Stakeholder ID 2494 discussed why blue warehou numbers declined and have never come back. CGG referred to the CSIRO paper which addressed this. Relevant Stakeholder ID 2494 agreed it could be any combination of factors including fishing and seismic and stated indicated he was happy with CGG's plans to reduce seismic activity over SE Reef.
	04/09/18 23/09/18	2nd formal notification fishers and fisheries Email outgoing	No feedback received in response to the second stakeholder consultation letter. Via email outgoing 23/09/18: CGG invited fishers to meet on the 25th September 2018 to update them on CGG's responses to stakeholder feedback to date and changes that have been made. Relevant Stakeholder ID 2494 did not attend the meeting.	NA	NA
	26/10/18 02/11/18 02/11/18 07/11/18	Email outgoing Meeting Meeting Email incoming	Via email outgoing 26/10/18: CGG invited fishers to meet on the 2nd November 2018 to update them on EP approval process and discuss the key issues identified during the previous meeting (25th September 2018), changes that CGG have made in response to feedback, overview of technical aspects of seismic surveys. Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): Several key issues were identified in the previous meeting on 25th September 2018. CGG followed up on the key issues as follows: • avoiding Zone 1 from Dec–Feb to reduce impacts on charter operators targeting snapper during that period • impacts to octopus and squid • difficulty for octopus fishers to move their gear • impacts to target species and catches of other fisheries. The Scientific Advisory Committee and ongoing consultation was also discussed. CGG advised that a Scientific Advisory Committee would	The meeting was held to respond to objections and concerns raised by fishing stakeholders and communicate the changes made in response to stakeholder feedback. The following objections and concerns were addressed: • reducing impacts on charter operators targeting snapper during the Christmas period • impacts to octopus and squid fisheries (and difficulty with moving gear used by octopus fishers) • impacts to target species and catches of other fisheries. Relevant Stakeholder ID 2494 raised three objections or claims, and all are considered	Via meeting held 2nd November 2018 (CGG, fishing representatives and fishers): CGG has provided the following responses to the three objections and concerns raised: • **reducing impacts on charter operators targeting snapper during the Christmas period:** CGG advised that the survey was now scheduled to commence in January 2019 to reduce impacts on charter operators during the Christmas period. The survey operations will commence in the offshore zones so that the nearshore areas are completely open during this period. • **impacts to octopus and squid fisheries and difficulty with moving gear used by octopus fishers:** CGG stated that the Scientific Advisory Committee will oversee the ongoing discussion and resolution of concerns raised by fishing stakeholders, particularly the impacts on target species and catches. The Committee is also tasked with developing studies and that studies on octopus and fish targeted by the Danish seine fishers are currently being proposed.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			be developed and would comprise fishing and technical representatives. The purpose of the Scientific Advisory Committee would be to provide advice on impacts and fisher concerns associated with the survey. They noted that studies on octopus and fish targeted by the Danish seine fishers were being considered and would be overseen by the Scientific Advisory Committee. As part of the ongoing consultation process, CGG welcomed feedback on the control measures presented and any other information that could be used to reduce impacts. The meeting minutes are still being reviewed and finalised for this meeting. Once finalised they will be distributed to all attendees.	relevant to his functions, interests and activities. These are addressed in the right-hand column. **Action:** CGG to address each objection and claim and respond with any control measures that have been adopted in response to his feedback.	• **impacts to target species and catches of other fisheries:** CGG summarised the changes they had made since consultation began, including; changes to the survey area (reduction in size and changes to avoid important fisheries habitat (e.g. SE Reef, a scallop bed, Big Horseshoe Canyon and habitat important to Danish seine fishers; adopting a zoning system and scheduling operations in zones for times that minimise impacts to fishing stakeholders and cetacean movements; changing the start of the survey and order of data collection in zones to reduce impacts on seafood supply during the Christmas period. Also refer to above bullet regarding the role of the Scientific Advisory Committee to provide ongoing advice on impacts and fisher concerns associated with the survey. This information listed above was subsequently described in the third stakeholder consultation letter provided to stakeholders (see row below). Once meeting minutes are finalised, they will be distributed to all attendees.
			Via meeting held 2nd November 2018 (FLO and Relevant Stakeholder ID 2494) and email incoming 07/11/18: Relevant Stakeholder ID 2494 handed the Fisheries Liaison Officer a handwritten note with the following objections and claims, which was then emailed to CGG. The concerns raised were: • who is going to monitor the effects on marine life? • how are you going to measure the impact on marine life? • who is going to be accountable in the long-term?		CGG has responded to the objections and concerns raised by Relevant Stakeholder ID 2494 as follows: • **who is going to monitor the effects on marine life?** CGG had previously addressed this query raised by Relevant Stakeholder ID 2494 in the meeting on 26/07/18 (refer to Item #13 above from that meeting). In the meeting on 02/11/18 CGG stated that the Scientific Advisory Committee will oversee the development of monitoring programs associated with the survey. This was also described in the third stakeholder consultation letter provided to Relevant Stakeholder ID 2494 (see below). • **how are you going to measure the impact on marine life?** CGG had previously addressed this query raised by Relevant Stakeholder ID 2494 in the meeting on 26/07/18 (refer to Item #13 above from that meeting). In the meeting on 02/11/18 CGG stated that the Scientific Advisory Committee will oversee the development of monitoring programs and methods of measuring impacts. This was also described in the third stakeholder consultation letter provided to Relevant Stakeholder ID 2494 (see below). • **who is going to be accountable in the long-term?** CGG had previously addressed this query raised by Relevant Stakeholder ID 2494 in the meeting on 26/07/18 (refer to Item #14 above from that meeting). The matter of compensation was discussed during the first Scientific Advisory Committee meeting on 23/11/18. The meeting minutes are still being drafted and once finalised will be sent to relevant stakeholders (as stated in Section 9 of this EP).
	12/11/18	Email outgoing (meeting minutes)	No feedback received in response to the meeting minutes from meeting held on 25th September 2018 that CGG distributed to attendees. Note that Relevant Stakeholder ID 2494 did not attend this meeting.	NA	NA
	22/11/18 22/11/18	3rd formal notification (Rev 0) Email outgoing	No feedback received in response to the third stakeholder consultation letter or email checking that Relevant Stakeholder ID 2494 received the letter.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2494 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2277	06/08/18 15/08/18 04/09/18 24/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries SMS outgoing Email outgoing 3rd formal notification Rev 0	No feedback or response received to any outgoing communications.	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: Relevant Stakeholder ID 2277 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Ship Agencies Australia Pty Ltd	06/08/18 14/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification Email outgoing 3rd formal notification	No response was received in response to the first consultation letter sent to Ship Agencies Australia Pty Ltd on 6th August 2018. Via phone call outgoing 14/08/18 Ship Agencies Australia Pty Ltd stated that they are fishing in the Gippsland area and would need to stay up to date with consultation material. Do not have any issues with the project. CGG confirmed they would continue to update Ship Agencies Australia Pty Ltd on the project. No response was received in response to the second consultation letter, email outgoing and third consultation letter sent to Ship Agencies Australia Pty Ltd on the 4th September, 26th October and 22nd November respectively.	No objections or claims. Ship Agencies Australia requested they are kept updated on the survey.	NA
	Ongoing consultation: Ship Agencies Australia Pty Ltd are a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2493	17/08/18 17/08/18 24/09/18 13/11/18 13/11/18 22/11/18	Phone call outgoing SMS outgoing SMS outgoing Phone call outgoing Phone call incoming 3rd formal notification	No response has been received in response to the phone call outgoing and SMS's outgoing sent to Relevant Stakeholder ID 2493 on the 17th August and 24th September. Via phone call incoming 13/11/18: Relevant Stakeholder ID 2493 retuned a missed call form CGG. Stated he would review the next package sent through to him and would be in touch with CGG if he has any concerns. CGG confirmed they would continue to keep Relevant Stakeholder ID 2493 updated on the project. No response has been received in response to the third consultation letter sent to Relevant Stakeholder ID 2493 on the 22nd November.	No objections or claims. Relevant Stakeholder ID 2493 requested he is kept updated on the survey.	NA
	Ongoing consultation: Relevant Stakeholder ID 2493 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2281	06/08/18 15/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No feedback or response received to any outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2281 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2452	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18 26/11/18 27/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0 Phone call outgoing Email Outgoing	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2452 on 6th August 2018. Via phone call on 16/08/18: Relevant Stakeholder ID 2452 stated that they are fishing in the Gippsland area and would need to stay up to date with consultation material. CGG confirmed they would continue to update Relevant Stakeholder ID 2452 with consultation material regarding the project. Via phone call outgoing 26/11/18: FLO contacted Relevant Stakeholder ID 2739after receiving an unclear text message from him. Relevant Stakeholder ID 2739was interested to learn what the current status of the survey was and the association of the survey over the emerging scallop bed. FLO informed Relevant Stakeholder ID 2739of the current status of the project and stated that he would follow with high resolution maps to be sent to Relevant Stakeholder ID 2739to see the overlay of the survey and the emerging scallop bed. No response was received in response to the second consultation letter, email outgoing, third consultation letter and email outgoing sent	No objections or claims. Relevant Stakeholder ID 2739requested he is kept updated on the survey.	Via email 27/11/18: CGG provided Relevant Stakeholder ID 2452 with updated maps of the survey area including the emerging scallop bed and its proximity to the proposed survey.

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			to Relevant Stakeholder ID 2452 on the 4th September, 26th October, 22nd November and 27th November respectively.		
	Ongoing consultation: Relevant Stakeholder ID 2452 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 764	28/05/18 04/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification fishers and fisheries 3rd formal notification	No feedback or response received	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 764 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2135	17/08/18 17/08/18 17/08/18 04/09/18 26/10/18 22/11/18	Phone call outgoing Phone call incoming 1st formal notification Rev2 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	Via phone call incoming 17/08/18: Relevant Stakeholder ID 2135 answered the phone call from CGG stating that he had not received any information regarding the project. Relevant Stakeholder ID 2135 stated he is based out of Tasmania however does have jurisdiction over the proposed survey area. Relevant Stakeholder ID 2135 stated he would look at the information provided and get back to CGG if he has any issues with the project or is not a relevant stakeholder. CGG confirmed they would continue to update Relevant Stakeholder ID 2135 with consultation material regarding the project No response has been received in response to the first and second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2135 on the 17th August, 4th September, 26th October and 22nd November 2018 respectively.	No objections or claims. Relevant Stakeholder ID 2135 requested he is kept updated on the survey.	NA
	Ongoing consultation: Theo Herin is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2563	30/08/18 24/09/18 24/09/18	Phone call outgoing SMS outgoing Email outgoing	Via phone call outgoing 30/08/18: Relevant Stakeholder ID 2563 informed CGG that SETFIA had provided information to him. Stated he was not a supporter of the activity. His main concerns were as follows: • Size of the survey area represents the whole area they fish • Impacts on vessel movements – having to avoid the survey vessel and move around it or leave fishing areas • Unsure why the survey is necessary given the area has been thoroughly surveyed in the past • Impacts on catch of flathead and whiting are noticed immediately (within matter of days). Relevant Stakeholder ID 2563 further stated that he was happy to receive further updates and communication via SETFIA rather than directly. No response received to the SMS outgoing and email outgoing on the 24th September 2018	Four objections or claims were raised by Relevant Stakeholder ID 2563 (listed in left column) and are considered relevant to his functions, interests and activities. **Action:** CGG to respond to each objection and claim stating how it had been addressed and any control measures adopted in respond to the feedback.	CGG responded to Relevant Stakeholder ID 2563's claims as follows: • **Area covered by the survey represents entire extent of their fishing grounds:** via the third consultation letter, CGG explained they have reduced the survey area and are implementing a zoning system so that vessels are not excluded from the operational area for the duration of the activity • **Impacts on vessel movements:** the second consultation letter included information regarding displacement of other marine users from the survey area. CGG listed the control measures and notification arrangements adopted in response to feedback in the second and third letters • **Necessity of the survey to be conducted:** CGG explained in the second consultation letter they have reprocessed the existing data from the region and identified several issues with it that prevent a comprehensive regional geological evaluation of the Gippsland Basin. This survey is intended to resolve these issues by achieving a basin-wide coverage of seismic data to accurately map the extent of geological structures within the basin with confidence. Discovery of further hydrocarbon reserves could extend the working life of the existing petroleum industry in the region. • **Impacts on catch of flathead and whiting are noticed immediately (within a matter of days):** The impact assessment summarised in the second consultation letter states that the effects of underwater noise on fish (and sharks) within the vicinity of the Gippsland MSS may be physiological injury (no fish mortality is expected) or behavioural disturbance. The summary noted there are many confounding factors to drops in catch rates, including environmental variability such as changes in temperature and variability in natural recruitment rates as well as catch volumes. There has been recent research conducted by the CSIRO and Geoscience Australia to quantify fish behaviour and commercial fisheries catches before and after airgun operations for a 2D seismic survey in the Gippsland Basin (Bruce et al. 2018).

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
					The study found that seismic activity did not adversely affect catches of most commercial fish species. The results of this study are directly relevant to CGG's proposed survey. Catch rates for commercially important fish species are expected to be unaffected or to recover rapidly following the seismic survey, with recovery beginning as soon as the loudest (most intense) sound passes overhead. Noted that some fishing stakeholders in the Gippsland area have stated that they have observed drops in catch rates following past seismic surveys for varying periods but have not provided evidence such as catch data to support this claim. The letter explained that it is difficult to assess the potential long-term effects of seismic activity on fish catchability because of the confounding influence of other factors such as fishing pressure, climatic changes and variation in the natural population dynamics of fish species. However, despite the lack of evidence that short-term or long-term catch rates will decline following the Gippsland MSS, CGG has adopted several control measures to reduce potential impacts to ALARP.
	Ongoing consultation: Relevant Stakeholder ID 2563 is a relevant stakeholder (and will remain on CGG's list of relevant stakeholders), however he has stated he prefers that all communication regarding the survey come through SETFIA not CGG.				
Relevant Stakeholder ID 2215	10/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2215 on 10th August 2018. Via phone call outgoing 16/08/18: Relevant Stakeholder ID 2215 answered the phone call from CGG stating that he had not looked at the information distributed to himself. He stated that he doesn't fish above the 39th parallel, however would look at the information and get back to CGG as to whether he had any concerns if he thought he was affected. CGG informed Relevant Stakeholder ID 2215 that consultation material will continue to be sent through as it is composed, unless informed otherwise that he was not affected by the proposal. No response was received in response to the second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2215 on the 4th September, 26th October and 22nd November respectively.	No objections or claims. Relevant Stakeholder ID 2215 requested he is kept updated on the survey.	NA
	Ongoing consultation: Relevant Stakeholder ID 2215 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2529	08/08/18 23/09/18 26/11/18	Phone call outgoing Email outgoing Phone call outgoing	Via phone call outgoing 08/08/18: Relevant Stakeholder ID 2529 answered a phone call from CGG. Relevant Stakeholder ID 2529 stated that he receives all information regarding the survey through SETFIA as a member. No response received in response to email outgoing sent to Relevant Relevant Stakeholder ID 2529 on 23rd September 2018. Via phone call outgoing 26/11/18: Relevant Stakeholder ID 2529 he is happy to continue to receive stakeholder information from SETFIA and does not need to receive it from CGG as well. CGG noted they would not continue to phone him regarding impacts if going forward he is consulting with SETFIA regarding his concerns.	No objections or claims. Relevant Stakeholder ID 2529 requested updates on the survey come to him via SETFIA.	NA
	Ongoing consultation: Relevant Stakeholder ID 2529 is a relevant stakeholder (and will remain on CGG's list of relevant stakeholders), however he has stated he prefers that all communication regarding the survey come through SETFIA not CGG.				
Relevant Stakeholder ID 1745	10/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 1 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 1745 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
Relevant Stakeholder ID 2153 *Refer also to Relevant Stakeholder ID 2434*	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 1 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No feedback received in response to the first consultation letter sent to Relevant Stakeholder ID 2153 on 6th August 2018. Via phone call outgoing 16/08/18: Relevant Stakeholder ID 2153 stated that Relevant Stakeholder ID 2434 will be representing them regarding this proposal. Requested to be kept updated on the survey. CGG confirmed those arrangements would be followed going forward.	No objections or claims. Relevant Stakeholder ID 2153 stated Relevant Stakeholder ID 2434 will consult with CGG on their behalf. **Action**: CGG continue to send project updates and consult Relevant Stakeholder ID 2434 on stakeholder objections and claims.	NA
	Ongoing consultation: Relevant Stakeholder ID 2153 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Relevant Stakeholder ID 2334	17/08/18 17/08/18 24/09/18 13/11/18	Phone call outgoing SMS outgoing SMS outgoing Phone call outgoing	No feedback or response received to outgoing communications.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2334 is a relevant stakeholder and attempts to contact will therefore continue for the stakeholder to receive project updates from CGG.				
Relevant Stakeholder ID 2316	06/08/18 16/08/18 04/09/18 26/10/18 22/11/18	1st formal notification Rev 0 Phone call outgoing 2nd formal notification fishers and fisheries Email outgoing 3rd formal notification Rev 0	No response was received in response to the first consultation letter sent to Relevant Stakeholder ID 2316on 6th August 2018. Via phone call outgoing 16/08/18: Relevant Stakeholder ID 2316answered the phone call from CGG and noted he had not looked at the information however he does fish in the area and would need to be kept informed. CGG noted they would keep him updated on the survey. No response was received in response to the second consultation letter, email outgoing and third consultation letter sent to Relevant Stakeholder ID 2316on the 4th September, 26th October and 22nd November respectively.	No objections or claims. Relevant Stakeholder ID 2316 requested he is kept updated on the survey.	NA
	Ongoing consultation: Relevant Stakeholder ID 2316 is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
Tourism and recreation					
Relevant Stakeholder ID 2535	24/08/18 24/08/18 26/08/18 27/08/18 04/09/18 22/11/18	Phone call outgoing 1st formal notification Rev 2 Email incoming Email outgoing 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	Via phone call outgoing 24/08/18: CGG phoned to introduce the proposal and discuss potential impacts on Relevant Stakeholder ID 2535 activities. Followed up with email (below). Via email outgoing 24/08/18: CGG provided a copy of the first consultation letter. Noted that the potential impacts are mainly associated with seismic sound on marine animals including whales and commercial fish species. Also, divers so if possible, please let us know where their dive sites are so CGG can review them to determine if they overlap the survey area. CGG also noted the other main impact is displacement of other marine users but noted this will be less of an issue to them. Via email incoming 26/08/18: Relevant Stakeholder ID 2535 replied noting he doesn't believe his activities will be impacted and to let him know about the proposed dates for the survey. Via email outgoing 27/08/18: CGG stated proposed start dates (at the time) and noted they would keep Relevant Stakeholder ID 2535 on the relevant stakeholders list. No feedback in response to the second or third consultation letters.	No objections or claims.	NA
	Ongoing consultation: Relevant Stakeholder ID 2535 is a relevant stakeholder and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2571	30/08/18	Phone call outgoing	CGG phoned Relevant Stakeholder ID 2571 to find out if they were aware of the proposed seismic survey and if they had any concerns or feedback. No answer and left a voicemail message. No response received.	NA	NA

Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	Ongoing consultation: Relevant Stakeholder ID 2571 is a relevant stakeholder so CGG will continue to make reasonable attempts to contact Relevant Stakeholder ID 2571				
Relevant Stakeholder ID 2572	04/09/18 22/11/18	2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2572 is a relevant stakeholder and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2573	22/11/18	3rd formal notification Rev 0	No feedback received in response to the third stakeholder consultation letter.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2573 is a relevant stakeholder and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2569	30/08/18 30/08/18 04/09/18 22/11/18	Phone call outgoing 1st formal notification Rev 2 2nd formal notification fishers and fisheries 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: Relevant Stakeholder ID 2569 is a relevant stakeholder and will continue to receive project updates from CGG.				
Relevant Stakeholder ID 2567	30/08/18 04/09/18	Phone call outgoing 2nd formal notification fishers and fisheries	CGG contacted Relevant Stakeholder ID 2567 to discuss proposed survey. He raised concerns about the need of the survey given the amount of seismic data collected in the area over the years. Also concerned about impacts on catch declining over the years, no compensation provided and the effects on the viability of their business.	Relevant Stakeholder ID 2567 raised the following claims: • Justification for the survey • Declining catch over the years • No compensation provided to fishers • Effects of reduced catch on the viability of their business. **Action:** CGG to address these claims and respond with any changes or control measures adopted in response to the feedback.	CGG responded to Relevant Stakeholder ID 2567's claims as follows: • **Justification for the survey:** the second consultation letter later sent to Relevant Stakeholder ID 2567 provided a summary of the main drivers for the survey • **Declining catch over the years:** the second consultation letter provided a summary of the impact assessment on the effects of seismic noise on catch rates including the outcomes of the literature review and modelling conducted. The letter also explained the uncertainty associated with the research in this area and how CGG were addressing that • **No compensation provided to fishers:** CGG has established a Scientific Advisory Committee to advise on potential compensation agreement. The first Committee meeting was on 23 November and the minutes are going to be circulated to relevant stakeholders when they are finalised. • **Effects of reduced catch on the viability of their business:** the second consultation letter provided a summary of the impact assessment on the effects of seismic noise on catch rates.
	Ongoing consultation: Relevant Stakeholder ID 2567 is a relevant stakeholder and will continue to receive project updates from CGG. CGG noted during the preparation of this table that Relevant Stakeholder ID 2567 has not received the third stakeholder letter so that will be forwarded to him and any further objections or claims raised will be addressed in accordance with the ongoing consultation process in Section 9.0 of the EP.				
Research					
Blue Whale Study	03/12/18 09/12/18 11/12/18 22/01/19 22/01/19	Email incoming Email outgoing Email incoming Email outgoing Email incoming	Via email incoming 03/12/18 BWS identified himself as a relevant stakeholder for the project conducting studies of whale populations along southern Australia. BWS stated that the survey is in close proximity to the upwelling plume in eastern Bass Strait and questioned whether CGG had any information on the whales and the Bonney Upwelling. Via emails incoming and outgoing X3 11/12/18 to 22/01/19 CGG confirmed a response was being drafted and BWS was looking forward to receiving the information.	BWS raised the following claims: Questioned whether CGG was aware of the Bonney Upwelling and whether the potential presence of whales in the survey area had been noted. **Action:** CGG to respond to BWS and include the impact assessment on whales and current control measures in place to reduce potential impacts.	Via Email outgoing 09/12/18 CGG acknowledged BWSs email and stated a response would be drafted as soon as possible. CGG has been prioritising response to RFWI comments and will be contacting BWS in Late January to discuss his concerns. They impact assessment has included the potential impact on whales and their BIA's adjacent and within the survey area. CGG will communicate the control measures in place to minimises impacts on whales to BWS in his response.
CO2CRC (GipNet)	09/08/18 09/08/18 09/08/18	1st formal notification Rev 0 Email incoming Email outgoing	Via emails (x2) 09/08/18: CGG introduced the proposed survey and CO2CRC confirmed the Project Manager and to continue to send project updates.	No objections or concerns raised.	NA
	06/09/18 07/09/18 10/09/18	2nd formal notification general Email incoming Email outgoing	Via email incoming 07/09/18: In response to the second stakeholder consultation letter, the stakeholder engagement officer for CO2CRC emailed requesting to be placed on the stakeholder engagement list. Via email outgoing 10/09/18: CGG confirmed she had been added and would be kept updated.	No objections or concerns raised.	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	22/11/18 22/11/18 22/11/18 23/11/18 23/11/18 23/11/18	3rd formal notification Rev 0 Phone call outgoing Email outgoing Email incoming Email outgoing Email incoming	No response to third stakeholder consultation letter. Via phone call outgoing 22/11/18: CGG phoned CO2CRC to confirm we were sending project updates to the correct person still. He confirmed he had been receiving the updates and reviewing them for potential issues. Stated they had buoys and landers in place and would have OBSs as well, but closer to shore and not affected by CGG's survey. CO2CRC said he was liaising with his seismologists and they indicated there should be no problem with the CGG survey affecting their data collection. He also noted he had asked his team members if there were potential opportunity with CGG looking at using OBNs or similar. He also confirmed the University of Melbourne contacts CGG were distributing project information to were correct but noted the CSIRO contact for GipNet and provided her email address. CGG also noted they had recently come across another potential industry stakeholder in the area (Indigo Project, a cable installation project) and asked if CO2CRC was familiar with it. He hadn't heard about it. CGG said they would send the little information they had on it and said they would be contacting Indigo to discuss potential issues. Via emails (x4) 22/11/18 and 23/11/18: CGG and CO2CRC discussed getting details for the contact person for Indigo Project and passing them on once contact had been made.	No objections or concerns raised. CO2CRC noted their activities were unlikely to be affected by the survey but that he was still discussing potential issues and synergies internally. CGG noted intention to contact Subpartners about the Indigo Project (cable installation project). **Action:** CGG to contact Subpartners regarding CGG's survey and potential SIMOPs issues.	CGG has been prioritising resubmission of this EP and will be contacting Subpartners mid-December to discuss their work program.
	Ongoing consultation: CO2CRC is a relevant stakeholder and will therefore continue to receive project updates from CGG.				
CSIRO	09/08/18	1st formal notification Rev 0	No feedback in response to the first stakeholder consultation letter.	NA	NA
	04/09/18 06/09/18 13/09/18	2nd formal notification fishers and fisheries 2nd formal notification general Email incoming	Via email incoming 13/09/18: CSIRO provided information on their current research activities focussed in the Golden Beach area. Stated they did not perceive that there will be any conflict between their operations and CGG's. Noted their research is focused within Victorian State waters only, outside the proposed survey area. Also noted their equipment currently installed in the area will be removed in early November and there are no plans to redeploy this equipment until mid-2019. Their autonomous platforms, which will shortly be transiting the area will also leave the region in early November prior to the MSS. Requested they be kept informed, so they are aware of ongoing activities in the region and can plan future work to take this into account.	No objections or claims. Requested they be kept updated on CGG's survey. **Action:** CGG to continue to keep CSIRO updated for the duration of the survey.	Via email outgoing 29/11/18: Following the third stakeholder consultation letter, CGG replied to CSIRO would keep him updated on the project.
	22/11/18 22/11/18 22/11/18 22/11/18 22/11/18 22/11/18	3rd formal notification Rev 0 Email outgoing Email incoming Email outgoing Email incoming Email outgoing	Via emails (x5) 22/11/18: Following distribution of the third stakeholder consultation letter and discussions with CO2CRC (CO2CRC) who recommended UoM, CGG forwarded information to UoM. UoM stated the information was useful, that they plan to deploy some equipment into the area in 2019 (dates to be determined over the next few weeks). CGG noted that CO2CRC had indicated it was probably outside of CGG's survey area. She couldn't confirm where the equipment would go yet, until they were further into their planning.	No objections or claims. CSIRO indicated activities are planned for 2019 but no locations were confirmed. **Action:** CGG to continue to keep CSIRO updated and follow up on equipment locations as part of SIMOPs planning.	CGG confirmed they would keep CSIRO updated on the proposed survey.
	27/11/18	Email outgoing	Via email incoming 27/11/18 CSIRO informed CGG that the as stated in previous consultation their research area is not within the operational areas, being exclusively in Victorian state waters off Lakes Entrance. However due to the modified start time of the project, there will be diver surveys and the deployment of moored instruments that coincide with the updated survey timing. CSIRO have requested to be kept up to date on the detailed timeline of the survey to ensure minimal disruptions to CSIRO activities.	No objections of claims however CSIRO have requested to stay up to date with the survey timeline. The survey will now coincide with diving activities and therefore planning will need to be done to ensure minimal disruptions to CSIOR activities.	CGG will continue to keep CSIRO informed with details of the survey and timing to ensure no disruptions to their activities are felt. SIMOPS planning may need to be devised between CGG and
	Ongoing consultation: CGG will continue to provide project updates to the CSIRO and consult on their work programs so that any SIMOPs issues are resolved.				

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
CarbonNet (Victorian Department of Economic Development, Jobs, Transport and Resources)	09/08/18 24/08/18	Email incoming Letter incoming	Via email incoming 09/08/18: DEDJTR (CarbonNet) provided CGG with a contact person within GB Energy to follow up with. Via letter incoming 24/08/18: CarbonNet provided a letter to CGG covering the following issues: • listed the activities and timing proposed by CarbonNet • requested further consultation on CGG survey progress • requested a joint SIMOPs workshop prior to survey commencement • listed the items to be addressed as part of SIMOPs planning (monitoring, vessel operating zones, etc) • raised potential issue with seismic sound affecting CarbonNet geophysical data acquisition.	CarbonNet have active operations that overlap with the survey area. They raised the following issues that needed to be addressed: • requested further consultation on CGG survey progress • requested a joint SIMOPs workshop prior to survey commencement, that addressed monitoring, vessel operating zones, etc. • noted there may be potential issues with seismic sound affecting CarbonNet geophysical data acquisition that would have to be considered. **Action:** CGG to address these concerns and commit to resolving them as part of SIMOPs planning. **Action:** CGG to keep CarbonNet updated on survey progress.	CGG replied to the letter on 03/12/18 (refer to row below).
	06/09/18 22/11/18	2nd formal notification 3rd formal notification	No feedback in response to the second or third stakeholder consultation letters.	NA	NA
	03/12/18 03/12/18 03/12/18	Email outgoing Email incoming Email outgoing	Via email outgoing 03/12/18: CGG followed up on the letter sent 24/08/18 and provided update on the survey. Noted they were still in the process of obtaining environmental approval and therefore the start date has slipped to possibly late January/early February. Explained that the overall scope had reduced, so CGG anticipate completing the survey in July. Noted that CGG understood that CarbonNet would have operations ongoing in that timeframe and noted their request to have a SIMOPS workshop to ensure that both operations can be undertaken safely and with minimal disruption. CGG confirmed they would work with CarbonNet on this and asked for them to supply an updated schedule of their operations, so CGG could work that into ongoing planning. Via email incoming 03/12/18: CarbonNet acknowledged the email and said they would provide further details to CGG. Via email outgoing 03/12/18: CGG acknowledged email and thanked CarbonNet.	NA	NA
	Ongoing consultation: CarbonNet is involved in research activities in the Gippsland area, therefore CGG will continue to keep them updated on the proposed survey and will participate in a SIMOPs planning workshop assuming the EP is approved.				
University of Melbourne	10/08/18 06/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification general 3rd formal notification Rev 0	No feedback in response to the first, second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: The University of Melbourne is involved in research activities in the Gippsland area, therefore CGG will continue to keep them updated on the proposed survey.				
Industry operators					
3D Oil	31/08/18 22/11/18	1st formal notification Rev 0 3rd formal notification Rev 0	Note that shapefiles were provided with the first stakeholder consultation letter. No feedback in response to the first or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: 3D Oil have an active Exploration Permit (a collaboration with Hibiscus Petroleum) that overlaps with the survey area, therefore CGG will continue to provide project updates to 3D Oil and consult on their work programs so that any SIMOPs issues are resolved.				
Basslink	07/08/18 08/08/18	1st formal notification Rev 0 Email incoming	Note that shapefiles were provided with the first stakeholder consultation letter. Via email incoming 08/08/18:	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			Basslink replied he would internalise the report and get back to CGG if they have any questions.		
	06/09/18	2nd formal notification titleholders and operators	No feedback in response to the second stakeholder consultation letter.	NA	NA
	22/11/18 29/11/18	3rd formal notification Rev 0 Email outgoing	Via email outgoing 29/11/18: CGG followed up after the third stakeholder consultation letter was sent that they would continue to keep Basslink informed and up to date with the latest information on CGG survey. Stated to contact CGG if he had any queries. No response received.	NA	NA
	Ongoing consultation: Basslink operate the Basslink Interconnector that runs through the survey area. CGG will continue to provide project updates to Basslink and consult on their work programs so that any SIMOPs issues are resolved.				
Cooper Energy	09/08/18 09/08/18 09/08/18	1st formal notification Email incoming Email incoming	Via email incoming 09/08/18: In response to the first stakeholder consultation letter, Cooper Energy replied they had forwarded the information and they would be in contact with CGG. Via email incoming 09/08/18: Cooper Energy replied, and she would be in contact with CGG if they had any comments.	NA	NA
	31/08/18 03/09/18 04/09/18	Phone call incoming Email incoming Phone call outgoing	Via phone call incoming 180831: Cooper Energy phoned CGG to discuss the survey. Missed call and left message for CGG to call back. Via email incoming 03/09/18: Cooper Energy provided one week notice of Sole pipeline installation activity scheduled to start on 10 September. Stated the first activity is the diving scope from the Silver Star (which will be set up at approx. co-ords 626 524E 5 814 439 N (-37Deg 48.52/148Deg 26.23), a few hundred metres off the coast of the existing Orbost Gas Plant and will be on site for approx. 2 weeks). The Silver Star will also transit along the pipeline route to perform a pipelay pre-lay survey. Attached a stakeholder flyer for information on the campaign vessels, including call signs.	No objections or claims.	Via phone call outgoing 04/09/18: CGG returned call. No Answer, left message to call back.
	06/09/18 07/09/18 10/09/18 10/10/18	2nd formal notification titleholders and operators Phone call incoming Phone call outgoing Email outgoing	Via phone call incoming 180907: Cooper Energy phoned CGG to discuss the survey. Missed call and left message for CGG to call back. Via phone call outgoing 04/09/18: CGG returned call to Environment Manager at Cooper Energy. Discussed timing regarding their pipeline for the Sole field shortly and raised the need to discuss a SIMOPS Plan and the zoning system with CGG. Noted that their pipe lay vessel cannot move off track for the seismic vessel.	Cooper Energy are commencing installation of a pipeline for the Sole field that will cross the survey area. They raised concern about vessel interactions and requested discussion about a SIMOPs Plan and CGG's zoning system (of direct relevance to their interests and activities).	Via email outgoing 10/10/18: CGG noted they were continuing to plan for the proposed survey, which is scheduled to begin around December 2018, subject to receiving EP approval. Noted it would last for up to about six months. Stated that from the flyer Cooper Energy provided, CGG were aware of Cooper's ongoing development activities and will develop a SIMOPs Plan to ensure that both activities can go ahead safely and with minimal disruption. CGG requested a more detailed timeline and scope of activities.
	11/10/18	Email incoming	Via email incoming 11/10/18: Cooper Energy replied and provided a map of the Sole field layout and summary of current activity status: • two Christmas trees to be installed at SOLE 3 and SOLE 4 • 12-inch pipeline from the HDD pipe out towards the Christmas tree drill centre to be completed end of October/early Nov 2018 • scheduled to lay umbilical mid Jan to end March 2019. Actual lay campaign is ~40 days within that time • Q2 sometime the pipeline system will start production. There will be no vessel at site during start up and production. Cooper Energy stated they would require a minimum of 1 km separation from their pipeline and umbilical installation spread and CGG's vessel could not approach the pipeline and umbilical corridor. They also noted the 500 m safety zone around the drill centre that must be avoided at all times.	Cooper Energy are commencing installation of a pipeline for the Sole field that will cross the survey area. They requested the following requirements to manage SIMOPs issues: • they require a minimum of 1 km separation from their pipeline and umbilical installation spread • CGG's vessels could not approach the pipeline and umbilical corridor • the 500 m safety zone around the drill centre must be avoided at all times. **Action:** CGG to include these requirements in SIMOPs Plan for the survey.	Via email outgoing 11/10/18: CGG acknowledged the information and stated as they progressed their seismic survey they would be in touch. CGG plans to commence SIMOPs planning with all affected industry operators following approval of the EP (assuming it is approved).

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
	22/11/18 29/11/18	3rd formal notification Rev 0 Email outgoing	Via email outgoing 29/11/18: CGG followed up the third stakeholder consultation letter noting they would continue to keep Cooper Energy updated on CGG's survey status. No response received.	NA	NA
	Ongoing consultation: Cooper Energy have a pipeline installation program underway expected to run until Q2 2019. CGG will continue to provide project updates to Cooper Energy and consult on SIMOPs planning.				
Emperor Energy	04/09/18	1st formal notification Rev 0	Via email outgoing 04/09/18: CGG emailed (following up formally on communications via LinkedIn) and attached the first stakeholder consultation letter and ArcGIS Shapefiles for CGG's proposed survey. Stated they would follow up with Emperor Energy following EP approval to discuss any SIMOPS implications and offset requirements. No response received.	NA	NA
	06/09/18 22/11/18	2nd formal notification titleholders and operators 3rd formal notification Rev 0	No feedback in response to the second or third stakeholder consultation letters.	NA	NA
	Ongoing consultation: Emperor Energy have an active Exploration Permit that overlaps with the survey area, therefore CGG will continue to provide project updates to Emperor and consult on their work programs so that any SIMOPs issues are resolved.				
ExxonMobil (Esso Australia Pty Ltd)	07/08/18 20/08/18	1st formal notification Rev 0 Email incoming	Via email incoming 20/08/18: Esso responded to the first stakeholder consultation letter stating they would like to continue with consultation on the survey. Noted that CGG stated that pending EP approval, CGG would like to discuss SIMOPS implications, etc. Asked if CGG had a high-level timeline on when the EP is expected to be approved and therefore when CGG will be expecting to engage with Esso. Also noted that for our early evaluation on impacts to our pipelines, compared to the airguns used during the CarbonNet seismic survey, asked what the strength of the guns being used for CGG's survey were.	No objections or claims. Requested further information on the survey, timeline for EP approval and strength of the airguns.	CGG provided additional details to Esso Australia via the second and third stakeholder consultation letters. These covered the details requested and subsequent consultation has confirmed CGG will continue to keep Esso updated as the survey program progresses.
	06/09/18	2nd formal notification titleholders and operators	No feedback in response to the second stakeholder consultation letter.	NA	NA
	22/11/18 23/11/18 23/11/18 23/11/18 23/11/18	3rd formal notification Rev 0 Email incoming Email outgoing Email incoming Email outgoing	Via email incoming 23/11/18: Replied they couldn't open the attachment and to resend it. Via email outgoing 23/11/18: CGG resent the letter. Via email incoming 23/11/18: Esso confirmed attachment was received. Via email incoming 23/11/18: Esso requested additional people be added to CGG's distribution list.	No objections or claims. Requested for additional Esso personnel to be added to the distribution list. **Action:** CGG to add personnel to CGG's distribution list.	Via emails outgoing (x2) 23/11/18: CGG confirmed they had been added to the distribution list. Requested additional details for CGG's database. No response received.
	Ongoing consultation: Esso Australia have Exploration Permits that overlap with the survey area and existing pipelines installed within the survey area, therefore CGG will continue to provide project updates to Esso and consult on their work programs so that any SIMOPs issues are resolved.				
GB Energy	09/08/18 11/08/18	1st formal notification Rev 0 Email incoming	Via email outgoing 09/08/18: CGG emailed the first stakeholder consultation letter and ArcGIS Shapefiles for CGG's proposed survey. Stated they would follow up with GB Energy following EP approval to discuss any SIMOPS implications and offset requirements. Via email incoming 11/08/18: GB Energy acknowledged CGG's email and noted they would like to continue to receive updates on the survey.	No objections or claims raised.	NA
	06/09/18 22/11/18 29/11/18	2nd formal notification titleholders and operators 3rd formal notification Rev 0 Email outgoing	No feedback in response to the second or third stakeholder consultation letters. Via email outgoing 29/11/18:	NA	NA

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Relevant stakeholder	Date	Method	Summary of relevant stakeholder feedback	Assessment of merit	Summary of CGG response
			CGG noted they should have received the third stakeholder consultation letter and confirmed they would continue to keep them updated on the survey.		
	Ongoing consultation: GB Energy have an active Retention Lease that overlaps with the survey area and are planning geophysical surveys for Q2 2019, therefore CGG will continue to provide project updates to GB Energy and consult on their work programs so that any SIMOPs issues are resolved.				
Hibiscus Petroleum	09/08/18 06/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification titleholders and operators 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: Hibiscus Petroleum have an active Exploration Permit that overlaps with the survey area (a collaboration with 3D Oil) that is located within the survey area, therefore CGG will continue to provide project updates to Hibiscus Petroleum and consult on their work programs so that any SIMOPs issues are resolved.				
Llanberis Energy	09/08/18 06/09/18 22/11/18	1st formal notification Rev 0 2nd formal notification titleholders and operators 3rd formal notification Rev 0	No feedback received in response to the first, second and third stakeholder consultation letters.	NA	NA
	Ongoing consultation: Llanberis Energy is lease and operator of active Exploration Permit that overlaps with the survey area, but no current activities planned. CGG will continue to provide Hibiscus Petroleum with project updates for the duration of the survey.				
SGH Energy	10/09/18 05/10/18 22/11/18 29/11/18	1st formal notification Rev 0 Email incoming 3rd formal notification Rev 0 Email outgoing	Via email outgoing 10/09/18: CGG emailed the first stakeholder consultation letter and ArcGIS Shapefiles for CGG's proposed survey. Stated they would follow up with SGH Energy following EP approval to discuss any SIMOPS implications and offset requirements. Via email incoming 05/10/18: SGH Energy advised they currently have no offshore activities planned over our VIC/L29 permit or along the Longtom pipeline (VIC/PL38) for at least the next 6 months. Noted they look forward to further updates regarding the timing of your survey.	NA	Via email outgoing 29/11/18: CGG noted they should have received the third stakeholder consultation letter and confirmed they would continue to keep them updated on the survey.
	Ongoing consultation: SGH Energy have an active Exploration Permit that overlaps with the survey area, but no activities planned for at least six months. CGG will continue to provide them with project updates for the duration of the survey.				

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Appendix I

Stakeholder consultation records

Appendix I Stakeholder consultation records

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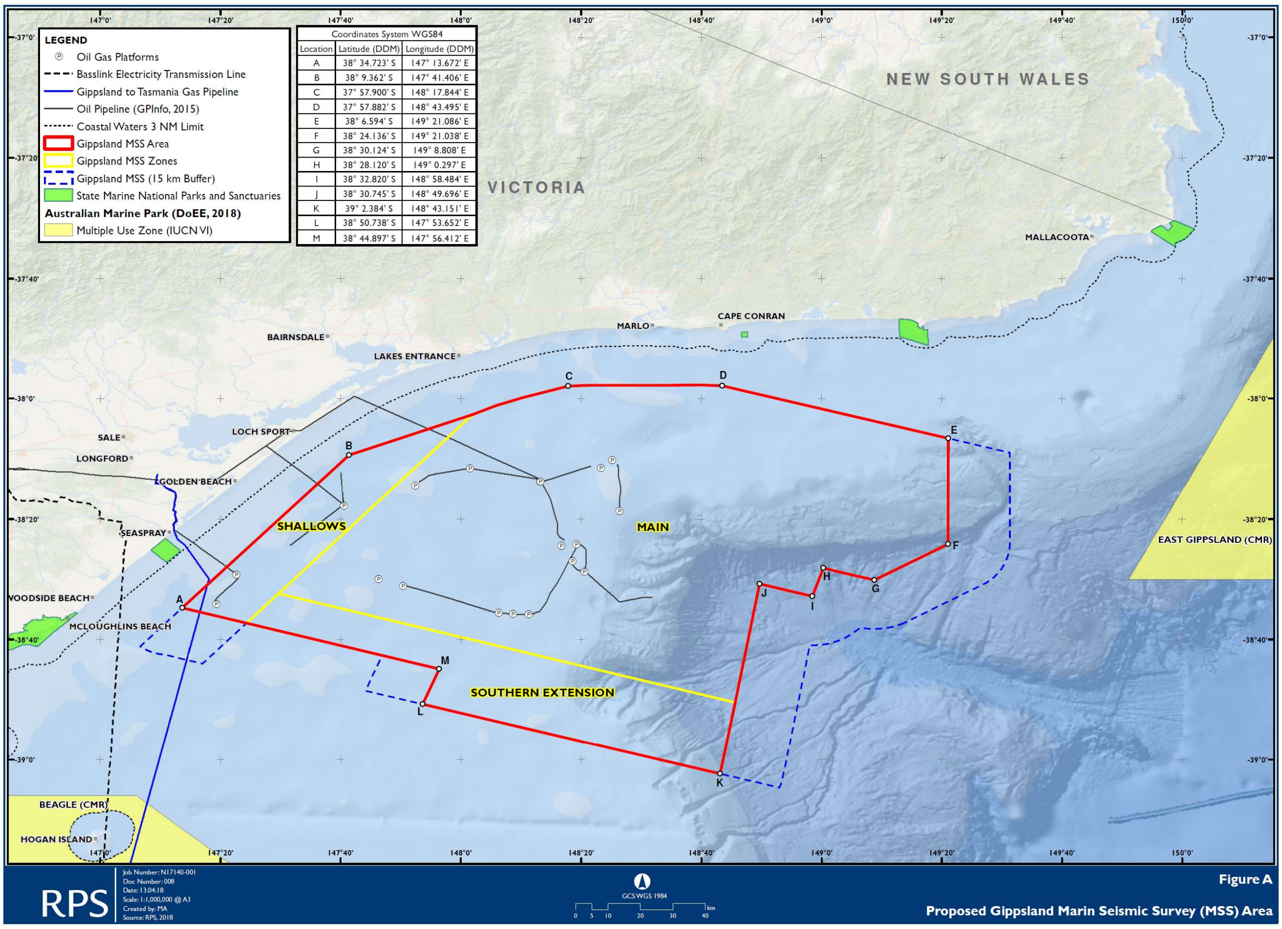
SETFIA report (2018)

Final Report to
RPS Australia West Pty Ltd
on
CGG Gippsland MSS EP



Prepared by the
South East Trawl Fishing Industry Association (SETFIA)

SOUTH EAST TRAWL FISHING INDUSTRY ASSOCIATION
sustainable fishing practices protect our future

fishwell CONSULTING

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1. EXECUTIVE SUMMARY:

A list of fisheries whose boundaries overlapped with the proposed Gippsland Marine Seismic Survey (GMSS) was provided to RPS at the beginning of the project. They included the following: Victorian Rock Lobster Fishery (Eastern Zone), Victorian Ocean Fishery, Victorian Ocean Purse Seine Fishery, Victorian Ocean Wrasse Fishery, Victorian Trawl (Inshore) Fishery, Victorian Ocean Scallop Fishery, Commonwealth Southern Squid Jig Fishery, Commonwealth Eastern Tuna and Billfish Fishery and five Commonwealth Sothern and Eastern Scalefish and Shark Fishery (SESSF) sub-sectors: Commonwealth Trawl Sector (CTS) otter board trawl, CTS Danish Seine, Gillnet Hook and Trap (GHaT) shark gillnet, GHaT shark hook, and GHaT scalefish hook.

Requests for commercial catch and effort data were submitted to the Victoria Fisheries Authority (VFA) who manage Victorian commercial fisheries and the Australian Fisheries Management Authority (AFMA) who manage fisheries under Commonwealth jurisdiction.

This spatial data was analysed against the footprint of the GMSS using Geographic Information System (GIS) software. This showed that there are 15 fisheries that potentially actually operate in the area of the GMSS; nine Commonwealth and six Victorian fisheries. They are listed in order of potential impact shown in Table 1. At least thirteen of these fisheries are impacted to some extent. Potentially impacted annual fisheries production is at least \$8.2 m and likely higher given the limited data available for smaller fisheries not within this figure.

The potential impacts are severe on the Southern and Eastern Shark and Scalefish Fishery (SESSF). The SESSF is Australia's largest Commonwealth fishery and consists of a number of smaller sectors and sub-sectors. The annual SESSF revenue and catch in the GMSS footprint is 12% of revenue and 14% of catch. The SESSF is the major domestic supplier of fresh local fish in Australia and the main supplier to Sydney and Melbourne. The SESSF accounts for 7% of Australia's total wildcatch production (by weight).

This report contends that the % of a fishery's revenue and catch that is affected by a proposed seismic survey is an important metric because it is an indication of the fishery's ability to move elsewhere while a survey is underway and to cope with the perception of reduced catches in the surveyed area.

The most affected SESSF sector is the Commonwealth Trawl Sector (colloquially known as the South East Trawl Fishery). This fishery consists of two sub-sectors; Otter-board trawl and Danish seine, both of which are severely affected. Data on the two subsectors is aggregated but the Danish seine sub-sector is highly affected with almost all vessels in the sub-sector working within the GMSS footprint with very little effort elsewhere. Danish seine vessels are small and dependant on favourable weather conditions and therefore have limited range with almost all operating from Lakes Entrance, and holding shares in the Fisherman's Cooperative. The otter-board trawl fishery is less affected, but the impact remains major. The CTS sector would have 16% of its revenue and its catch impacted in some manner by the GMSS.

The second most affected SESSF sector is the Commonwealth Gillnet Hook and Trap (GHaT) fishery. The GHaT sector has three sub-sectors; gillnet, shark hook and scalefish hook. Data is aggregated across the three sub-sectors but impact based on 10-year catches is 5% of revenue and 7% of catch. Fishermen and AFMA report that following sealion closures in the GHaT off South Australia that there has been more effort in recent years off Lakes Entrance meaning that this report may underestimate the GMSS impact to some extent. The impact on the GHaT is much less than the CTS, but still significant compared to past projects at 5% of revenue and 7% of catch.

Commonwealth managed scallop and squid fisheries are impacted to a much lesser extent.

Due to the broader spatial resolution of the catch and effort data, the Victorian managed Eastern Zone Rock Lobster and four other fisheries (Ocean General, Ocean Wrasse, Purse Seine, Inshore Trawl) are impacted to some unknown extent.

SETFIA has completed more than 10 similar projects and the GMSS has by far the most significant overlap and the highest potential impact on SE Australian fisheries production of any seismic project analysed to date.

This report recommends that extensive work be undertaken to minimise GMSS's effects with all commercial fishing sectors listed in Table 1 other than the Commonwealth's Small Pelagic Fishery and Eastern Tuna and Billfish fisheries which are likely unaffected. Emphasis should be given to fisheries having a large amount of their revenue and catch exposed to seismic impact (Table 1 columns E and F). We urge RPS to not underestimate the challenge of moving such a large amount of fishing effort elsewhere given that:

- Large areas (44%) of the CTS trawl fishery is closed by fishery closures (39%) and marine parks (9%, 388,00km^2) and much is unfishable or unproductive meaning that only 6% of the fishery is ever trawled
- Vessels and their crews are tied to fish handlers, processors and ports of domicile
- The presence of the Duntroon, Otway Deep, Dorrigo and Geoscience Australia seismic surveys to the west
- The lack of ports in eastern Victoria and supply agreements into the Melbourne fish market (the main buyer of SESSF fish)

Table 1 List of fisheries impacted and unaffected by GMSS in order of financial impact

Fishery by order of impact			**Fishery Production**		**GMSS Impact** (based on 10 year fishery production averages)			
Fishery	**Sub-fishery or Sector** (if applicable) and [relevant section(s) of report]	**Jurisdiction-Manager**	**Fishery Revenue Most Recent Year**	**Fishery Catch Most Recent Year**	**Revenue from Impacted Area**	**Annual Catch from Impacted Area**	**Annual Revenue from Impacted Area**	**Annual Catch from Impacted Area**
			$m	tonnes	$m	tonnes	%	%
			A	B	C=D*price	D	E=C/A	F=D/B
SESSF	CTS Otter-board trawl [6.2]	Cth AFMA	≈$44.0m[1]	≈10,000	$2.5m	618	16%[2]	16%
SESSF	CTS Danish seine [6.2]	Cth AFMA			$4.5m	964		
SESSF	Shark gillnet [6.3] 'SGHS'	Cth AFMA	$17.2m	1,832	$0.6m	101	5%	7%
SESSF	Shark hook [6.3]	Cth AFMA			$0.4m	69		
SESSF	Scalefish hook [6.3 & 6.4]	Cth AFMA	$4.7m	≈600				
SESSF Sub-totals			**$65.9m**	**12,432**	**$8.0m**	**1,752**	**12%**	**14%**
Scallop [6.5]		Cth AFMA	$4.6m	2,855	$0.15m	18.4	3%	1%
Squid jig [6.6]		Cth AFMA	$1.0m	384	$0.02m	12.0	3%	2%
Scallop [6.11]		Vic VFA	$0.9m	603	Confidential, some reported		Likely very low or nil, investigate	
Rock Lobster [6.9]	Eastern Zone	Vic VFA	$4.3m	53	Confidential, some reported		Confidential ≈<10%	
Ocean General, Ocean Wrasse, Purse Seine, Inshore Trawl (4) [6.10]		Vic VFA	N/A	2,755	Confidential, some reported		Need to investigate	
Small pelagic [6.7]		Cth AFMA	N/A	≈8,000	Confidential, likely no impact N/A (conf)			
Eastern tuna & billfish [6.8]		Cth AFMA	$47.1m	5,139	Confidential, likely no impact			
TOTAL ALL FISHERIES/SECTORS			**$124m**	**32,221**	**$8.2m**	**1,782**	**7%**	**6%**

[1] ABARES 2017

[2] Noting that the Danish seine fishery, a sub-fishery of the CTS may likely take all of its revenue and catch from within the proposed GMMS area

2. INTRODUCTION

The Gippsland Basin covers an area of about 46,000 km^2 in south-east Australia, with about two thirds of the basin located offshore (Geoscience Australia, 2011). The offshore area is considered part of Bass Strait and comprises mainly shallow water (<200 m deep), however depths exceeding 3,000 m are reached in the Bass Canyon in the east of the basin (Figure 1). The area has become one of Australia's most prolific hydrocarbon provinces since the first Australian oilfield was discovered at Lake Bunga in 1924. The offshore oil and gas fields have historically provided about two thirds of Australia's oil production and one third of its gas production (Earth and Energy Resources, 2016).

Bass Strait has had a rich history of fishing since European settlement. These waters now support a range of Victorian, Tasmanian and Commonwealth commercial fisheries that use a variety of different fishing gears (Figure 2) including otter-board trawl, Danish seine, demersal gill nets, demersal longlines, droplines, scallop dredges, traps, pots and hand-harvest to target more than 15 commercial species. These commercial fisheries provide fresh fish and other products mainly to local, Melbourne and Sydney markets, and are an important source of employment in eastern Victoria (Figure 2).

This report analyses fishery catch and effort data in the area of the Marine Seismic Survey (MSS), and where possible, quantifies the catch, effort and value of the catch in the area by fishery.

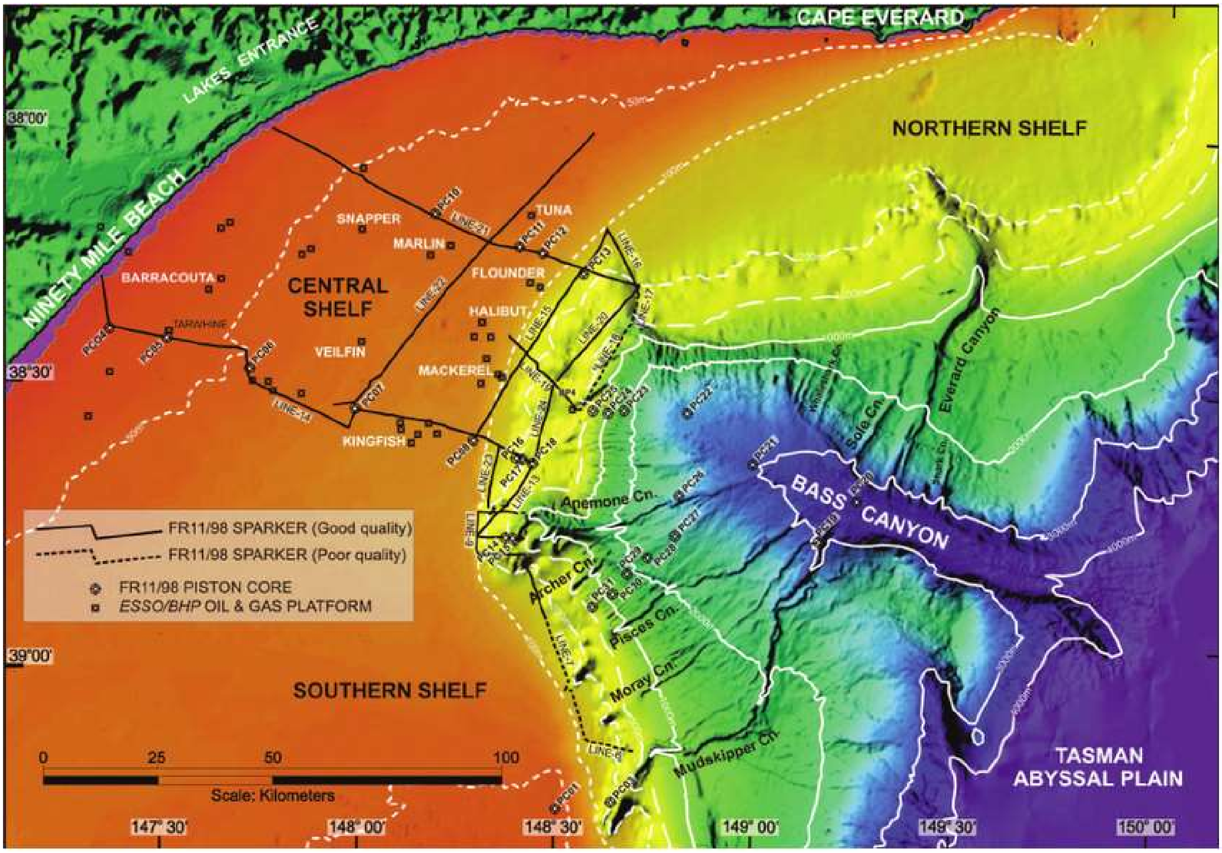


Figure 1. Bathymetry of eastern Bass Strait (from Lindsay *et al.*, 2012). Approximate location of proposed survey is marked with blue.

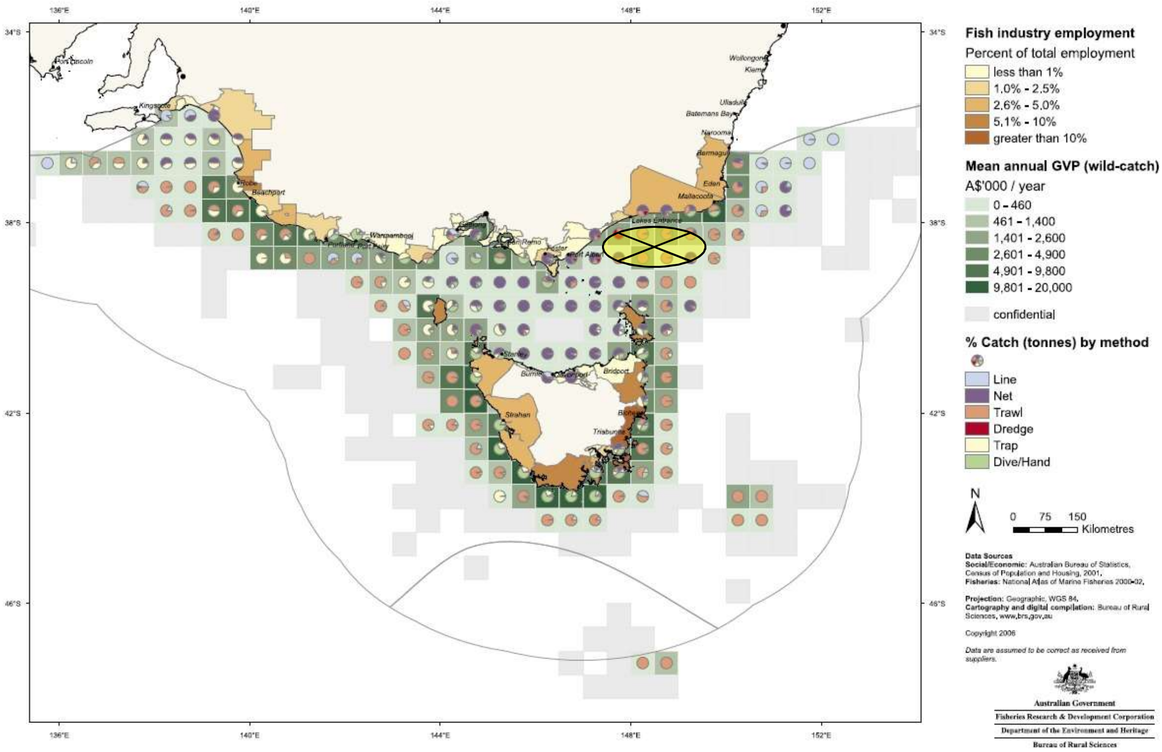


Figure 2. Fishing industry employment, mean annual gross value production from fishing and percent catch by method for south east Australia from 2000–02. From Larcombe *et al.* (2006). Approximate location of proposed seismic survey area shown as yellow balloon.

1.1. <u>Client Brief</u>

RPS engaged the South East Trawl Fishing Industry Association (SETFIA) to prepare a report on the proposed seismic survey and its potential impact on commercial fishing in the area. Specifically, SETFIA were engaged to provide the following:

1. A high level review of ABARES effort data (not catch) that will give some indication of the Commonwealth sectors that fish in the proposed area. This will allow RPS to begin consultation with the fishing industry;
2. From formal catch and effort data requests to Victorian and Commonwealth fisheries agencies; the commercial fishing sectors that operate in the proposed area; their catches, number of vessels and licenses, their effort and approximate revenue;
3. Information obtained by discussions with any operators who for reasons of confidentiality do not appear in the data in (2) that the project believes do fish in the relevant area;
4. An analysis and presentation in a meaningful way of commercial fishing effort and catch identified in (2);
5. The seasonality of the fishing effort identified in (2) with regard to any proposed survey timing; and,
6. The best contact points for sectors identified in (2);
7. Supporting background information on affected fishing sectors in (2) and (3);
8. An SMS notification service to affected fishers (before and during the survey); and,
9. A report covering 2-7 above.

3. DATA REQUEST

Fisheries catch and effort figures from published reports were used if available. Data requests were sent to the VFA and AFMA.

Most Commonwealth managed fisheries report effort by either start or start and end position of the fishing operation. We requested records where either the start or end position was reported from within a much larger area than the area of the MSS, so we could decide on the rules for inclusion in the final data summaries (Table 2, Figure 3). Data fields requested included trip, shot and catch data from 2008–2017. AFMA's data confidentiality policy restricts release of data comprising less than five vessels. As such, the Project aggregated data to as fine a level as possible so as not to break that policy, but still be able to address the scope of the work.

It is very likely that some fishing effort (tows, net sets or longline sets) are partially inside the polygon, and partially outside of the polygon. It was decided to use the **start** set position to filter the catch and effort data, assuming that there will be an equally amount of effort partially in and partially out, and that the set direction is random. Data used in the final report was filtered for those records with a start set location that is within the polygon shown in Figure 3.

Table 2. Boundaries of the raw data request to AFMA.

Boundary	Latitude / Longitude
North	-37˚28′
West	146˚37′
East	150˚02′
South	-39˚35′

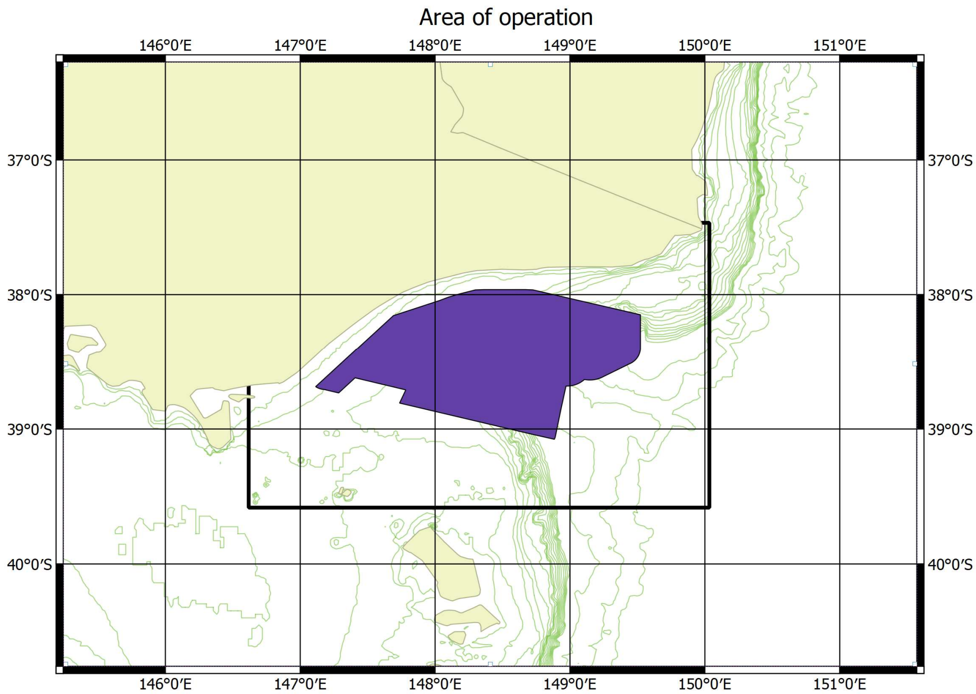


Figure 3. Data requested from AFMA included records where the start or end position was located within the data request area (black lines) from 2008–2017.

Most Victorian managed fisheries that operate off east Gippsland report catch and effort by 10 x 10 minute grid areas (Figure 4). The VFA have a policy whereby they will not release data that is not aggregated in accordance with a five boat rule. This differs from AFMA who allowed the project to aggregate the data in line with confidentiality rules. Data requests submitted at too small a temporal or spatial scale risk being filtered to such course level of detail that it is not useful for informing projects such as this. We have requested data in such a way so that as much of the data can be included, but it is aggregated in a way that can be used to address the information requirements.

Data was provided by reporting grid where possible, and by “reporting grid rows” (e.g. row D) that extended into shore. Where possible, catch from grid cells inshore of the MSS area were excluded from data summaries. Some grid cells are only partially overlapping with the MSS area, and it is impossible to tell if those catch records were really within the GMSS footprint. Where data was provided for those partially overlapping cells, the catch was adjusted as follow: 50% overlap or more – retain 100% of the catch; 20–49% overlap or more – retain 50% of the catch; 5–19% overlap or more – retain 20% of the catch.

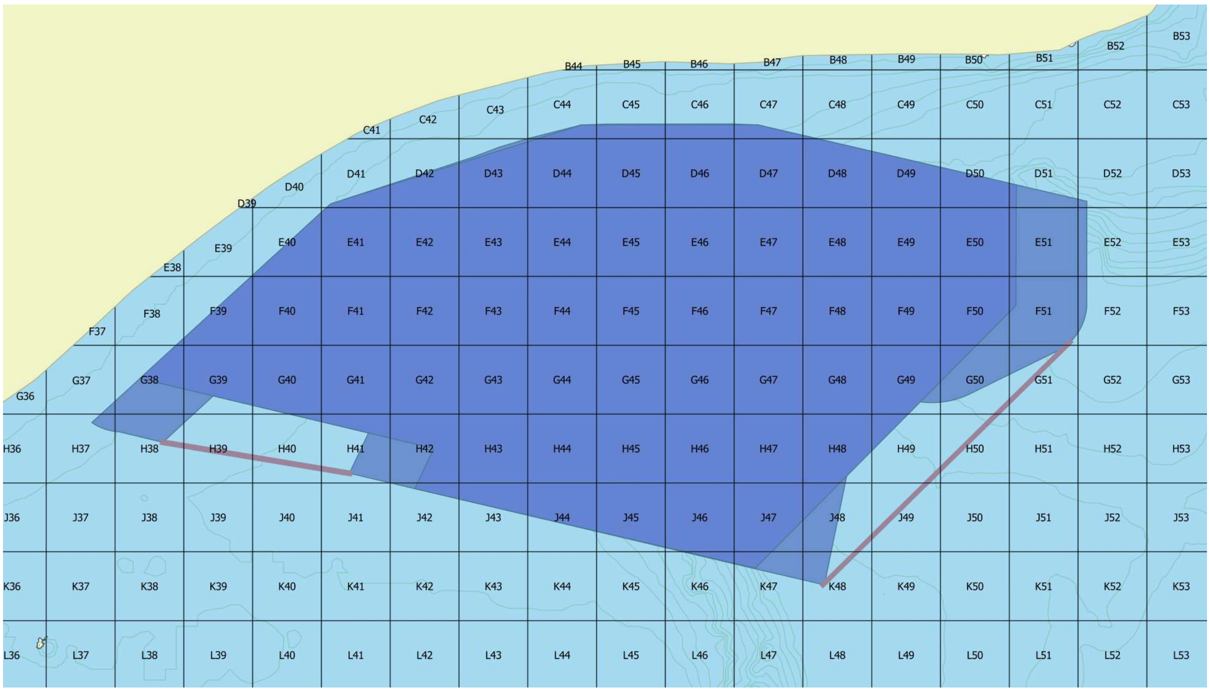


Figure 4. Data requested from VFA included records from within grid areas that overlapped with the MSS as well as those inshore of the MSS area 2007/08–2016/17.

4. DESCRIPTION OF FISHERIES

The location of the proposed MSS overlaps numerous State and Commonwealth managed fisheries. These fisheries use a range of fishing gear from relatively species-selective methods such as potting in the Victorian Rock Lobster Fishery, to less selective methods such as trawling. Species landed across the various fisheries include molluscs, crustaceans, teleosts (ray-fined fishes) and elasmobranches (cartilaginous fishes like sharks and rays).

Commonwealth and State managed fisheries that are licensed to fish in the MSS area are described below.

4.1. Commonwealth managed fisheries:

1. Southern and Eastern Scalefish and Shark Fishery (SESSF) which includes four sub-sectors that operate within Bass Strait:
    a. Commonwealth Trawl Sector (CTS)
        i. Otter-board trawl gear – recent effort in area
        ii. Danish seine gear – recent effort in area
    b. Shark Gillnet and Shark Hook Sector
        i. Shark Gillnet – recent effort in area
        ii. Shark Hook – recent effort in area
    c. Scalefish hook –recent effort in area
2. Southern Squid Jig Fishery – some recent effort nearby but outside of the survey area
3. Small Pelagic Fishery –recent effort in area – small number of operators, data cannot be shown
4. Eastern Tuna and Billfish Fishery –recent effort in area – small number of operators, data cannot be shown
5. Skipjack Tuna Fishery – there has been no fishing effort in this fishery since the 2008–09 season, and that took place of South Australia (Patterson *et al*., 2016)
6. Southern Bluefin Tuna Fishery – some recent effort nearby but outside of the survey area
7. Bass Strait Central Zone Scallop Fishery – some recent effort nearby but outside of the survey area

4.2. State (Victoria) managed fisheries:

8. Victorian Rock Lobster Fishery – some effort in area over past 10 years
9. Victorian Ocean Fishery – some effort in area over past 10 years
10. Victorian Ocean Purse Seine Fishery – some effort in area over past 10 years
11. Victorian Ocean Wrasse Fishery – some effort in area over past 10 years
12. Victorian Trawl (Inshore) Fishery – some effort in area over past 10 years
13. Victorian Ocean Scallop Fishery – some effort in area over past 10 years

5. DESCRIPTION OF FISHING METHODS USED IN THE SURVEY AREA

5.1. Otter-board trawl (CTS, Victorian Trawl (Inshore) Fishery)

There are two types of trawling that currently operate in eastern Bass Strait as part of the CTS: otter-board trawl and Danish seine. These are termed as "active" fishing gear because they are towed through the water to catch fish.

Otter-board trawls come in a wide variety of configurations, but the typical set up is described. Otter-board trawls are towed behind the fishing vessel using two long steel cables called "warps" (Figure 5a). Warps are set and hauled using hydraulic net drums on the deck of the vessel. At the other end, each warp is attached to an otter-board, which are large, rectangular steel 'boards' that are attached at an angle designed to provide the outward force needed to spread the mouth of the net. While being towed, otter-boards can spread as wide as 100–120 m. The otter-boards connect to the net via sweeps and bridles, which act to herd the fish into the wings, then the mouth of the net[3], and eventually to the cod-end. The net is widest at its mouth and tapers towards the cod-end (the closed end or bag of the net), where the fish accumulate. The vertical opening of the mouth is maintained using floats on the headline. The lower edge of the net is weighted and uses 'bobbins' or 'rollers' to help the net move across the sea bed and protect it from damage (Figure 5c). Otter-board trawls can also be fished off the bottom to target schools of pelagic fish. When used for this purpose, they are called "mid-water" trawls (Figure 5b).

CTS otter-board trawl vessels are typically 18–28 m long, weigh 50–150 tonnes and are powered by 250–700 HP engines (Figure 5d). These vessels are generally operated by a skipper and two to four crew members. The net is towed behind the boat at speeds of 2.0–3.5 knots depending on current and ocean conditions and the species of fish targeted. Tows (fishing time) range from very short (5–10 minutes) to several hours. Once the cod-end has been hauled aboard, it is untied, and the catch is spilled onto the deck (Tomkin, 1998) and sorted. Otter-board trawl mesh sizes vary according to target species but in eastern Bass Strait they are $\geq$90 mm[4].

Typical CTS otter-boards measure 3–4 m^2 in area, and weigh about 700 kg each. Warps usually comprise 16–22 mm wire cable[5] and are fished using a 1:3 ratio with depth (i.e. 100 m deep = 300 m warp length when fishing). These warps typically have a breaking strain of 14–26 tonnes (Noble, 2006). The sweeps, which connect the net to the otter-boards, typically comprise 18–20 mm wire rope with a breaking strain of 16–20 t (Noble, 2006). Ground gear can be 16 mm chain and/or 4–8 inch (100 mm– 200 mm but always referred to in inches) rubber bobbins. An average set of trawl gear (net, ground gear, bridles) weighs about 1,000 kg.

[3] This report uses the term "net" to refer to the mesh part of the gear and the term "trawl" to refer to the net, headline, floats and ground gear when assembled.
[4] Measured internally from the edge to edge of a stretched mesh.
[5] Most fishing vessels use 6*19 general purpose round strand galvanised wire rope. All breaking strains stated for otterboard trawling wire rope are for this specification unless stated otherwise.

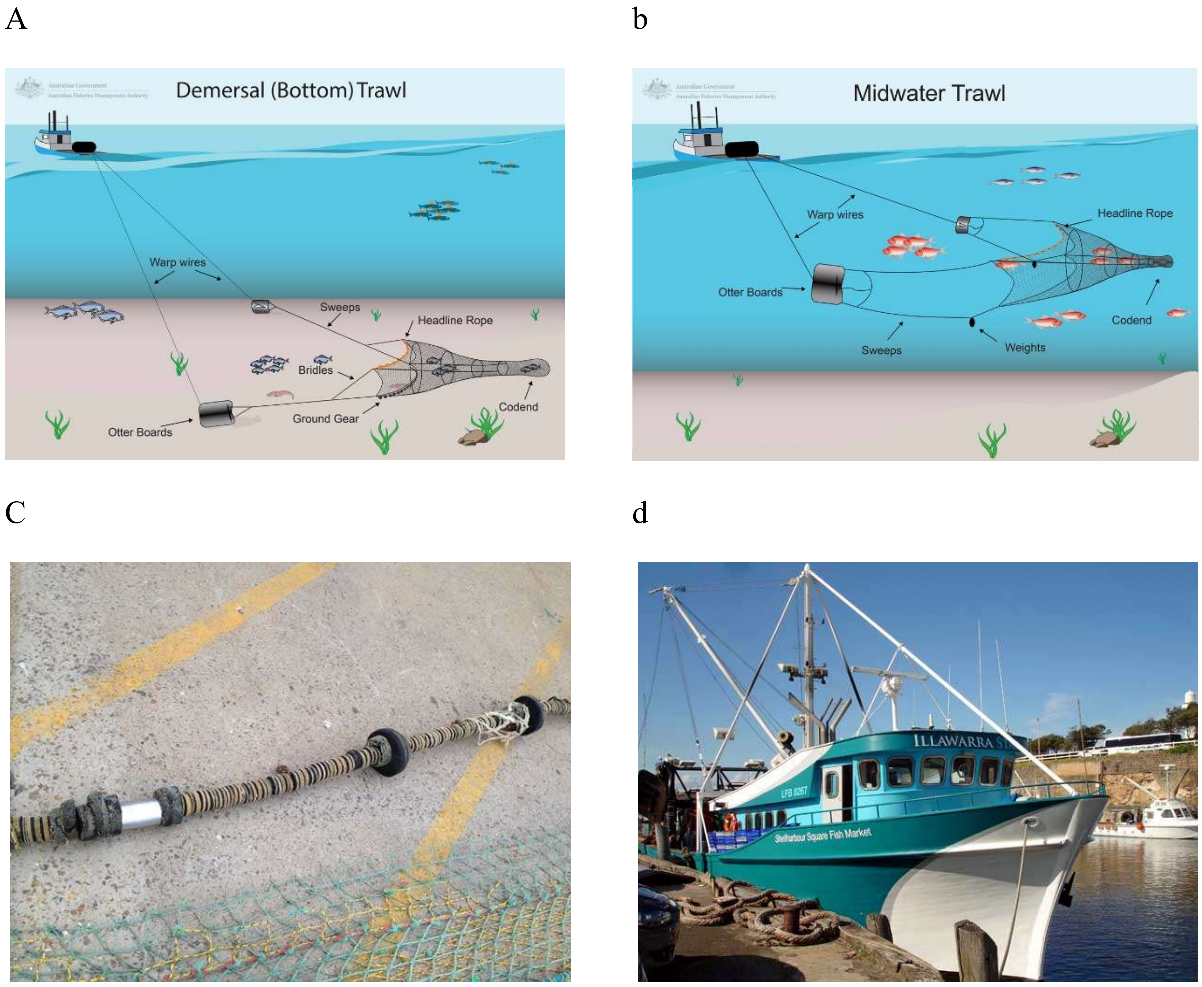


Figure 5 Illustrations of an (a) otter-board trawl (AFMA, 2018) and (b) midwater trawl and images of (c) typical trawl ground rope and (d) a typical trawl vessel.

5.2. Danish seine (CTS)

CTS Danish seine vessels are typically 15–20 m long and powered by 250–300 HP engines. They are usually crewed by one skipper and one or two deckhands (Figure 6b). Danish seine nets are conical in shape with two long wings, a bag where fish collect and warps that connect the net to the vessel and to surround an area fished (Figure 6a). Unlike otter trawls, Danish seines have no otter-boards, and they are not towed behind the boat, rather set in a circle over relatively flat sea beds and hauled slowly back to the vessel, only moving about 1 nm while it surrounds a large, pear shaped area. A Danish seine shot usually lasts around 70 minutes and can be described by three distinct phases (Koopman *et al* 2010), setting, towing and retrieval. The setting phase of the Danish seine trawl is of much longer duration than for an otter trawl. For the first ~45 minutes of the shot the tow ropes and wings of the net are let out and the net sinks to the sea floor; the codend only moves very slowly through the water during this phase. The shoulders and wings of the net are vertically flat for the first 15 minutes, before becoming concaved as the net starts to move. The towing phase is characterised by an increase in the codend speed, and therefore water flow through the net as the ropes are hauled back onto the vessel. The wings of the net are bowed over, and are being pulled forwards, as well as being drawn in towards the opposite wing. It is during this phase that most fish are herded towards the back of the net. As the retrieval phase begins, the wings begin to lift off the sea floor. After about an hour, fish have stopped entering the net apart from a few fish that are caught in higher sections of the net, and the foot-line in the shoulder comes off the seafloor. The net is tight and meshes fully stretched because of the pressure of being hauled in, and the weight of the fish in the codend. After a further ten minutes, the codend is on the surface, and usually hauled onboard within 2 or 3 minutes.

Danish seine warps are initially 22 mm lead core polypropylene rope with a breaking strain of 8.0 t (Noble, 2006), but taper down to lighter 12 mm polypropylene rope with a breaking strain of 3.0 t (Noble, 2006) under the net, with the same 22 mm rope at the other end of the gear (Figure 6c). Mesh size used depends on the target species and can be as small as 38 mm stretched diameter, but more typically 60–70 mm (Figure 6d).

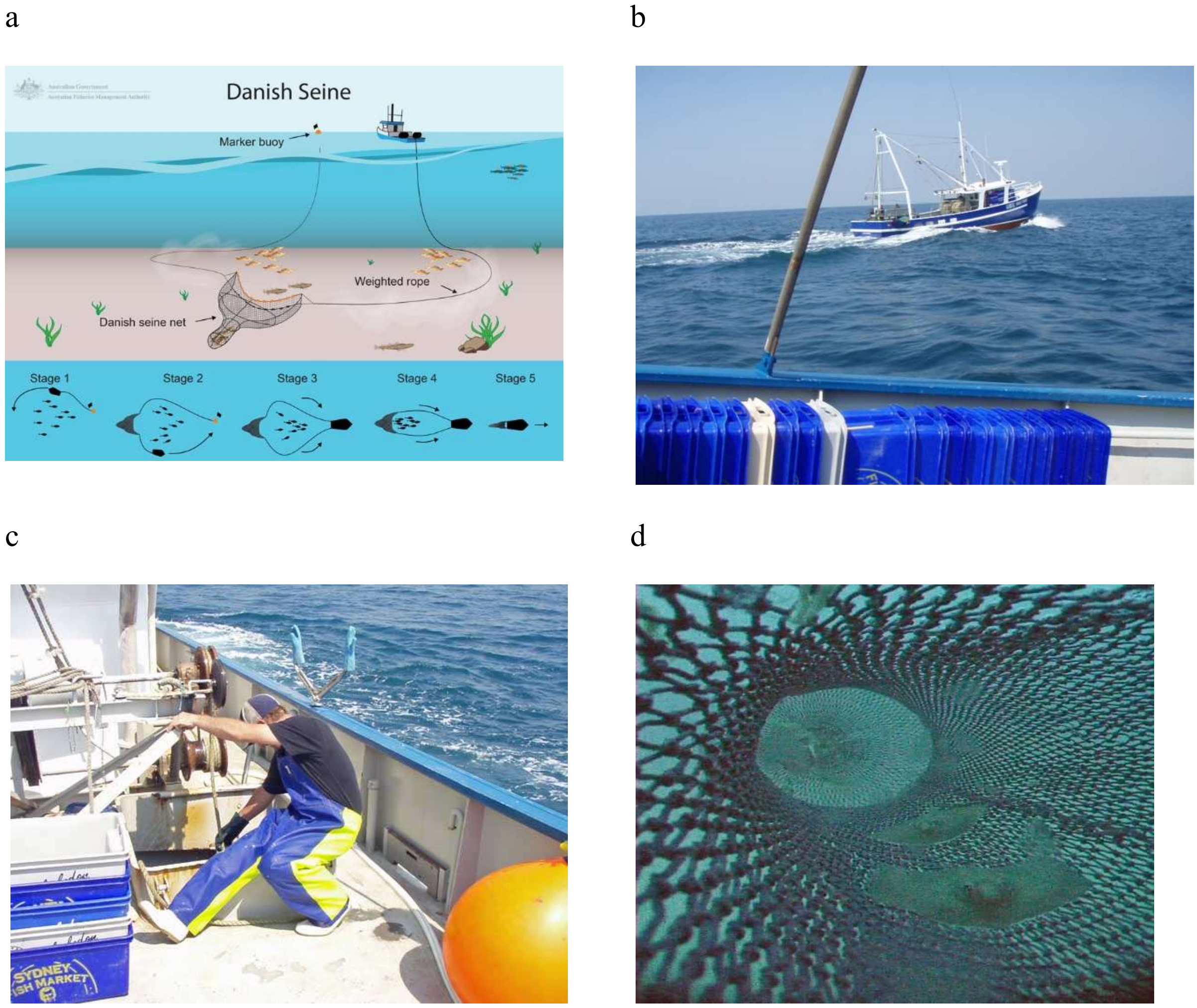


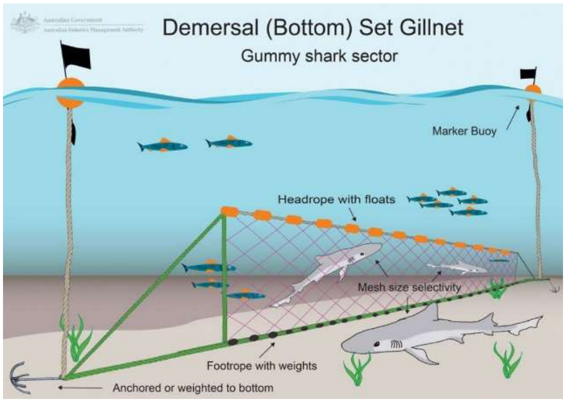
Figure 6 (a) Illustration of a Danish Seine shot (AFMA, 8, (b) a typical Danish seine vessel, (c) the ropes being hauled onboard, and (d) a view looking done the net into the codend.

5.3. <u>Demersal gillnets (SGSHS)</u>

Demersal gillnets are a "passive" fishing gear (they are not towed — the fish must swim into the gear) comprising a series of long panels of diamond shaped mesh anchored at each end and weighted along the bottom rope to keep the net on the sea floor. It is held upright by a series of floats (Figure 7a). Used in the SESSF mainly to target gummy sharks, the uniform sized (6 inch) meshes on a gillnet (Figure 7d) make them highly selective for a particular size of shark. Sharks that are smaller than the mesh can pass through, while larger sharks tend to "bounce" off the net without becoming meshed. Operators in the SGSHS can use gillnets up to 6,000 m long in Bass Strait. Many operators divide their maximum legal net length into two or three fleets, which can either be fished together or separately.

Gillnets used in the SGSHS generally have the headline (top horizontal rope) set 2.0 m above the seafloor. The headline is typically a 16 mm polypropylene rope floated using small floats (Figure 7b). The monofilament net is connected to a ground rope on the lower horizontal edge. The ground rope is usually a 14 mm weighted (lead core) polypropylene rope. At either end of the gillnet, a 9 mm down-line with a breaking strain 2.0 t (Noble, 2006) runs from floats that indicate the position of the net on the surface, to 2.0 m of chain attached to a 10–15 kg "J" anchor or lead weights (Figure 7c). Depending on tide and sea conditions there are often three or four other anchors along the ground rope. The chain is attached to the anchor mid-way down the anchor shaft, and a lighter break-away cord is usually used.

a



b

c

d

Figure 7 (a) Illustration of a demersal gillnet (AFMA, 2018), (b) a typical net drum, (c) lead weights, and (d) close-up of a gillnet.

5.4. <u>Demersal longline (SGSHS and SFHS, Victorian Ocean General Fishery)</u>

Demersal longlines are also a passive fishing gear consisting of a long mainline laid along the seabed, to which hundreds or thousands of baited hooks are attached at regular intervals (~1.4 m) via short lines (30 cm) called "snoods". In the SGSHS, longlines are typically 1.5 to 5.0 km in length (Figure 8) with less than 15,000 hooks. As the mainline is set from the stern of the vessel, each hook is baited by either hand or a baiting machine and released. The mainline is marked by a buoy with lights and can be anchored at each end. Some vessels use radio beacons to be able to find gear in low visibility or if it drifts in heavy current.

Demersal longline gear is much lighter than otter-board trawl or Danish Seine gear. Downlines (ropes connecting floats and the mainline) are generally made of 8–10 mm polypropylene with a 1.0–2.0 t breaking strain (Noble, 2006). Mainlines are thinner (e.g. 7 mm) but are more abrasion resistant. Snoods are usually monofilament with very low breaking strain (approximately 50 kg). Anchors are only large enough to manage onboard by hand (~15–25 kg). The number of anchors used depends on many factors including, currents, sea condition, ground fished, and species targeted.

Like other fishing vessels, longliners may lay-up at anchor during bad weather or while fishing gear soaks (fishes). Auto longlining is a variation of demersal longlining in which some of the functions (for example baiting the hooks) are automated. Many "autoliners" set, haul and steam between lines on a continual basis.

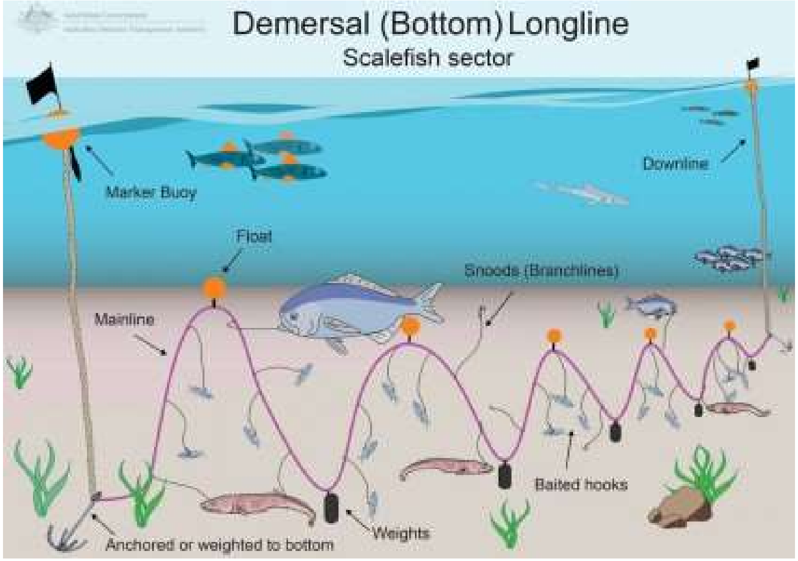


Figure 8 Illustration of a demersal longline: (AFMA, 2018)

5.5. <u>Pelagic longline (ETBF)</u>

Pelagic longlines are like demersal longlines except they are free-floating near the surface. They are a passive fishing gear consisting of a long mainline suspended under floats, with hundreds or thousands of baited hooks are attached at regular intervals via snoods (Figure 9). Radio beacons are attached to the floats to allow the vessel to track its movement. ETBF vessels generally fish in deep water which prohibits anchoring. They more often steam between lines, or drift while waiting to haul.

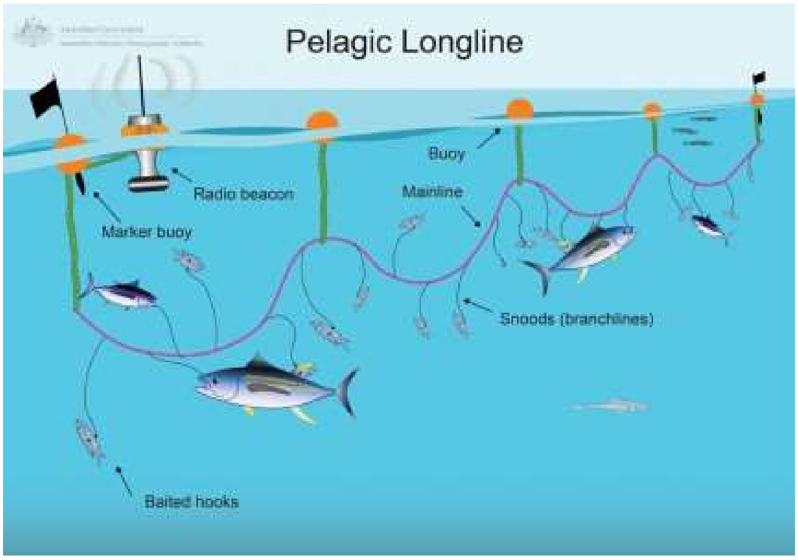


Figure 9 Illustration of a pelagic longline: (AFMA, 2018)

5.1. Minor line (ETBF, Victorian Ocean Fishery, Victorian Wrasse Fishery)

Minor lines is a general term to describe a range of line fishing methods that use a small number of hooks. Minor line methods include trolling, poling, rod and reel (often call hand-lining). Hooks are either baited or on lures or jigs and could either be fished near the bottom using a lead weight, slowly dragged through the water (trolling), of dragged through the water using the action of the rod or reel.

In the ETBF, Minor line methods are used to target large pelagic species such as tuna, but also smaller pelagic species to be used as bait.

Hand lines are used in the Victorian Ocean Fishery to target finfish including Snapper. There is a limit of six lines — each with three hooks — per licence. Handlines are usually lowered and retrieved using fishing rod and reel equipped with 20 lb breaking strain monofilament of braided nylon mainline and 40–50 lb leader. Hand lines are usually fished from small 6–8 m vessels undertaking day trips. Vessels may anchor while fishing, and typically use a reef anchor attached to 3–5 m of chain (typically 8 mm link) and 12 mm polypropylene rope.

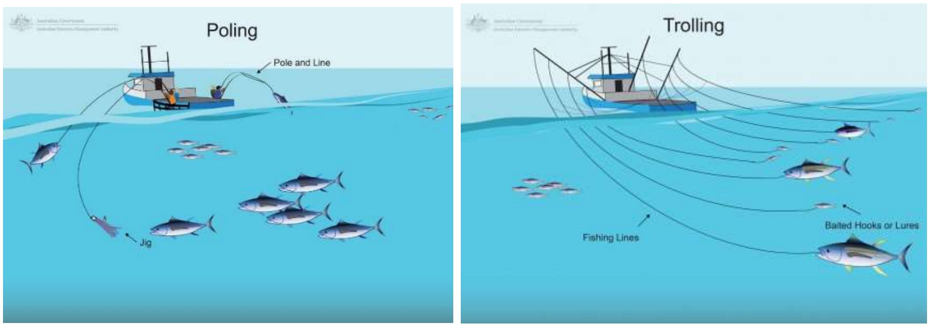


Figure 10 Illustration of minor line methods of poling and trolling: (AFMA, 2018)

5.2. Purse seine (SPF, Victorian Ocean Purse Seine Fishery)

Purse seines are used in the Commonwealth managed Small Pelagic Fishery. Purse seines are generally used to target schools of pelagic fish. A purse seine is comprised of a long wall of net framed by float line and lead line that is set in a circle to surround a school of fish, and then closed at the bottom using wire threaded through the bottom of the net (FAO 2001–2013; Figure 39). The catch is then brought onboard with the net, lifted out with small nets or pumped out. The fishing gear generally does not touch the sea floor.

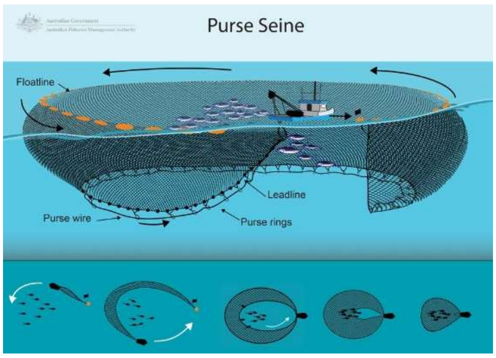


Figure 11 Illustration of a purse seine in operation (AFMA, 2017)

5.3. <u>Rock Lobster pots (Victorian Rock Lobster Fishery)</u>

Pots are a form of rock lobster traps that are baited and set individually, usually over rocky reef. A variety of baits are used, and include barracouta heads, salmon, carp and wrasse. Cray pots used in Victoria are usually ‘bee hived’ in shape, with a steel frame encased in with either cane or wire mesh (Figure 12a). Maximum dimensions are 150 cm x 150 cm x 120 cm high, but are usually smaller than that and weigh ~ 15 kg each. Pots are attached to a surface float via 10–12 mm polypropylene rope. They are set by being pushed overboard and retrieved using hydraulic pot hauler (Figure 12b).

a

b

Figure 12 Photos showing (a) close up of cray pots, and (b) the retrieval of cray pots using the pot hauler.

5.4. <u>Scallop dredge (Victorian Ocean Scallop Fishery)</u>

The Victorian Scallop Fishery extends 20 nm from the Victorian coast line. Scallops are caught using a steel dredge that is towed by the vessel along muddy to coarse sand substrates (Figure 13a).

The average scallop vessel is 18–25 m long, weighs ~100 t and is powered by 200–400 HP engines. Scallop dredges are a steel cage that weigh about 600 kg (Figure 13b). They have teeth (tooth bars) on the leading edge that range 75–100 mm long, which enter the benthos about half an inch (12 mm), scooping scallops into the basket. The gear is towed behind the vessel at a speed of ~3 knots using warps of 16–8 mm steel core (6*19 ply) with a breaking strain of 14–16 t (Noble, 2006).

a

b

Figure 13 Illustration (AFMA, 2017) and photo of a scallop dredge.

6. BACKGROUND INFORMATION ON FISHING SECTORS

6.1. Southern and Eastern Scalefish and Shark Fishery (SESSF)

The SESSF extends from Cape Leeuwin in Western Australia to Fraser Island in Queensland (Figure 14). This Commonwealth managed fishery is the main provider of fresh fish to the Melbourne and Sydney markets. The SESSF gross value of production (GVP) was about $75 million in the 2015–16 financial year but catches have declined significantly from historical levels primarily due to a reduction in fishing effort (Figure 15), largely associated with a 2006 Commonwealth Government led *Structural Adjustment* which removed 50% of fishing concessions but also from greatly reduced catches of Orange Roughy and Blue Grenadier (Patterson *et al.*, 2017).

AFMA manages fisheries to maintain stocks at ecologically sustainable levels, while maximising the net economic returns to the Australian community (DAFF, 2007). Main management measures used in the SESSF include limited entry, gear restrictions, closed areas and Total Allowable Catch (TAC) limits. Fishing licenses are required for fishermen to operate in the SESSF and there are dormant (unused) licenses in most sectors. TAC's are set each year based on outcomes of stock assessments conducted for each quota species. Statutory fishing right (SFR) quota units are converted to tonnes of quota each year depending on the annual TAC set.

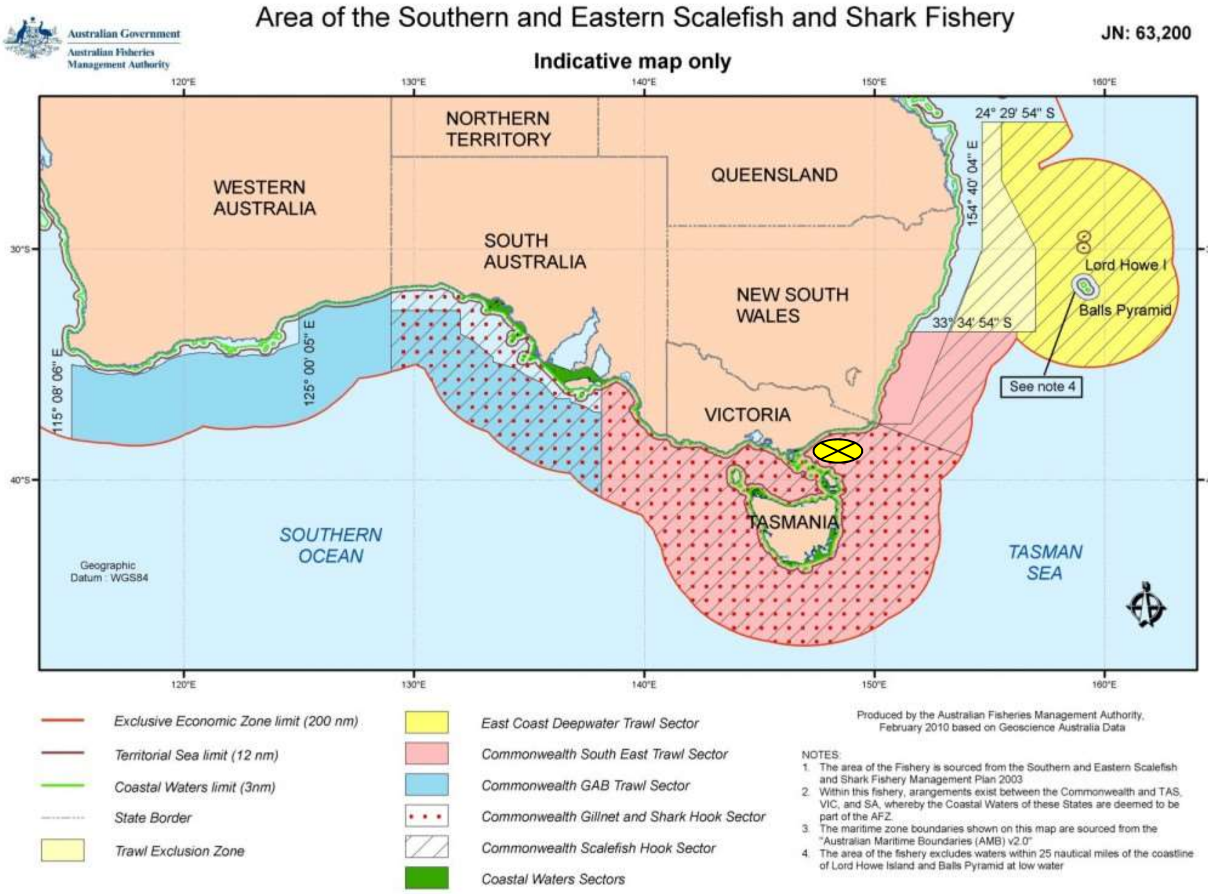


Figure 14 Area of the Southern and Eastern Scalefish and Shark Fishery (www.afma.gov.au). Very approximate location of proposed MSS shown by yellow balloon.

More than 100 species are regularly landed in the SESSF but only the main species are managed under quotas. At present, there are 34 fish stocks subject to TACs (Table 3). Only those in bold are generally found in the vicinity of proposed seismic survey area.

The SESSF is comprised of five sectors: the Commonwealth Trawl Sector (CTS), Great Australian Bight Trawl Sector (GABTS), East Coast Deepwater Trawl Sector (ECDTS), Gillnet and Shark Hook Sector (SGSHS) and Scalefish Hook Sector (SHS) (Figure 14). Of these, only the CTS, SGSHS and SHS sectors operate within the area of the proposed survey. Total landings by the CTS and SHS in 2016–17 was 8,691 t (Patterson *et al.*, 2017). GVP of the 2015–16 catch by the CTS and SHS was $41.52 million. The SGSHS landed 1,832 t of shark during 2016–17, and had a GVP of $17.21 million during 2015–16. of $37.7 million and $15.6 million respectively.

Table 3 List of 2018–19 TACs (whole fish unless otherwise stated) for SESSF quota species (AFMA, 2018b). Species that are likely to be caught in the area of the proposed MSS area are highlighted in bold.

Species	TAC (t)	Species	TAC (t)
Alfonsino	1,017	Orange Roughy – (GAB)	50
Bight Redfish (GAB)	800	Orange Roughy – (Cascade)	500
Blue Eye Trevalla	462	Orange Roughy – (East)	698
Blue Grenadier	8,810	Orange Roughy – (South)	53[6]
Blue Warehou	118	Orange Roughy – (West)	60
Deepwater Flathead (GAB)	1,128	Oreo (smooth Cascade)	150
Deepwater Shark (east)	23	**Oreo (smooth other)**	90
Deepwater Shark (west)	264	**Oreo (basket)**	185
Elephant Fish	114	**Pink Ling**	1,117
Flathead	2,501	**Redfish**	100
Gemfish East	100	**Ribaldo**	430
Gemfish West	200	Royal Red Prawn	381
Gummy Shark	1,763[7]	**Saw Shark**	430
Jackass Morwong	505	**School Shark**	215
John Dory	263	**School Whiting**	820
Mirror Dory	253	**Silver Trevally**	307
Ocean Perch	241	**Silver Warehou**	600

6.2. Commonwealth Trawl Sector

The CTS is one of the oldest commercial fisheries in Australia, with over a 100-year catch history. The main fishing gears used in this sector are otter-board trawl and Danish seine nets. The sector's area of operation extends from Cape Jervis in South Australia around the Victorian, Tasmanian and NSW coastlines northward to Barranjoey Point (Figure 14). During the 2016–17 fishing season there were 34 otter-board trawl and 16 Danish seine vessels actively operating in the CTS (Patterson *et al*, 2017).

SETFIA is the industry association for CTS operators, representing more than 80% of the catching and quota owning sector through voluntary membership. Contact details for SETFIA are provided in Table 10.

Overlap between CTS grounds and the area of the proposed seismic survey area

Total annual catch (fishery wide) in the CTS peaked in 1990 at just over 60,000 t, but fell to 20,000–30,000 t during the late 1990s (Figure 15) mainly as a result of the overfishing of Orange Roughy. Catches again fell during 2002–2007 from about 30,000 t to its current level of below 10,000 t.

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[6] Plus 31 t incidental

[7] Trunk weight.

The area off east Gippsland is heavily fished by the CTS using otter trawl and Danish seine, and is the main area of fishing for the Danish seine sector. Historical fishing effort shows significant overlap of the area of interest with fishing effort for each gear type (Figure 16, Figure 17). More recent data from 2015–16 shows that the area was still fished intensively by both otter-board trawl and Danish seine (Figure 18 and Figure 19).

Logbook data revealed that the area around the proposed seismic survey is very important for fishing by the CTS using otter-trawl gear. Between 9 and 13 CTS otter-board trawl vessels have recorded fishing effort using otter trawl gear within the area of interest since 2008 (Figure 20). Annual effort recorded by those vessels has ranged 1,742 shots in 2008 to 1,221 shots in 2017. More than 880 t of fish was landed in the GMSS footprint by the CTS using otter trawl gear during 2008, but that had consistently declined to about 444 t in 2017 (Figure 21). The estimated annual values within the GMSS of the catches from 2008 and 2017 were about \$3.6 million and \$1.7 million (Figure 22). Over the 10 year period of 2008–2017, a total of 6,183 t of fish was caught by the CTS (by otter trawl) within the survey area, with a value of nearly \$25.1 million (Table 4). Catch was dominated by the shelf dwelling tiger flathead (26%), and slope dwelling species including pink ling (13%) and silver warehou (9%) (Table 4, Figure 25).

The number of Danish seine vessels that recorded effort from the area of interest ranged 12–16 from 2008–2017, recording a low of 3,107 shots in 2009 and peak of 5,615 shots in 2016 (Figure 20). Total catches ranged 763 t in 2011 to 1,158 t in 2015 (Figure 21), while total value ranged \$3.8 million in 2011 to \$5.2 million in 2012 (Figure 22). Total catch over the 10 year period of 2008–2017 by Danish seiners was 9,639 t within the survey area, with a value of \$44.6 million (Table 4). Top three species lander were tiger flathead (65%), other flatheads (18%) and eastern school whiting (8%) (Table 4, Figure 25).

Effort by the CTS otter trawl sub-sector in the area around the proposed seismic survey has been lowest during January and February and increases throughout the year to peak in October (Figure 23). This increase is not closely reflected in catch, with retained catch relatively steady across April– December (Figure 24).

Danish seine effort has been lowest from May to September, as well as December (Figure 23). Retained catches have been clearly highest in January, and less than half that level in September (Figure 24).

Likelihood of fishing grounds developing in the future

Fishing effort in the CTS is more limited by quotas (TAC's) than the limited number of fishing licenses. Improved technology and exploration saw expansion of fishing grounds over the decades since the 1980s but subsequent to several Government-led structural adjustments and closures of many areas to trawling during the mid-2000s, there has been some contraction of fishing effort on both the shelf and shelf break. Figure 15 shows that in recent years, effort in the otter-board trawl fleet has fallen to the lowest levels on record (apart from 1985 when logbooks were introduced), while Danish seine effort slightly increased in 2016. The fishing grounds around the survey area are categorised as having high otter trawl 1–2.5 hrs per km^2), and high Danish seine effort (1–2 shots per km^2 (Figure 18 and Figure 19). While the catch of some CTS species is limited by TACs, the fishery has been unable to catch that TAC in recent years for unknown reasons that are now being investigated. Thus, while there is a significant amount of otter trawl catch and effort recorded from within the area of the seismic survey, it has been declining it is unlikely that this will increase to any appreciable extent in the near future. Despite the inability to catch TACs however, Danish seine catch has been consistently increasing over the past 10 years, and it is possible this trend will continue.

Table 4. CTS effort, catch, catch value and main species caught in the MSS area. Original data source: AFMA.

	Otter trawl	Danish seine
Years included	2008–2017	2008–2017

Number of different vessels	26	19
Total shots	14,990	44,823
Total catch (t)	6,183 t	9,639 t
Total value	$25.1 million	$44.6 million
Main species caught	Tiger flathead (26%)	Tiger flathead (65%)
	Pink ling (13%)	Flatheads (other) (15%)
	Silver warehou (9%)	Eastern school whiting (8%)
Fishing methods used	Otter trawl	Danish seine

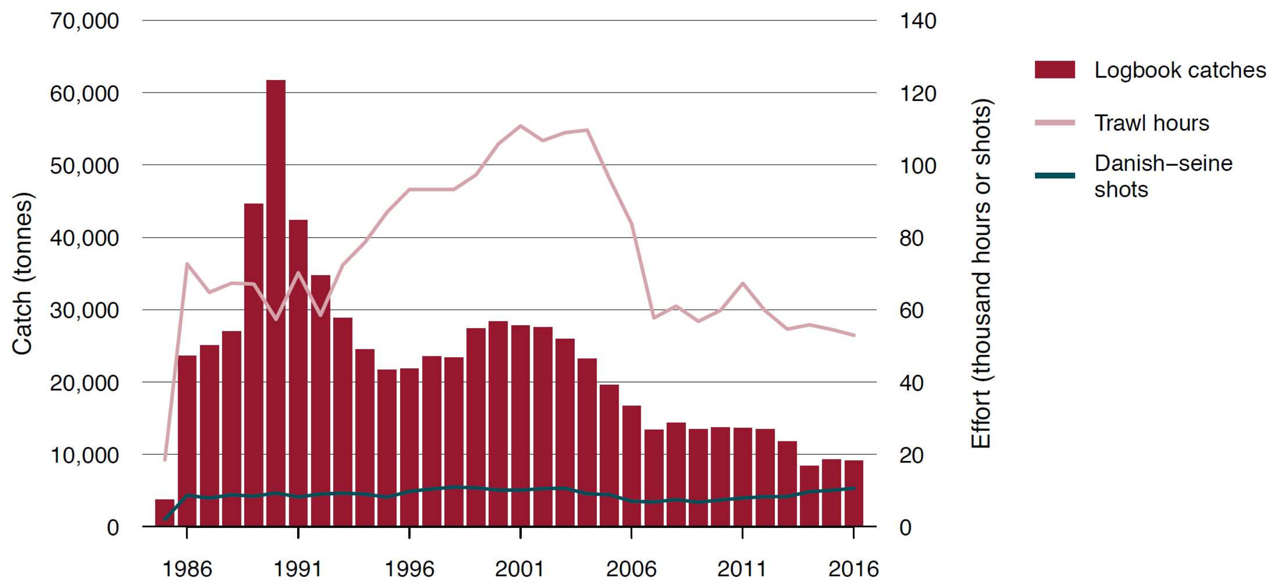


Figure 15. Total catch and effort by the CTS during 1985–16 (Patterson *et al*, 2017).

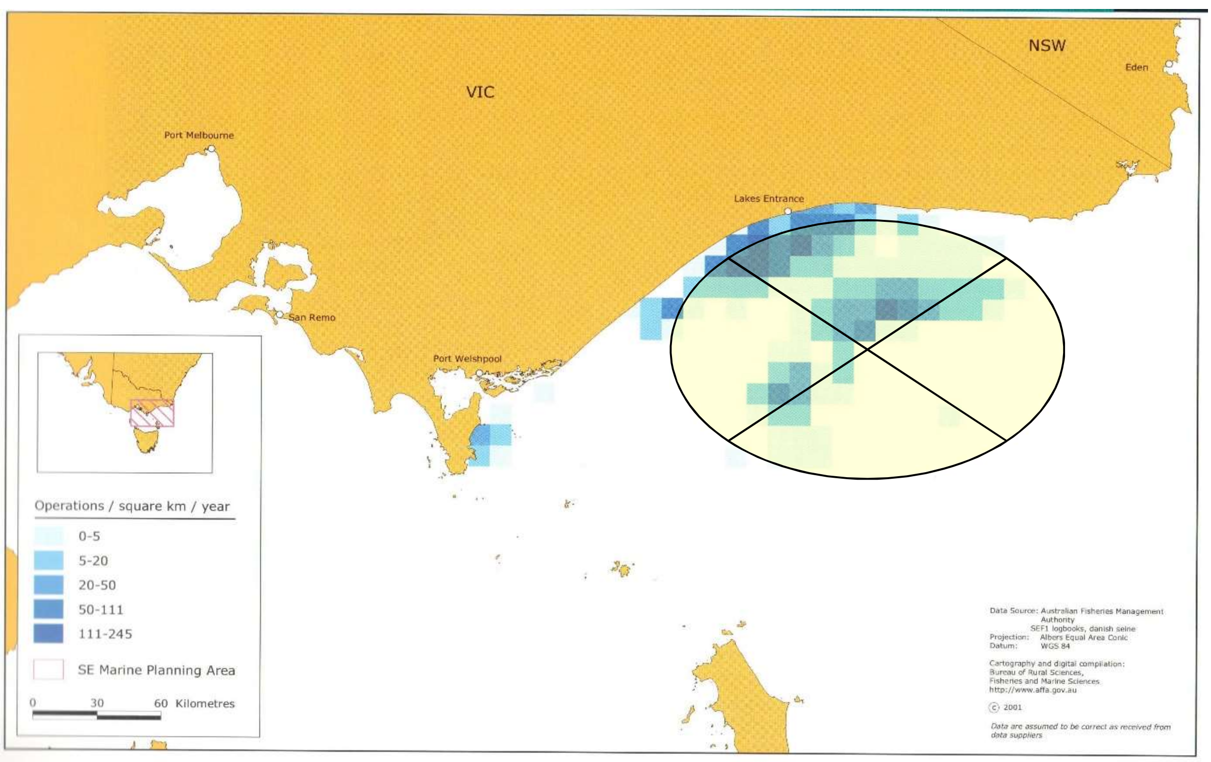


Figure 16 Fishing effort (operations/square km/year) by CTS Danish seine in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed MSS area shown by yellow shaded balloon.

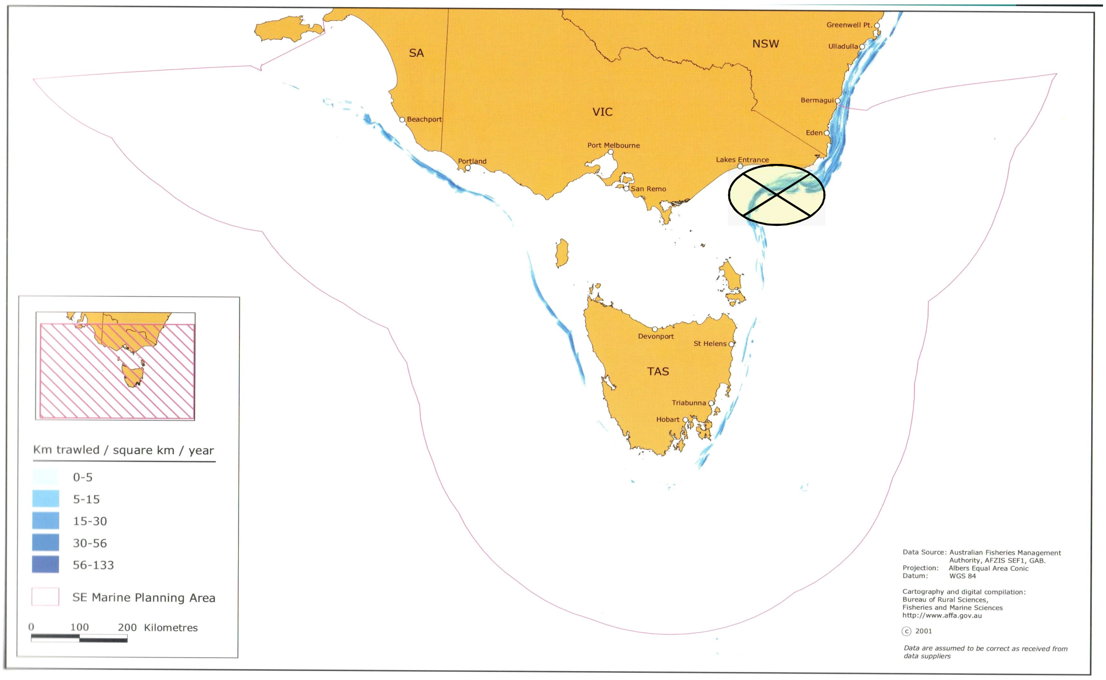


Figure 17 Fishing effort (km trawled/square km/year) by CTS otter trawl in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed MSS area shown by yellow shaded balloon.

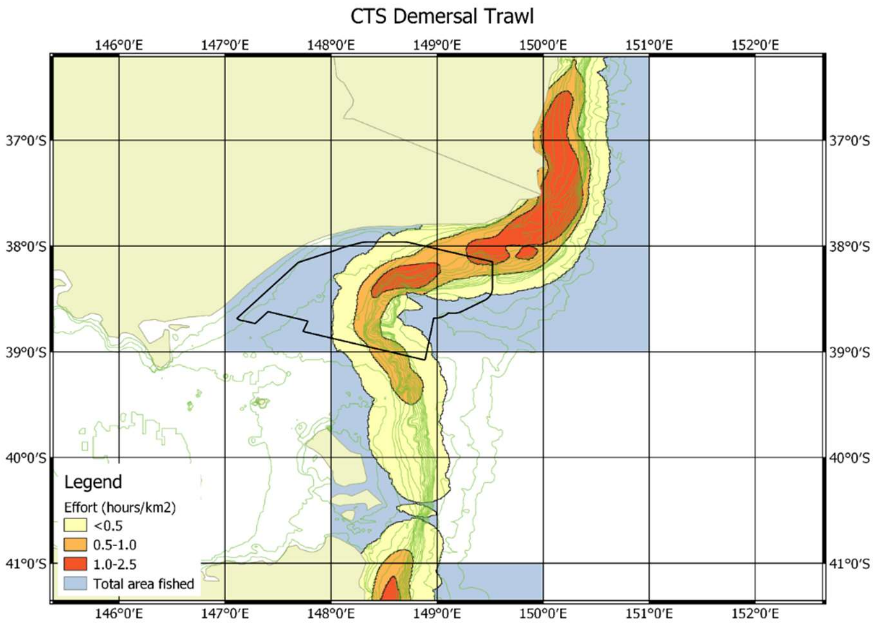


Figure 18. Relative fishing intensity (hrs/km^2) by the CTS using otter trawl in relation to the proposed MSS area (black polygon) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

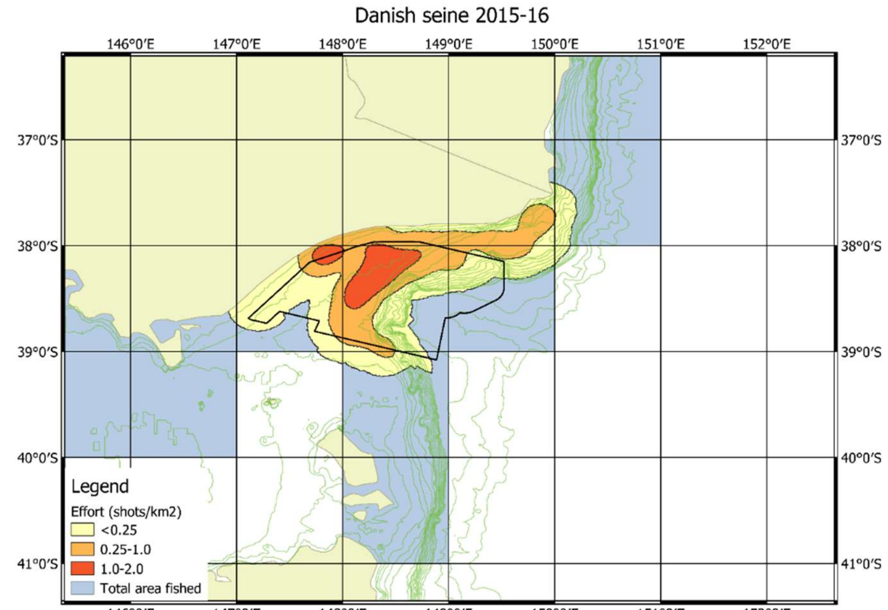


Figure 19 Relative fishing intensity (shots/km^2) by the CTS using Danish seine nets in relation to the proposed MSS area (black polygon) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

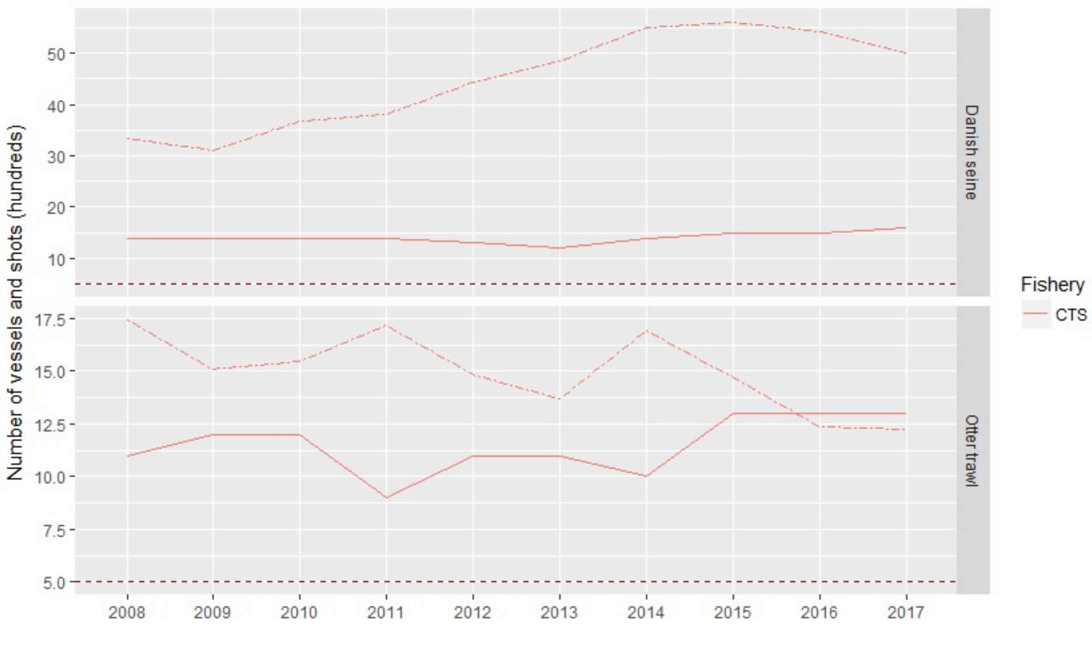


Figure 20. Number of vessels that recorded effort (solid line) and number of shots (hundreds) recorded (dashed lines) within the MSS area in each year from 2008–17 by the CTS using otter trawl and Danish seine gear. Note the minimum number of vessels in any one year was greater than 5. The horizontal red line intercepts the y-axis at 5. Original data source: AFMA.

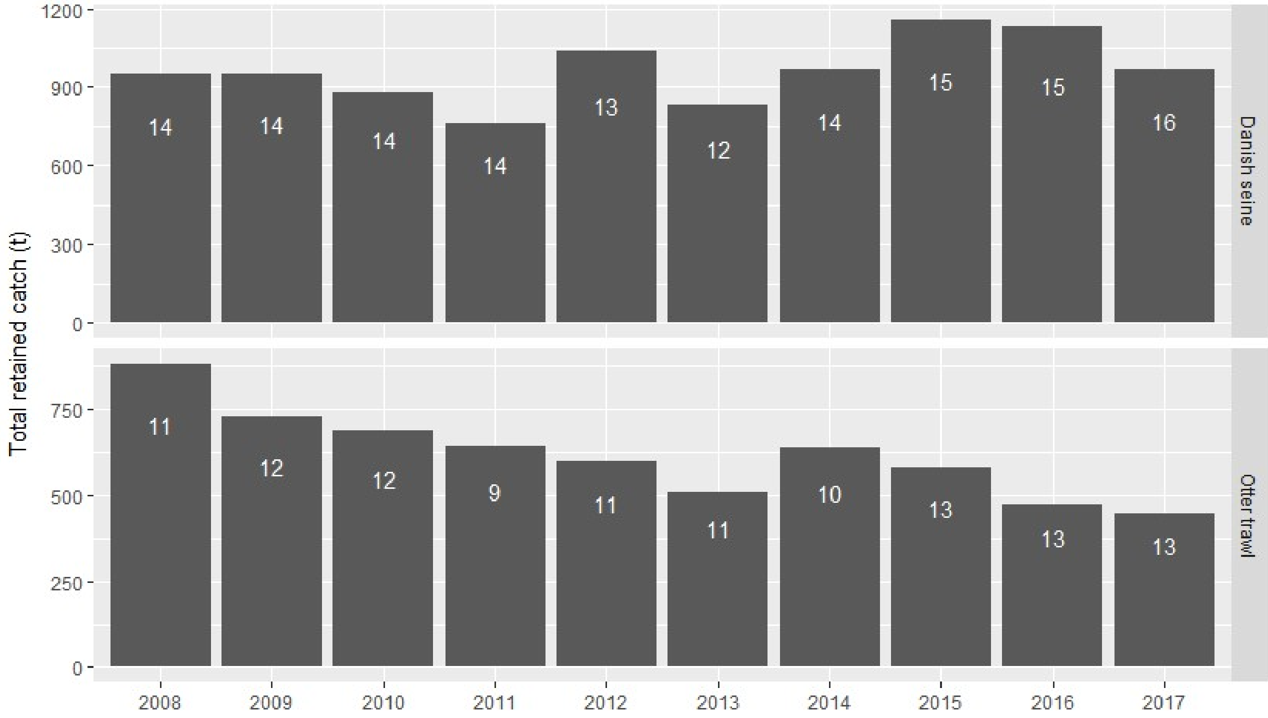


Figure 21. Annual retained catch from within the area of intertest by the CTS using otter trawl and Danish seine gear (see Figure 3). Note the minimum number of vessels in any one year was >5. Number of vessels is annotated on bars. Original data source: AFMA.

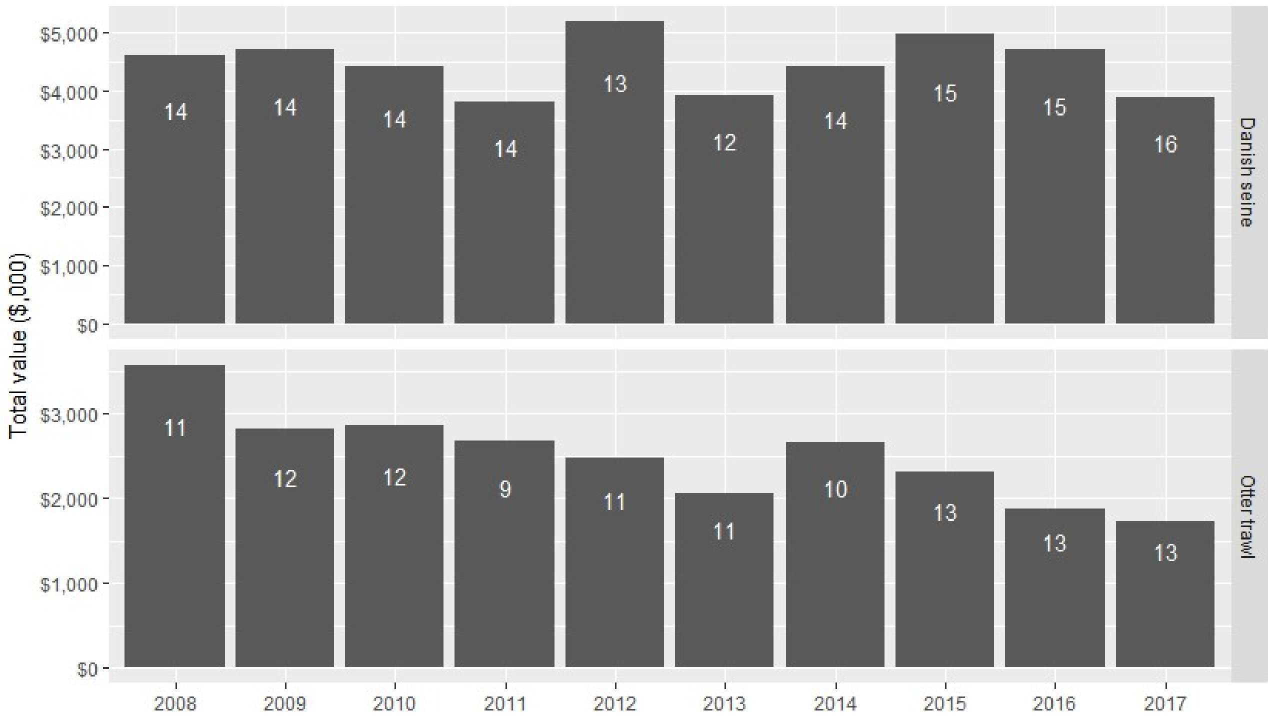


Figure 22. Estimated annual value of fish landed from within the area of intertest by the CTS using otter trawl and Danish seine gear (see Figure 3). Note the minimum number of vessels in any one year was >5. Number of vessels is annotated on bars. Original data source: AFMA.

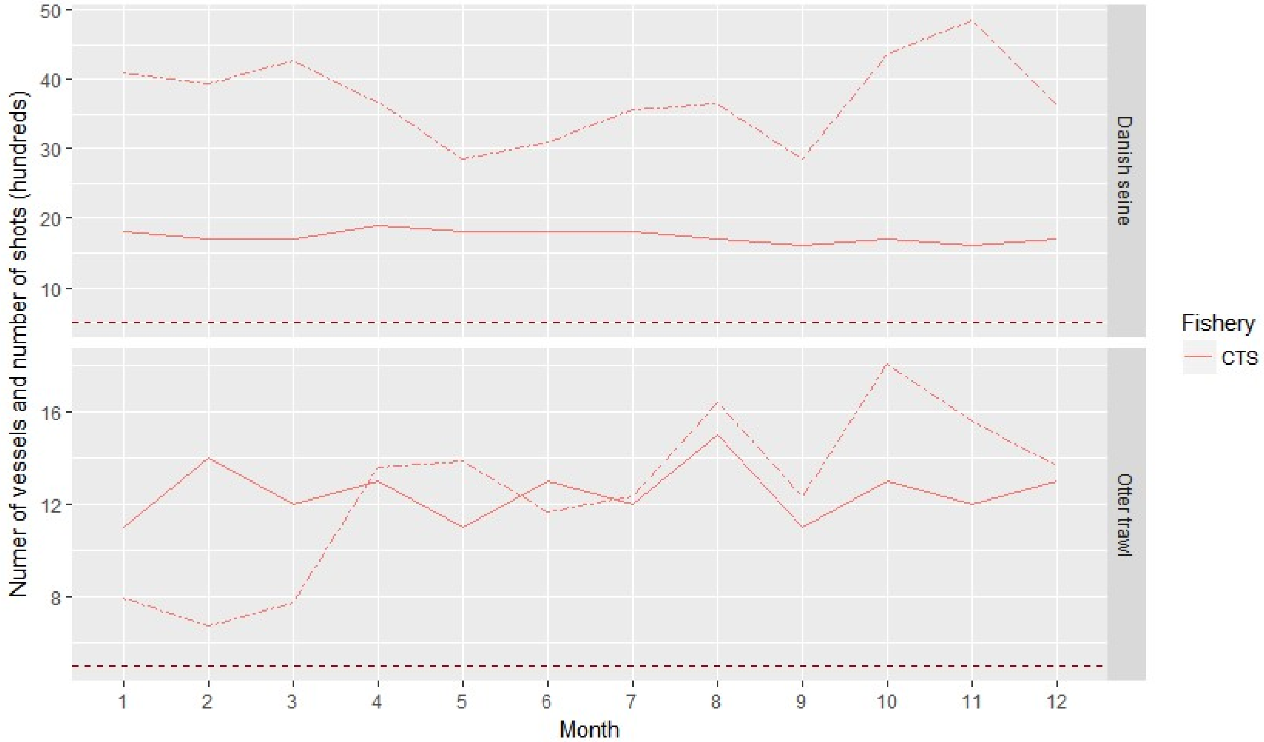


Figure 23. Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) from within the area of intertest by the CTS using otter trawl and Danish seine gear in each month from 2008–17. Note the minimum number of vessels in any one month was >5. The horizontal red line intercepts the y-axis at 5. Original data source: AFMA.

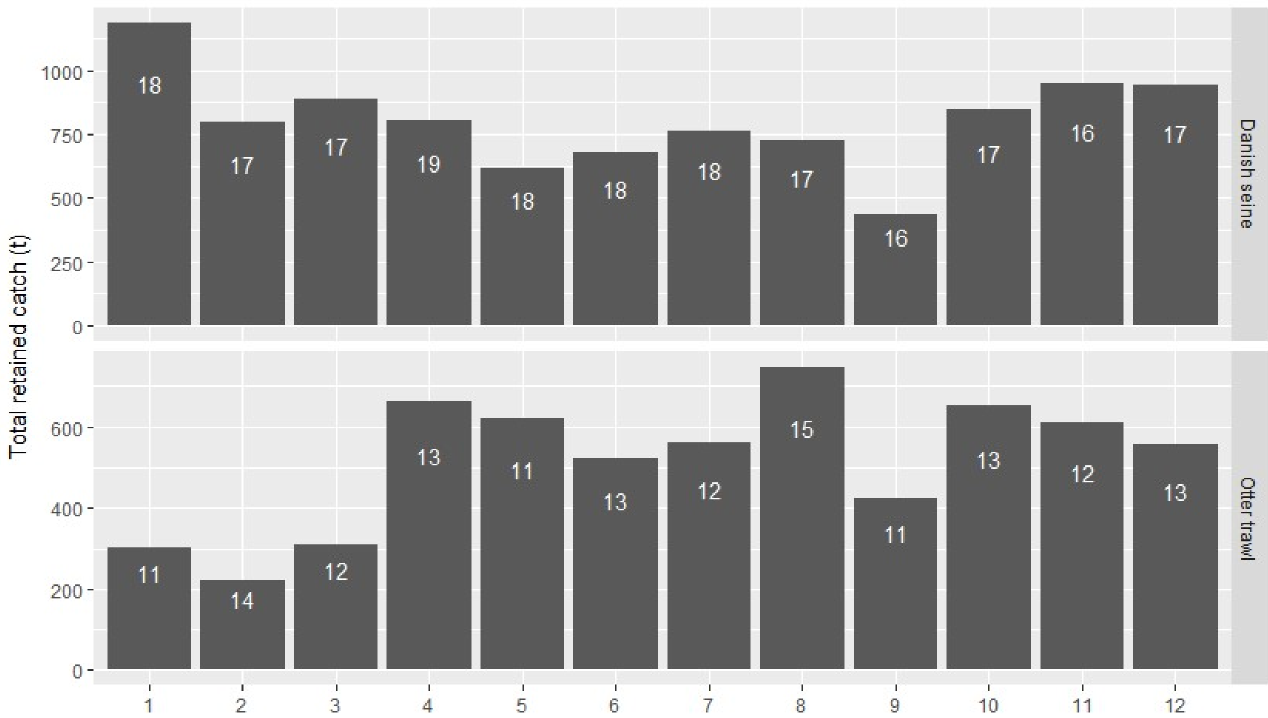


Figure 24. Total monthly (2008–17) retained catch from within the area of intertest by the CTS using otter trawl and Danish seine gear in each month from 2008–17. Note the minimum number of vessels in any one month was6. Number of vessels is annotated on bars. Original data source: AFMA.

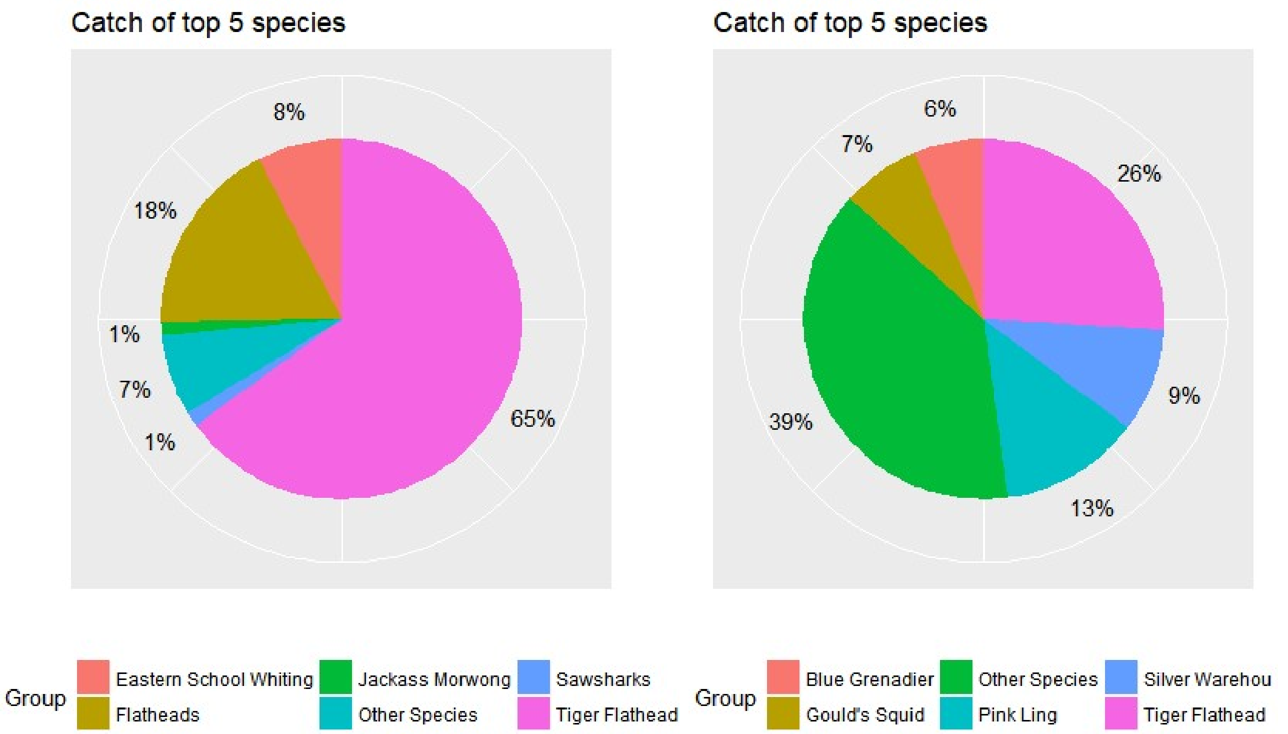


Figure 25. Main species caught by the CTS using Danish seine (left panel) and otter trawl (right panel). Note the minimum number of vessels in any species was > 5. Original data source: AFMA.

6.3. <u>Shark Gillnet and Shark Hook Sector (SGSHS)</u>

The SGSHS extends from the South Australian / Western Australian border to the Victorian / NSW border (Figure 26). The SGSHS targets gummy shark using demersal gillnets and demersal longlines (including auto-longline) and are restricted to waters shallower than 183 m. There has also been historical records of effort in that area by the shark gillnet sub-sector (Figure 28), and only gillnets were used in 1 degree boxes that overlap with the area of interest during 2015–16 (Figure 29, Figure 30). There has been shark longline effort recorded from within the area of interest over the time 2008–2017, however because of the low number of operators, detailed graphs or figure cannot be show, but some summary data combined with the scalefish hook sector is provided in Table 5.

The SGSHS landed 1,832 t of shark in 2016–17, and had a GVP of $17.21 million in 2015–16 (Patterson *et al*, 2017). During 2016–17 there were 36 active SGSHS vessels operating gillnets and 26 vessels using demersal longlines (Patterson *et al*, 2017).

Overlap between SGSHS grounds and the area of the proposed seismic survey area

Catch in the SGSHS peaked at more than 4,000 t during 1986, and effort peaked in the following year at about more about 120,000 km-lifts (Figure 27). Catch and effort has decreased considerably since, mainly due to declining stocks of School Shark, conservative School Shark management arrangements in place to promote recovery of that species, and removal of effort through Government-led structural adjustments and closures. Despite this decrease, Gummy Shark landings have increased from 1,288 t in 2012 to 1,667 t in 2015.

Figure 29 and Figure 30 show that relative to other areas of the fisheries, effort in the area of the proposed survey is high in some areas, but more medium to low. The 30 gillnet vessels that reported effort in the area of interest between 2008 and 2017 logged 4,862 shots, from which they caught 1,009 t of fish valued at about $5.9 million (Table 5). Main species caught were gummy shark (71%), common school shark (12%) and elephant fish (5%) (Table 5, Figure 36). Combined, seven shark hook and scalefish hook sub-sectors vessels fished in the area of interest during 2008–2017 undertaking 465 shots and catching 686 t of fish with a value of $4.3 million (Table 5).

Annual effort in the MSS area by the shark gillnet sub-sector has increased from about 328 shots per year in 2008 to about 629 shots in 2015, but has since decreased to 542 shots (Figure 31). Annual catch has ranged about 57 t in 2014 to 149 t in 2016 (Figure 32). Because of the small number of species dominating the catch, value closely follows catch ranging just under $0.4 million in 2014 to about $0.9 million in 2016 (Figure 33).

Shark gillnet effort is highly seasonal in the MSS area, peaking in May, and is lowest from September to December and in March (Figure 34). Like effort, catch is by far highest in May, and lowest in March and from September to December and February–March (Figure 35).

Likelihood of fishing grounds developing in the future

Of the 61 shark gillnet fishing permits available, only 36 were used during 2016/17, offering considerable latent effort in the fishery (Patterson *et al*, 2017). However, 87% of the Gummy Shark TAC was caught during that season, and would likely be a limiting factor in the expansion of effort. Fishing effort by gillnet vessels increased from 2009 to 2013, and this is likely due to displacement of effort from South Australia in response to changed management arrangements in waters off that state.

There are two industry associations that represent SGSHS, the Sustainable Shark Fishing Association and the Southern Shark Industry Alliance. Contact details for these industry associations are provided in Table 10.

Table 5. GHAT Shark Gillnet and shark and scalefish hook effort, catch, catch value and main species caught within the AFMA data area. Original data source: AFMA.

	Shark hook and scalefish hook	Gillnet
Years included	2008–2017	2008–2017
Number of different vessels	6	30
Total shots	465	4,862
Total catch (t)	686 t	1,008 t
Total value	$4.3 million	$5.9 million
Main species caught	Pink Ling	Gummy Shark (71%)
	Reef Ocean Perch	Common Sawshark (12%)
	Blue-eye Trevalla	Elephantfish (5%)
Fishing methods used	Longline	
	Automatic Longline	Gillnet

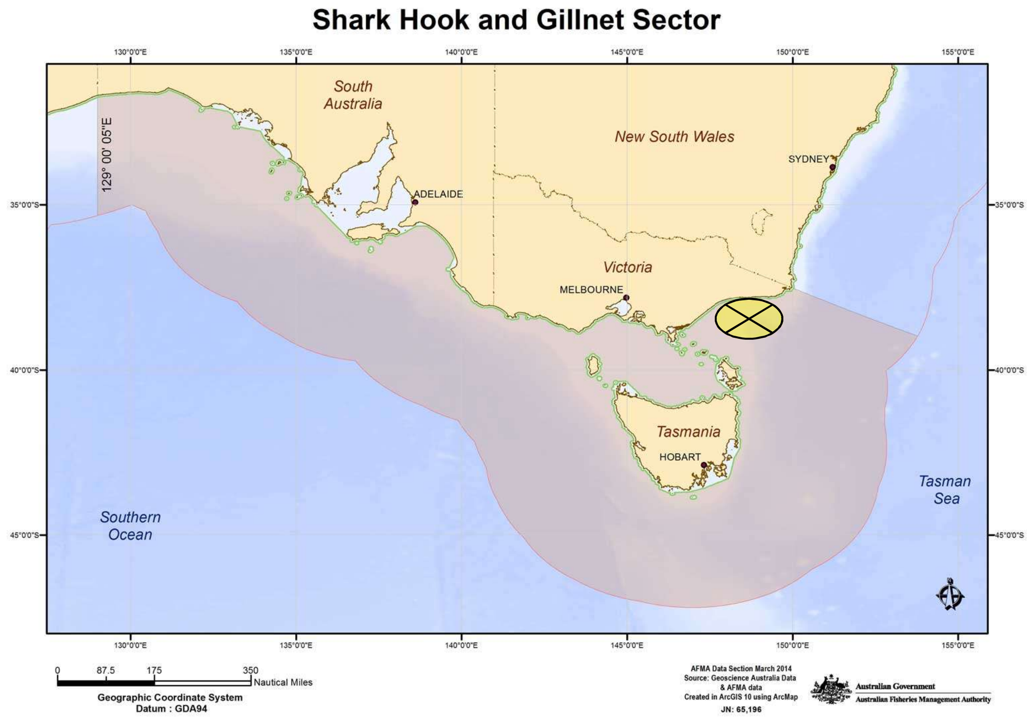
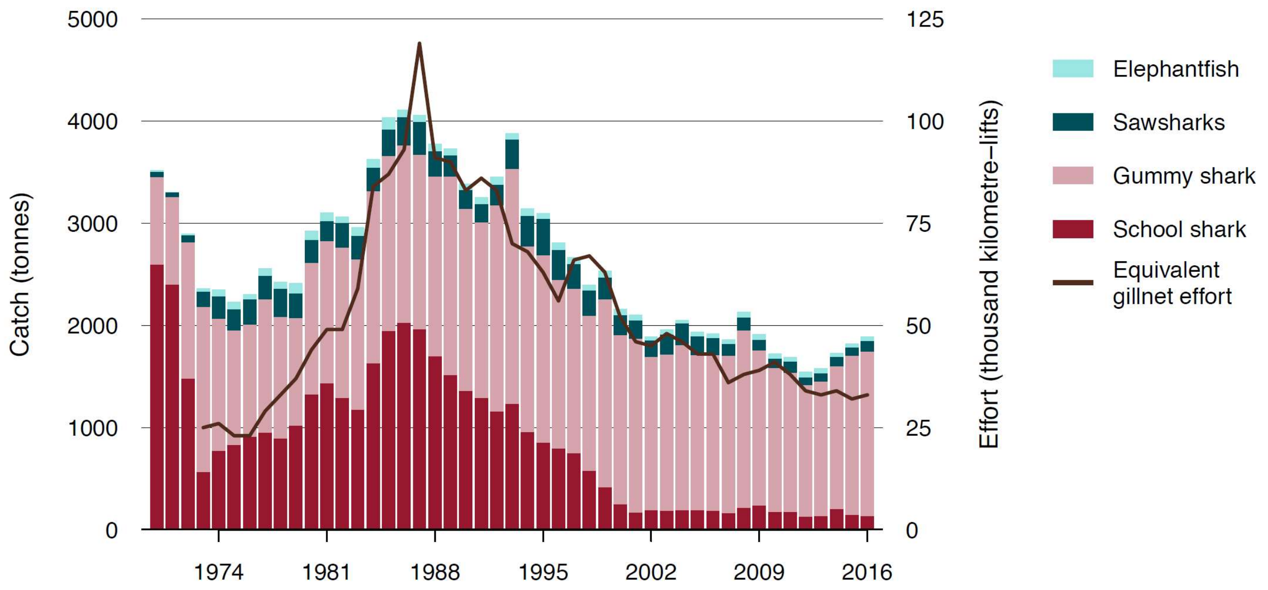


Figure 26 Shark Hook and Gillnet Sector (AFMA, 2018a). Approximate location of proposed MSS area shown as yellow balloon.



Note: 'Equivalent gillnet effort' is an estimate of total effort after converting hook effort to the equivalent gillnet effort using the methods in Walker et al. (1994).

Figure 27. Catch and effort in the SGSHS 1970–16 (Patterson *et al*, 2017)

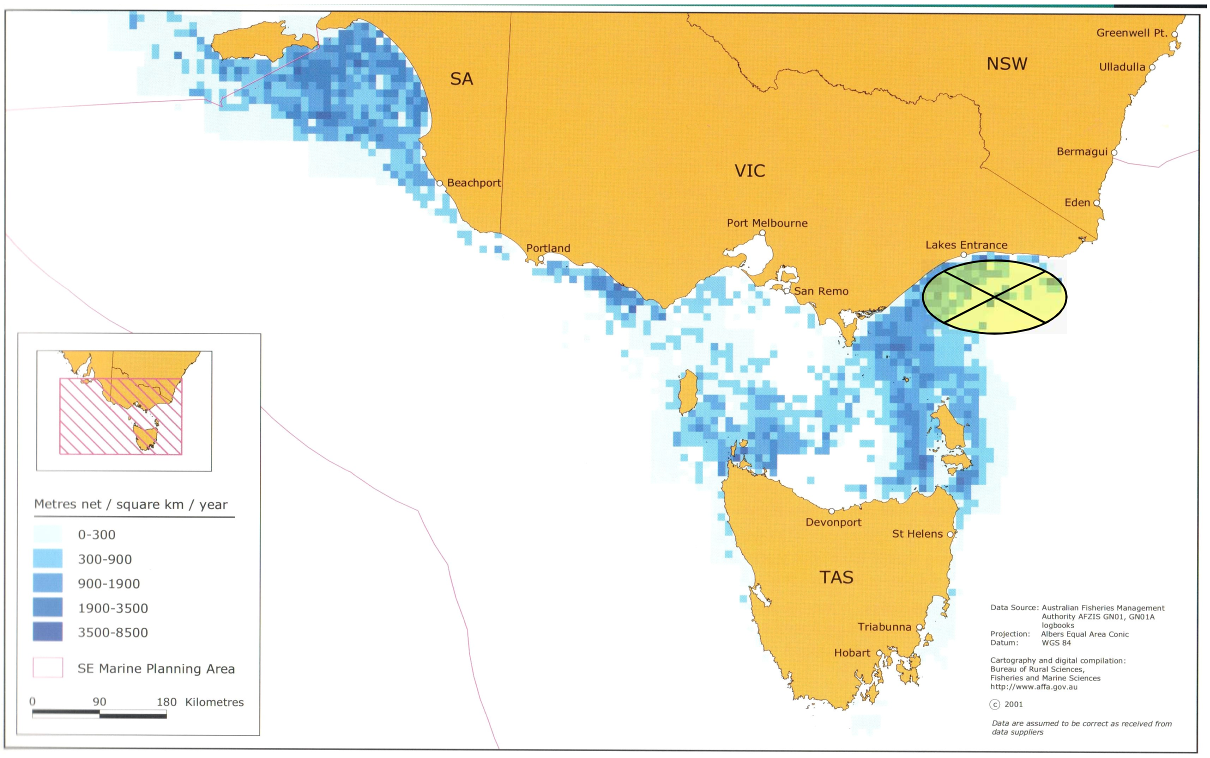


Figure 28. Fishing effort (metre of net/square km/year) of the Commonwealth Gillnet Fishery in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Very approximate location of proposed MSS area shown as yellow balloon.

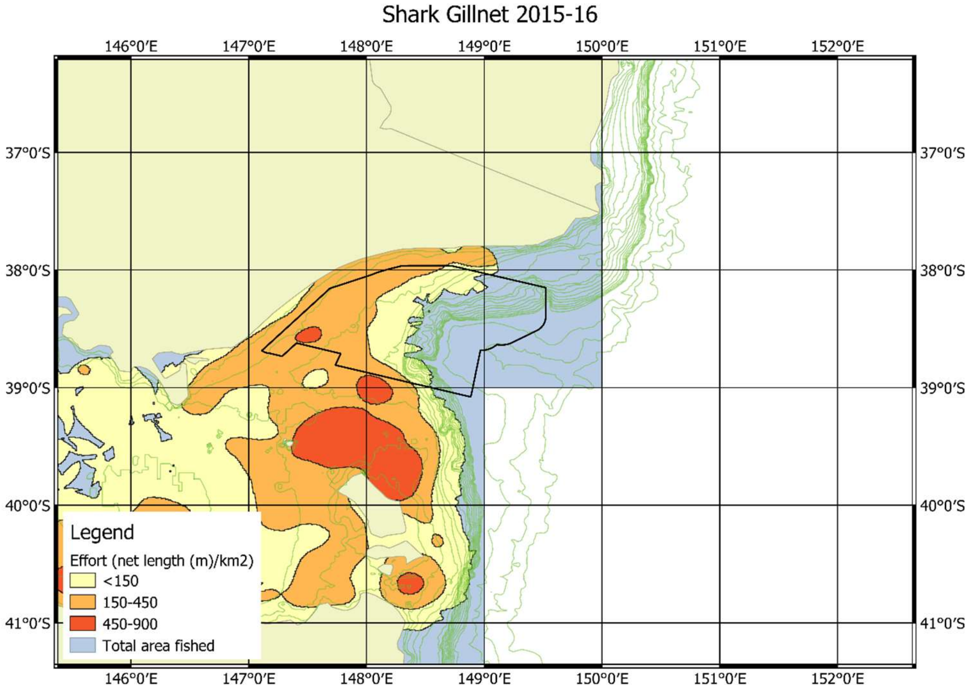


Figure 29. Relative fishing intensity (shots/km^2) by the Shark Gillnet Sector in relation to the proposed MSS area (black polygon) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

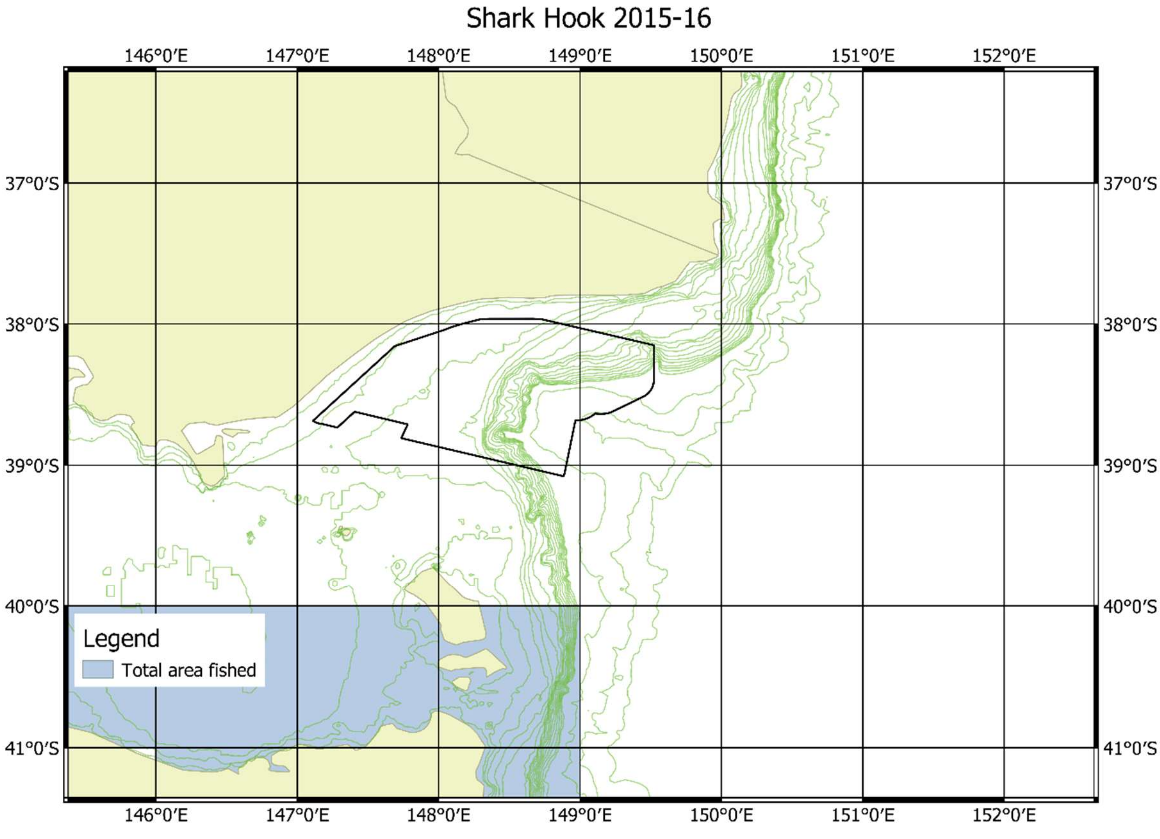


Figure 30. Relative fishing intensity (hooks/km^2) by the Shark Hook Sector in relation to the proposed seismic survey area (black polygon) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

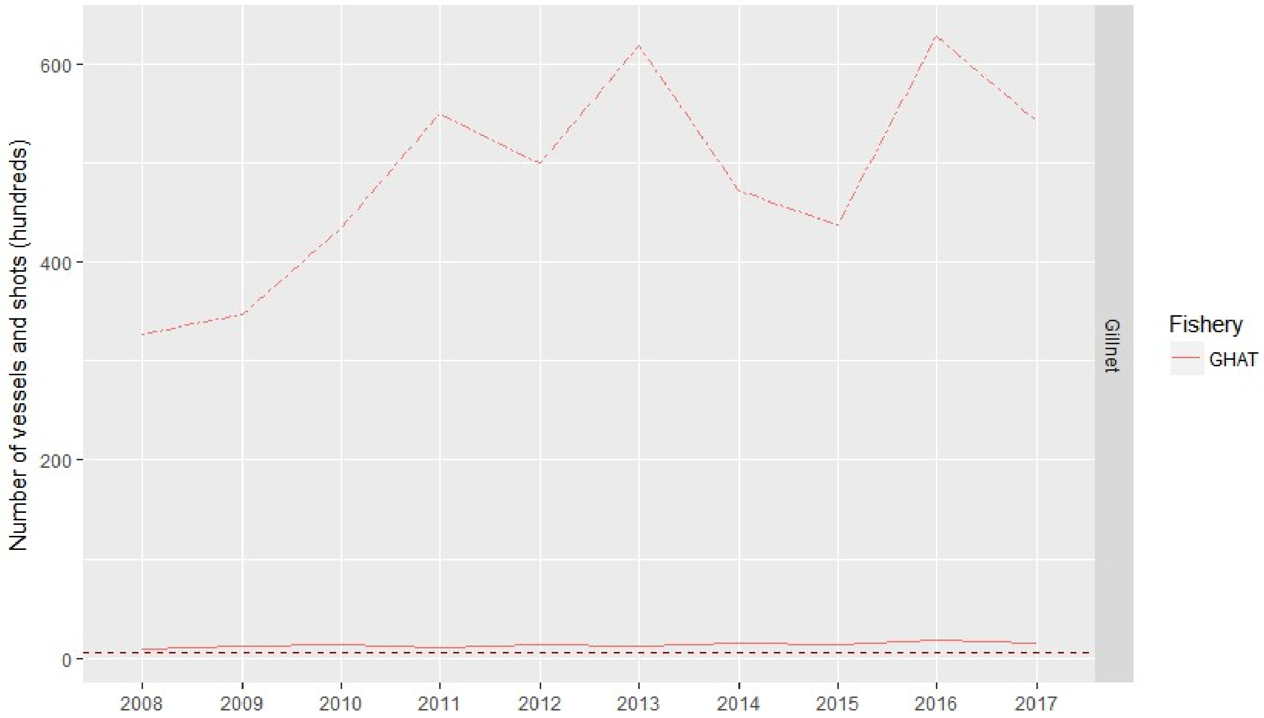


Figure 31. Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) within the area of interest in each year from 2008-17 by the Shark Gillnet sub-sector. Note the minimum number of vessels in any one year was greater than 5. The horizontal red line intercepts the y-axis at 5. Original data source: AFMA.

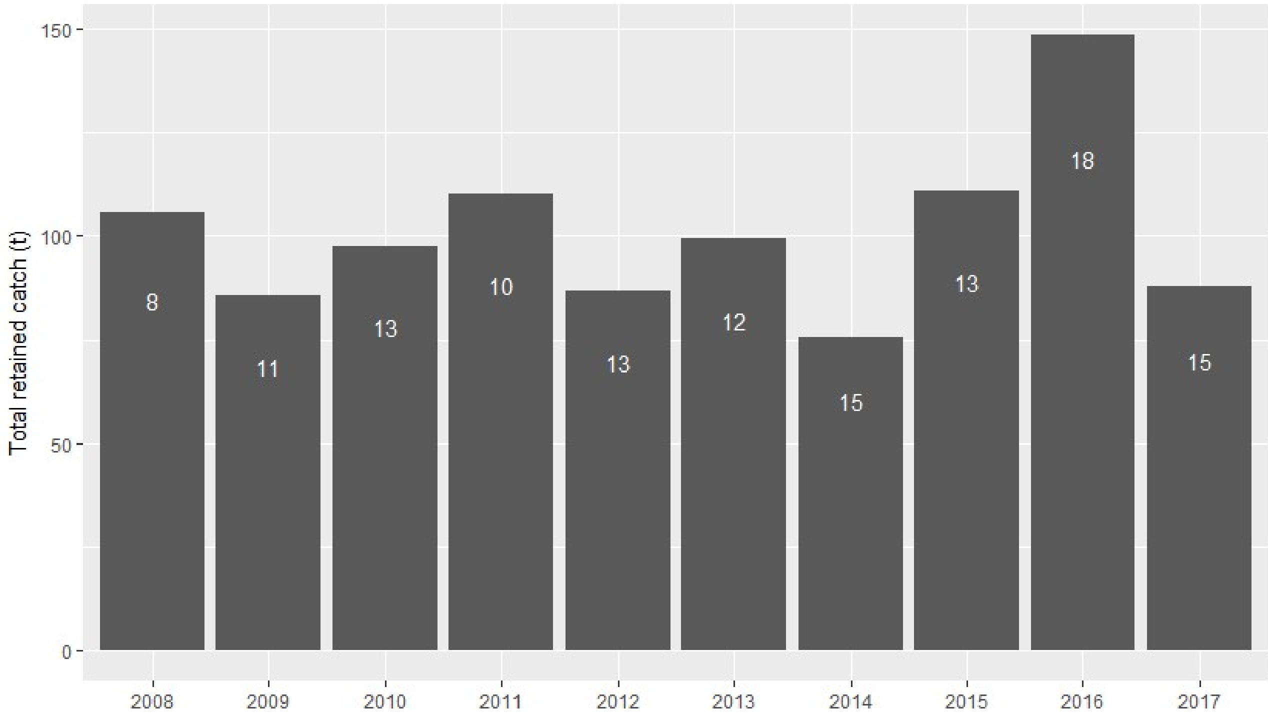


Figure 32. Annual retained catch by the GHAT shark gillnet subsector (top panel) within the area of interest (see Figure 3). Note the minimum number of vessels in any one year was 13. Number of vessels is annotated on bars. Original data source: AFMA.

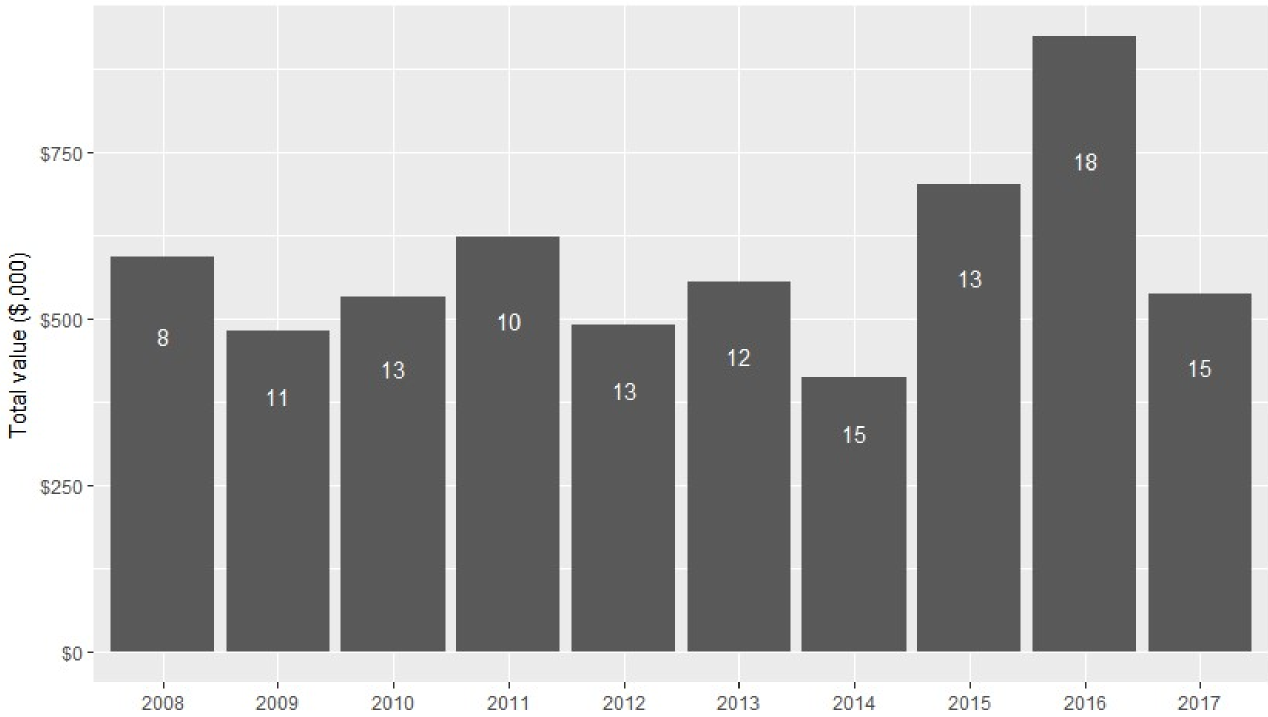


Figure 33. Estimated annual value of fish landed by the GHAT shark gillnet subsector (top panel) within the area of interest (see Figure 3). Note the minimum number of vessels in any one year was 6. Number of vessels is annotated on bars. Original data source: AFMA.

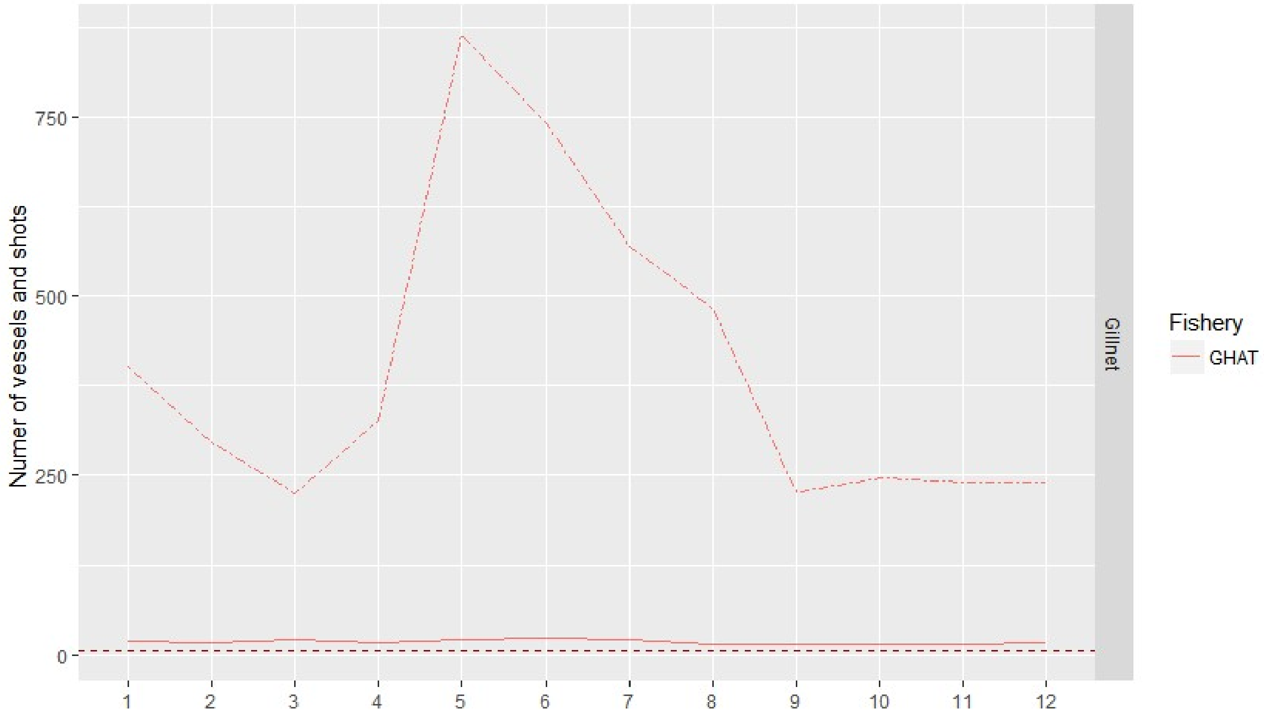


Figure 34. Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) within the area of interest in each year from 2008–17 by the Shark Gillnet subsector. Note the minimum number of vessels in any one year was greater than 5. The horizontal red line intercepts the y-axis at 5. Original data source: AFMA.

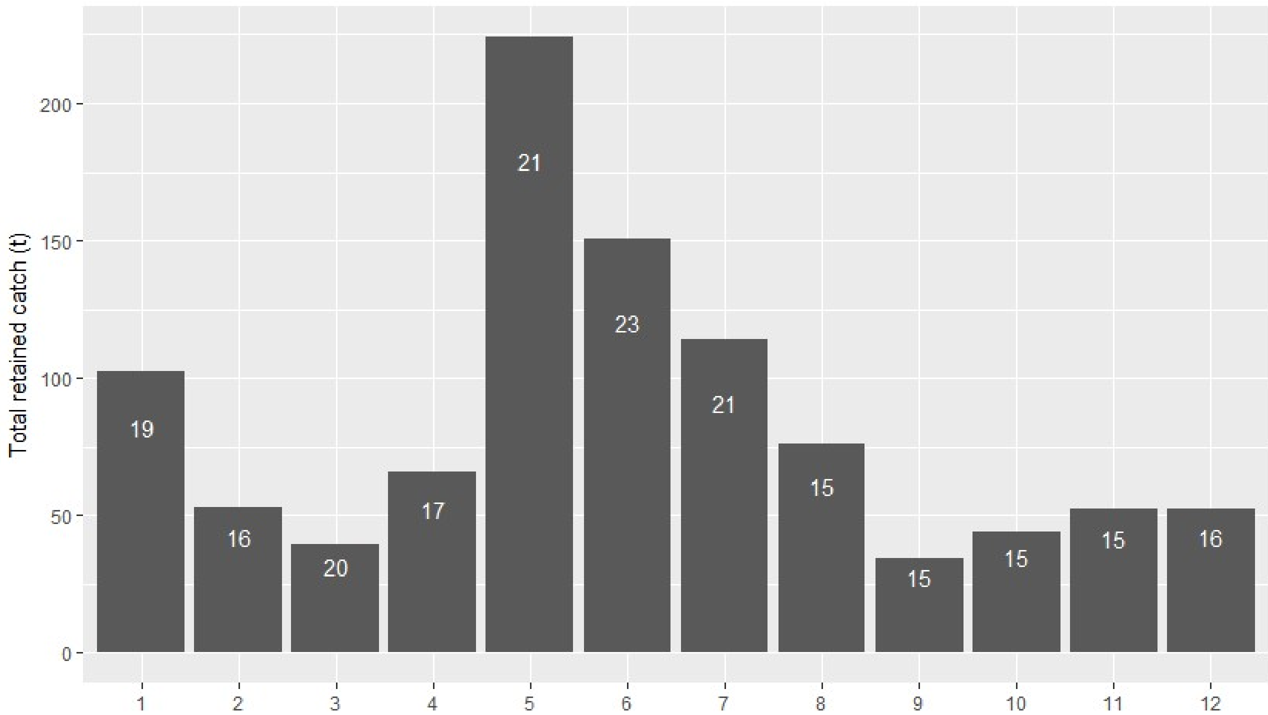


Figure 35. Total monthly (2008–17) retained catch from within the area of intertest by the Shark Gillnet in each month from 2008–17. Note the minimum number of vessels in any one month was >5. Number of vessels is annotated on bars. Original data source: AFMA.

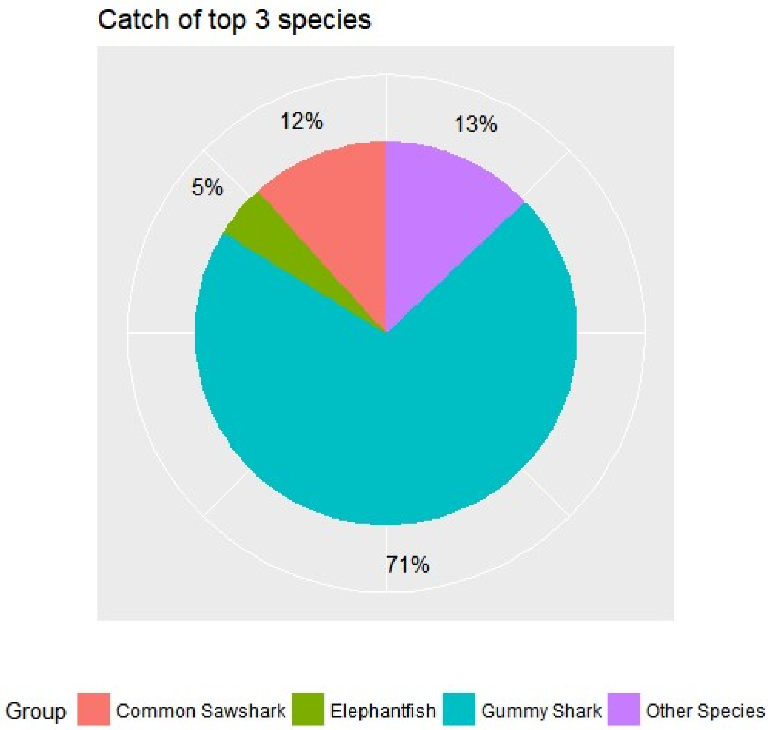


Figure 36. Main species caught by the GHAT (Gillnet) during 2008–2017 within the area of interest. Note the minimum number of vessels in any species was > 5. Original data source: AFMA.

6.4. Scalefish Hook Sector (SHS)

The SHS extends from the South Australian / Western Australian border, around south-east Australia and up the east coast to latitude 24˚29΄54΄΄S (Figure 37). The SHS targets Pink Ling and Blue-eye Trevalla using demersal longlines (including auto-longline) and, the use of auto-longline is restricted to waters deeper than 183 m. The SHS operated in 1 degree boxes that overlap with the MSS area during 2015–16 (Figure 38).

This sector landed about 600 t of fish in 2016, and had a GVP of $4.71 million in 2015–16 (Patterson *et al*, 2017). During 2016–17 there were 17 active SHS vessels operating in the fishery from the 37 boat SFRs allocated (Patterson *et al*, 2017).

Overlap between SHS grounds and the area of the proposed seismic survey area

Because of the small number of operators in this fishery, data were combined with the shark hook sub-sector and reported in section 6.3 Shark Gillnet and Shark Hook Sector (SGSHS) and shown in Table 5.

Likelihood of fishing grounds developing in the future

While there were 20 inactive boat SFRs in the fishery during 2016/17 which potentially harbours considerable latent effort, (Patterson *et al*, 2017), in the 2016/17 season, of the two main target species of the SHS, 100% of the Blue-eye Trevalla and 74% of the Pink Ling TAC was caught. The TACs would likely be a limiting factor in the expansion of effort, and given the low levels of effort recorded in the area of the seismic survey, it is unlikely that there will be a significant increase in fishing effort in that area in the near future.

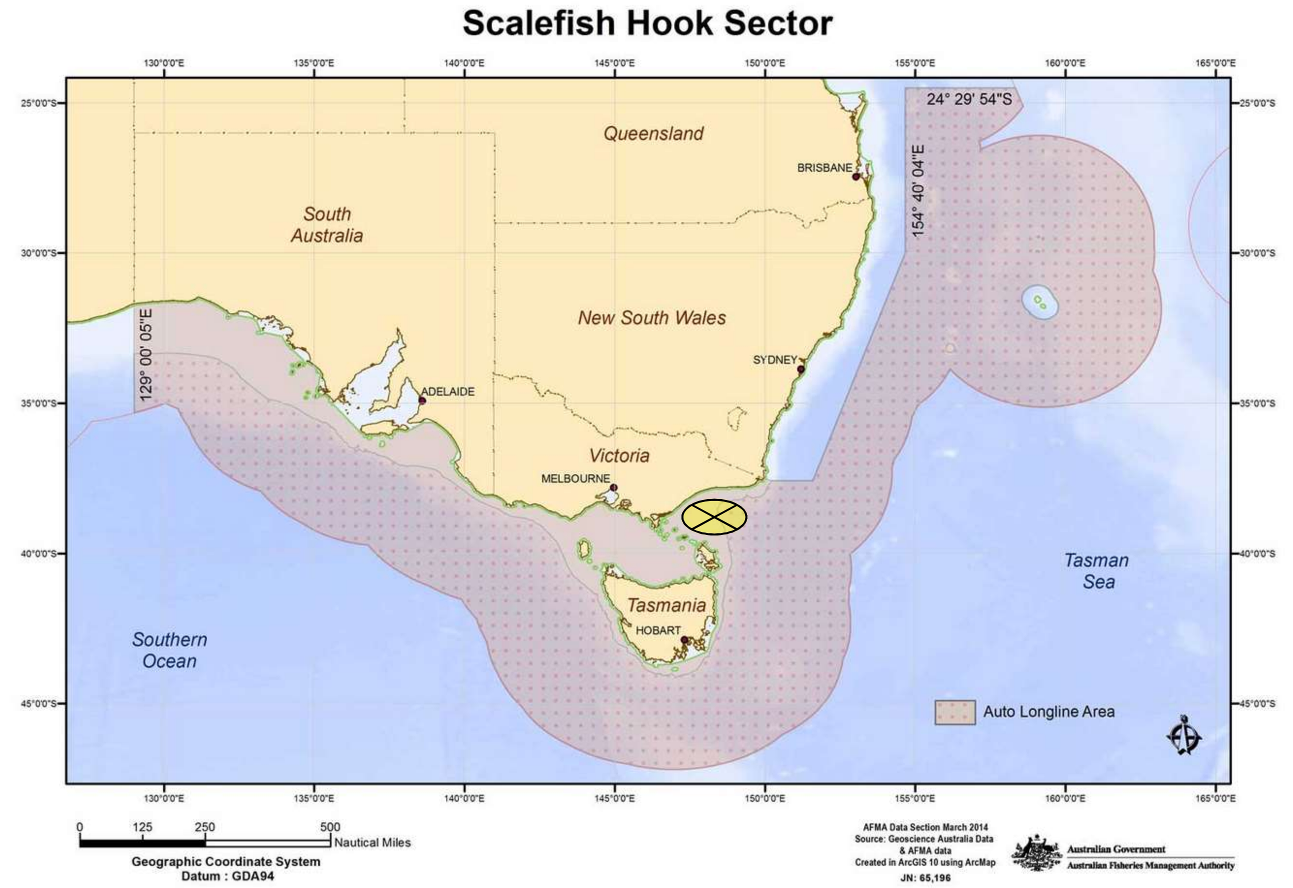


Figure 37 Scalefish Hook Sector (AFMA, 2018a). Approximate location of proposed seismic survey area shown as yellow balloon.

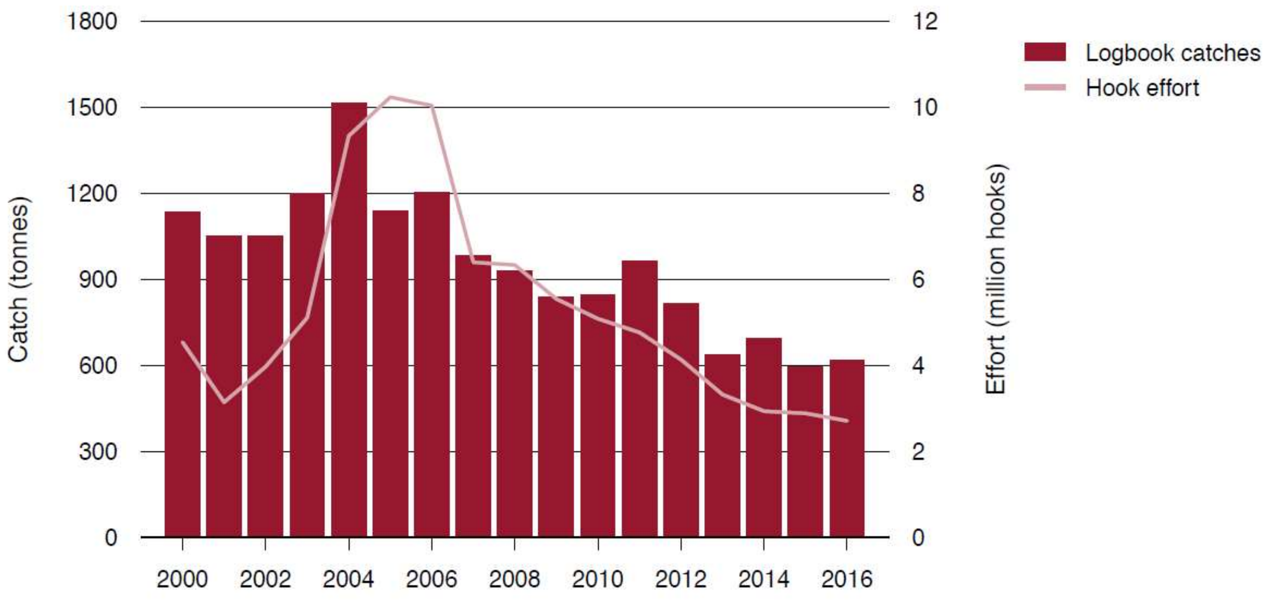


Figure 38. Catch and effort in the SHS 1970–16 (Patterson *et al*, 2017).

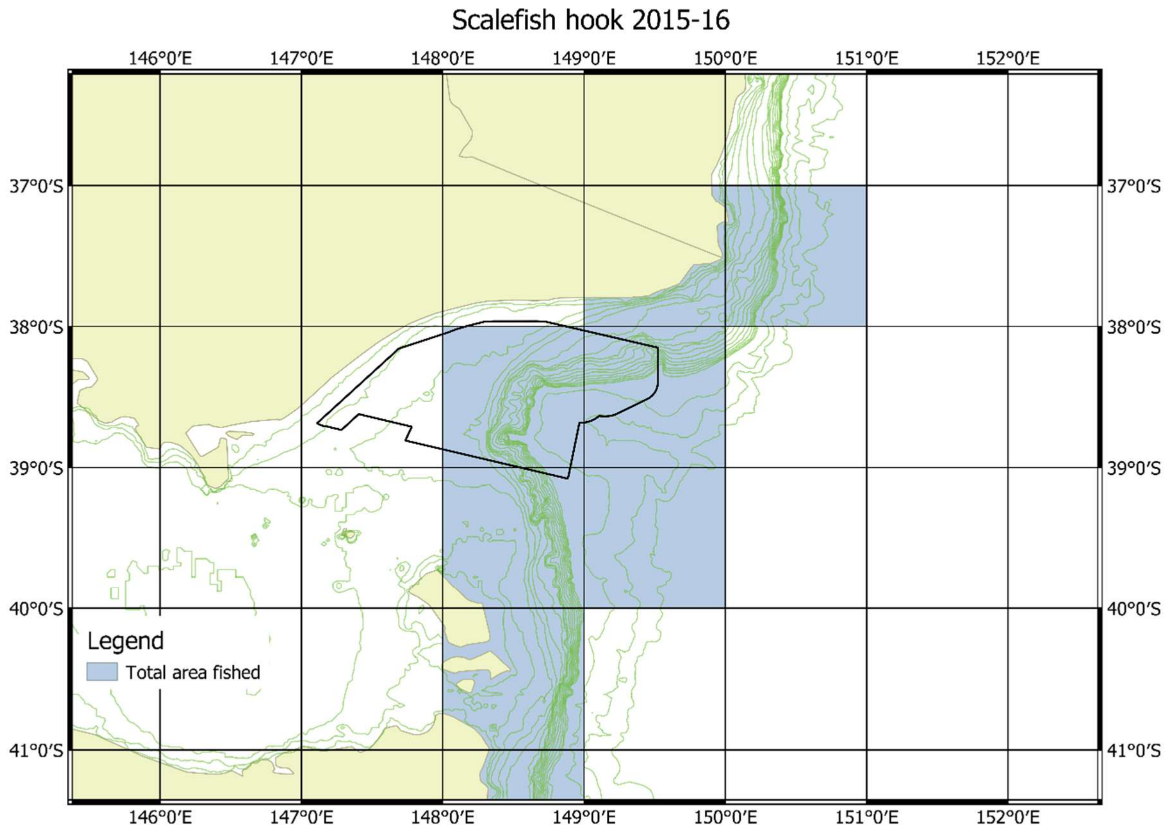


Figure 39. Area fished by the Scalefish Hook Sector in relation to the proposed seismic survey area (black polygon) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

6.5. Bass Strait Central Zone Scallop Fishery (BSCZSF)

The BSCZSF extends out from 20 nm from the coasts of Victoria and Tasmania to the EEZ across the length of the Victorian coast line (Figure 40). In 2006 the fishery was closed for a minimum of three years due to overfishing and was reopened in 2009. The 2009 season opened with a TAC of 2,500 tonnes (plus 150 tonnes for research) for Commercial Scallops (Patterson *et al*, 2017).

The number of scallop boats has dropped dramatically since 2003, from about 154 to only 12 active scallop vessels in 2016 (Patterson *et al*, 2017). Total catch during 2016 was 2,885 t, which had a GVP of $4.6 million (Patterson *et al*, 2017). The BSCZSF fish using towed scallop dredges along muddy to coarse sand substrates (Figure 13).

Overlap between BSCZSF and MSS footprint

There was effort reported from the area of interest during 2008–2017, however any disaggregation would contravene the confidentiality policy. No effort was recorded from the area during 2016 (Figure 41). Scallop fisheries are generally considered "boom and bust" fisheries, and this appears to be the case for the BSCZSF. There have been four "booms" since 1977, with the greatest in 1983 when nearly 25,000 t of Commercial Scallop was landed (Figure 42). Each boom however was followed by a bust. During 2008–2017, 9 different vessels have reported a total of 33 days fishing effort in the area of interest, landing 184 t with a value of about $1.5 million (Table 6).

Likelihood of fishing grounds developing in the future

It is unlikely that this fishery may develop in the near future in the area of interest. A recent survey of Commercial Scallops in the Victorian Scallop Fishery revealed only one moderately dense patch of scallops (Figure 62), and little evidence of recruitment (Koopman *et al*., 2018).

Some parts of the fishery are represented by the Scallop Fishermen's Association of Tasmania.

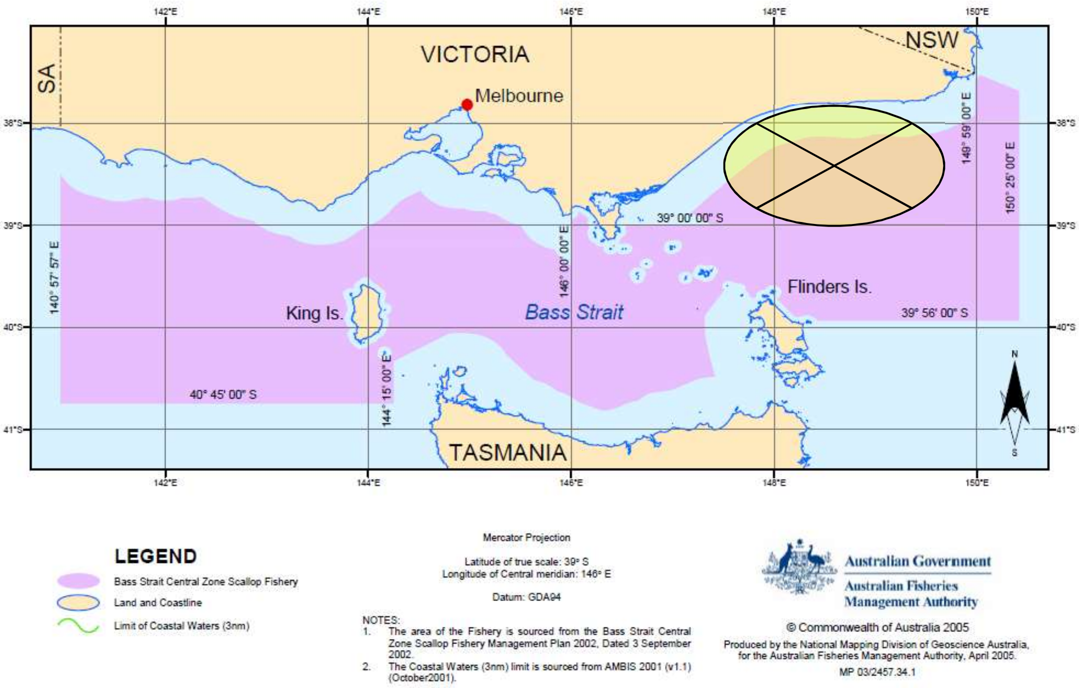


Figure 40 Scallop Zone: Area of the Bass Strait Central Zone Scallop Fishery. (www.afma.gov.au). Location of the seismic survey shown by yellow balloon.

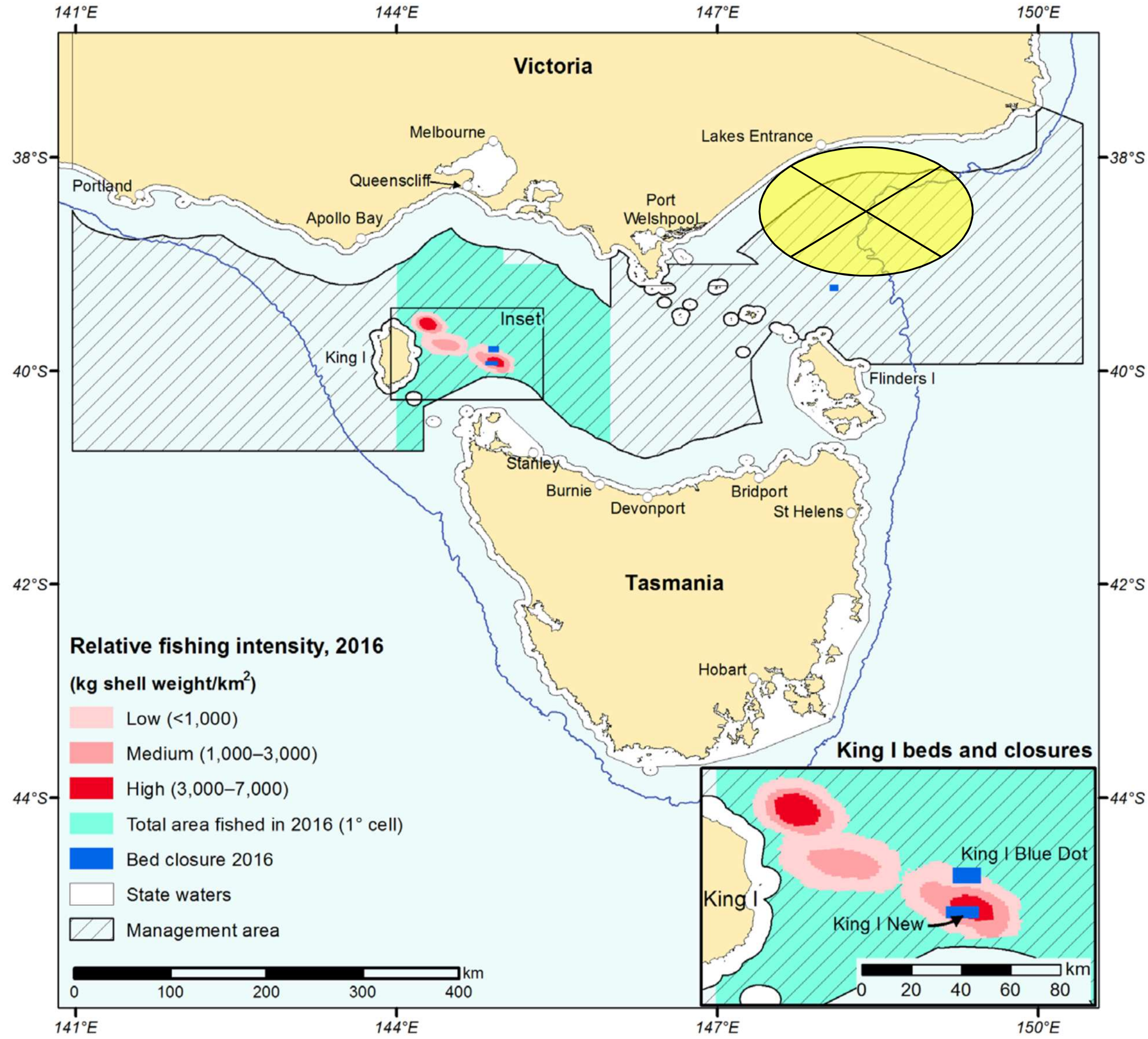


Figure 41 Bass Strait Central Zone Scallop Fishery (Patterson *et al*, 2017). Approximate location of proposed seismic survey area shown as yellow balloon.

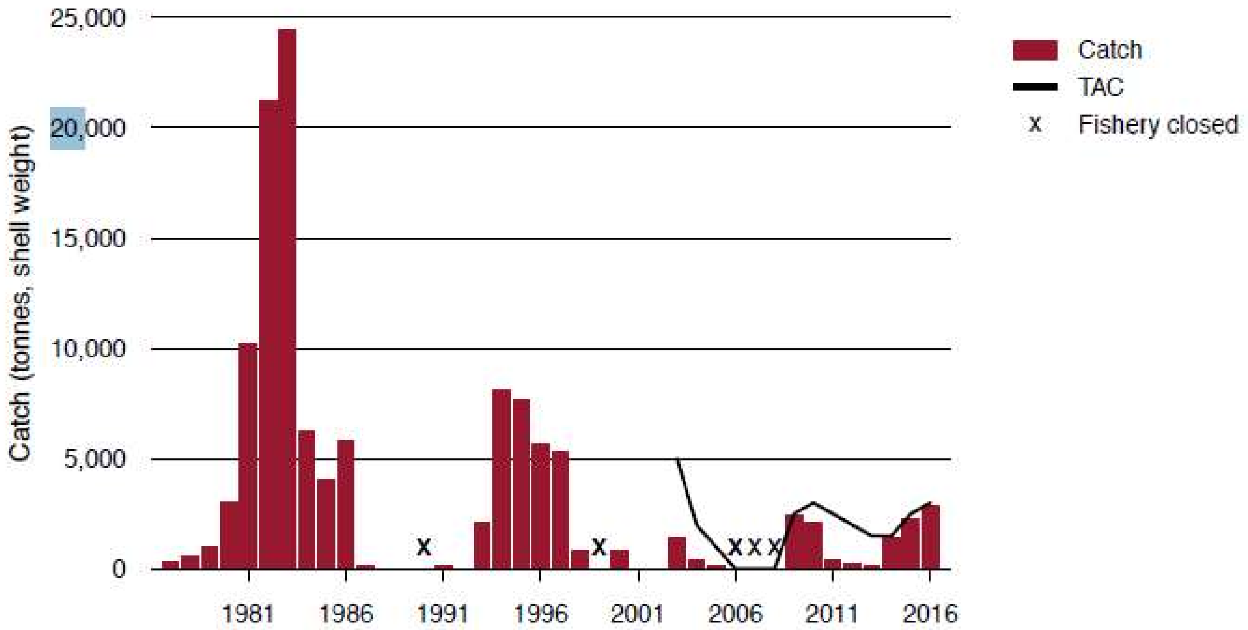


Figure 42. Catch and effort in the BSCZSF 1977–16 (Patterson *et al*, 2017).

Table 6. BSCZSF effort, catch, catch value and main species caught within the AFMA data area. Original data source: AFMA.

Years included	2008–2017
Number of different vessels	9
Total days fished	33
Total catch (t)	184 t
Total value	$1.5 million
Main species caught	Commercial Scallop (100%)
Fishing methods used	Scallop Dredge

6.6. Southern Squid Jig Fishery

The SSJF operates in Commonwealth waters off South Australia, Victoria, Tasmania, New South Wales and parts off Queensland (Figure 43), with most of the fishing effort occurring off the south-east of Australia. This fishery targets a single species — Gould's Squid — using either hand operated or mechanically powered jigs (Patterson *et al*, 2017).

Both fishing effort and the number of vessels participating in the fishery have decline significantly since 1996 (Figure 46). Poor domestic prices and high fuel costs have resulted in many operators choosing to avoid fishing for squid (Wilson *et al*, 2009), and consequently, there were only seven active vessels out of 64 concessions (91% latency) used during 2016 (Patterson *et al*, 2017). Together they landed 384 t of squid with a GVP of $1.03 million (Figure 45).

Overlap between SSJF Grounds and MSS Footprint

High fishing effort was reported in the SSJF during 2016, including high catch in the area of interest (Figure 46). Because of the small number of operators in the fishery, detailed results cannot be presented because they would contravene the privacy policy. In summary, nine different vessels fished in the areas of interest over 94 days during 2008–2017, landing 120 t of squid worth $0.2 million.

Likelihood of fishing grounds developing in the future

The development of this fishery will depend on squid prices and the cost of fishing in Australia. Being short lived, squid are a "boom or bust" fishery, and if environmental conditions are right, fishing effort could increase greatly in a short amount of time.

There is no SSJF Fishery Association.

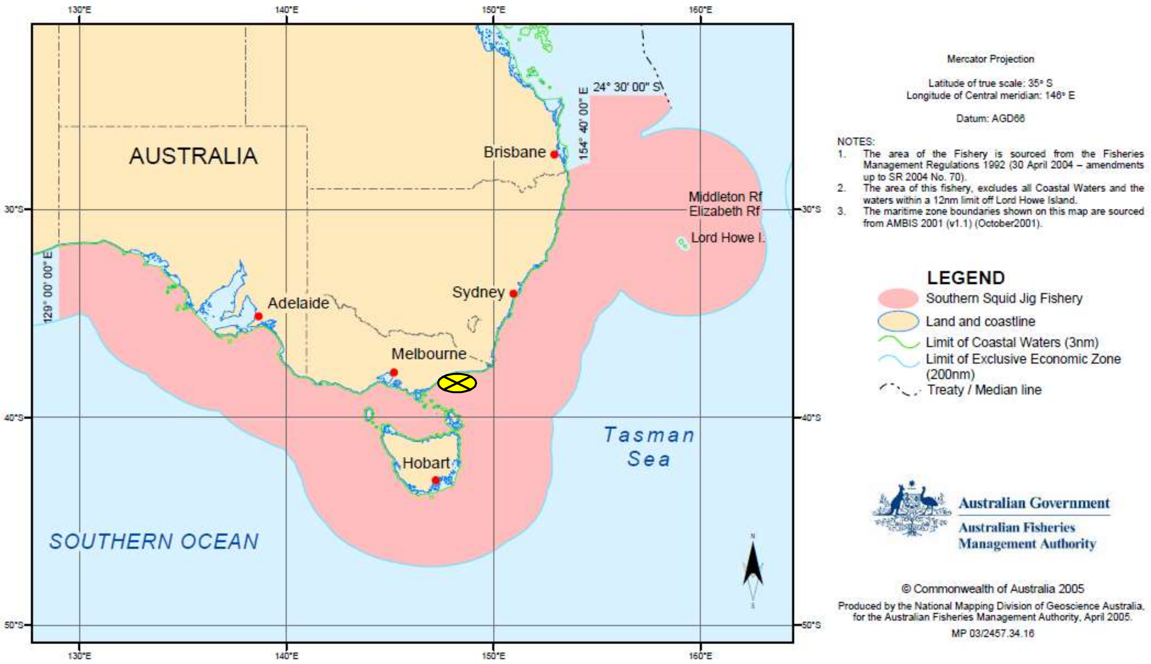


Figure 43 Area of the Southern Squid Jig Fishery (www.afma.gov.au). Very approximate location of seismic survey shown by yellow balloon.

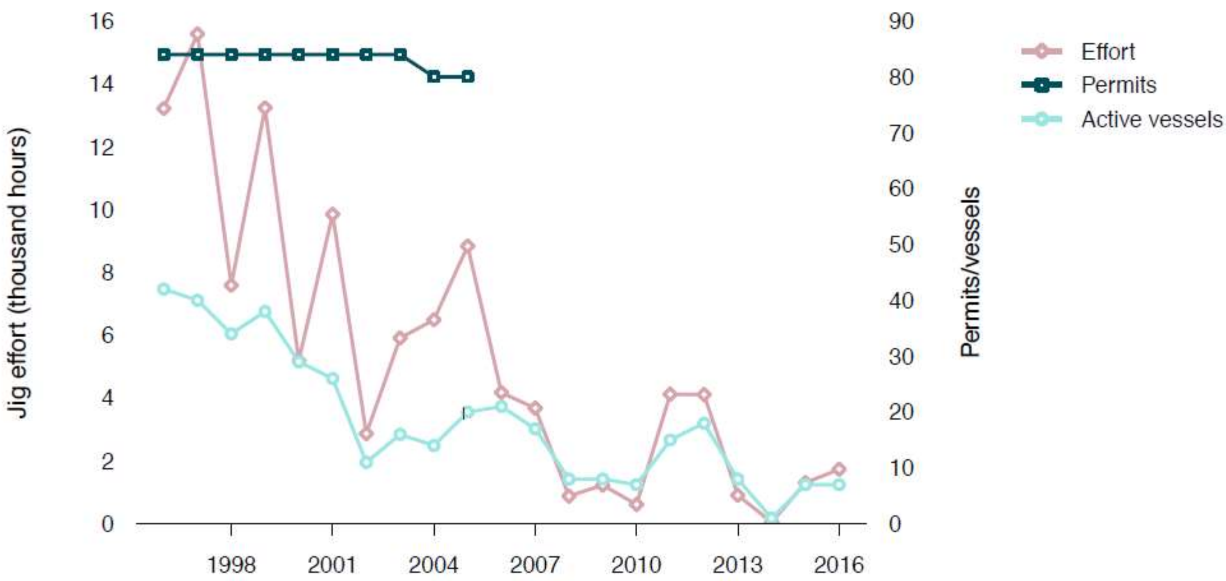
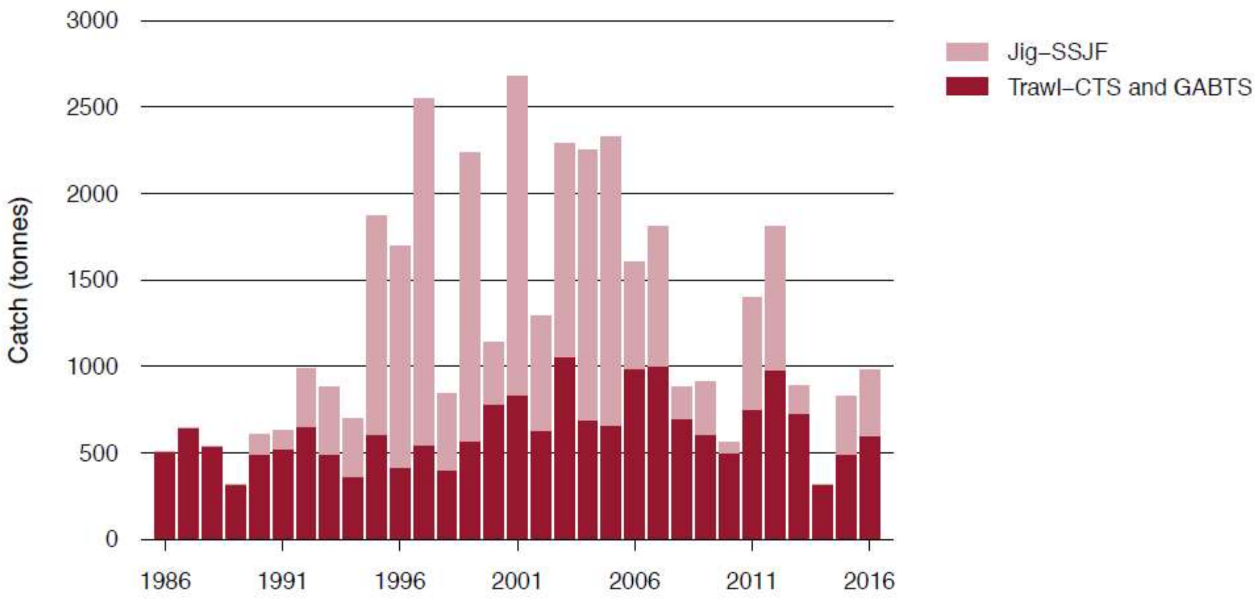


Figure 44 Number of permits, active vessels and fishing effort by the SSJF from 1996–2016 (Patterson *et al*, 2017). Approximate location of proposed seismic survey area shown as yellow balloon.



Notes: CTS Commonwealth Trawl Sector. GABTS Great Australian Bight Trawl Sector.

Figure 45. Catch and effort in the SSJF 1986–16 (Patterson *et al*, 2017).

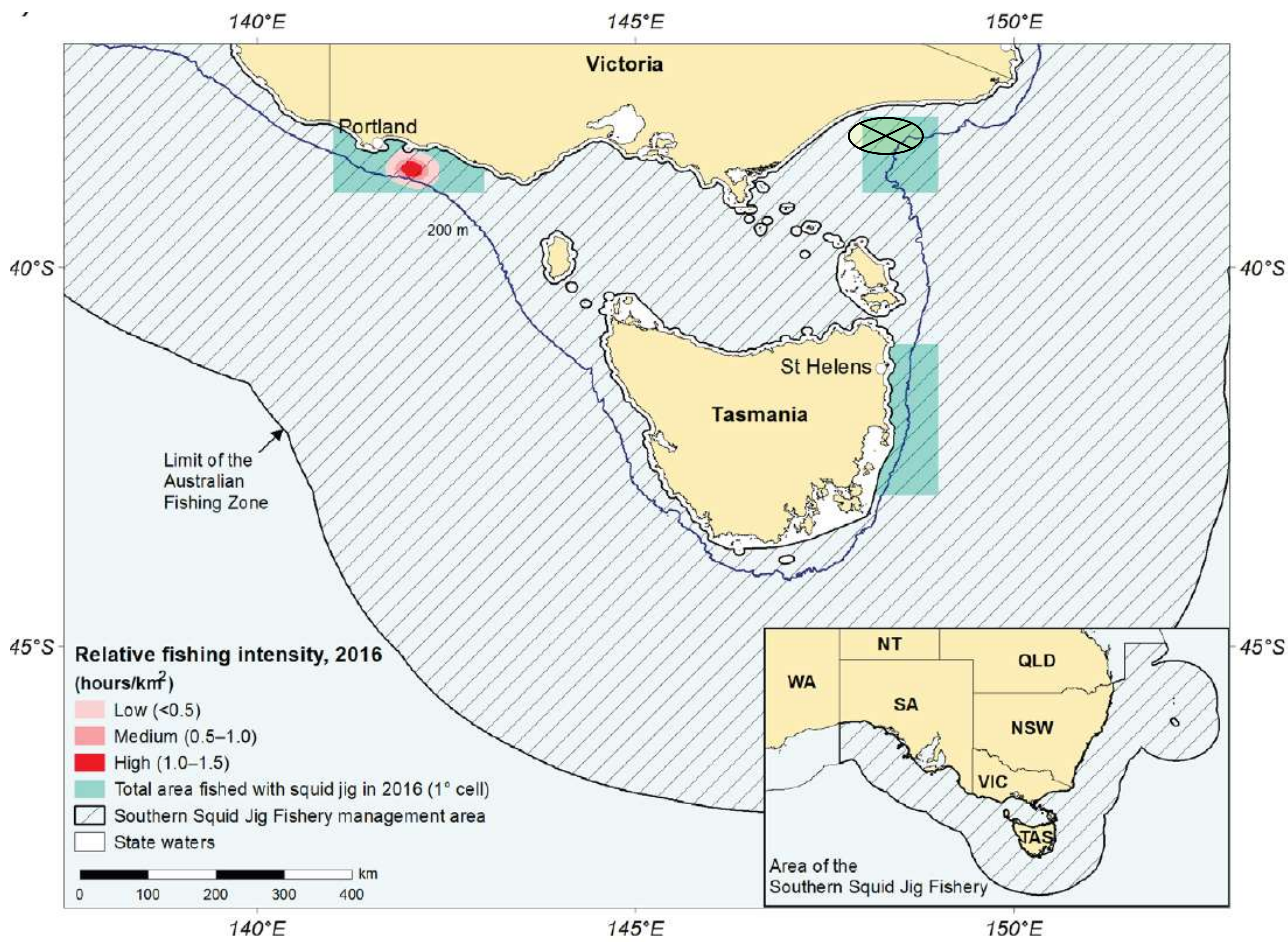


Figure 46 Southern Squid Jig Fishery (Patterson *et al*, 2017). Approximate location of proposed seismic survey area shown as yellow balloon.

Table 7. SSJF effort, catch, catch value and main species caught within the AFMA data area. Original data source: AFMA.

Years included	2008–2017

Number of different vessels	9
Total days fished	94
Total catch (t)	120 t
Total value	$0.2 million
Main species caught	Gould's Squid (100%)
Fishing methods used	Jig

6.7. Small Pelagic Fishery

The SPF operates in Commonwealth waters off southern Western Australia, South Australia, Victoria, Tasmania, New South Wales and parts of Queensland (Figure 47), with most of the historic fishing effort occurring off the east and west coasts of Tasmania (Patterson *et al*, 2017). This fishery targets four species: Australian sardine (*Sardinops sagax*), Blue Mackerel (*Scomber australasicus*), Jack Mackerel (*Trachurus declivis*) and redbait (*Emmelichthys nitidus*). Fishing was historically done using purse seine nets, but this method has largely been replaced by midwater trawling (Patterson *et al*, 2017).

Because of a lack of market and processing facilities, total catch in the SPF decreased from almost 42,000 t in 1986–87 to very low levels during the 2000s. The introduction of a factory trawler into the fishery from 2014–2017 led to increased catches, however the factory trawler has since left the fishery but a smaller vessel is operating out of southern NSW. Of the 32 fishing entities that held quota SFRs in 2016–17, there were only two active purse seine vessels and one midwater trawl vessel (Patterson *et al*, 2017). In that year there was 114 purse seine search hours and 156 midwater trawl shots recorded, together catching about 8,000 t of the 39,170 t TAC (Patterson *et al*, 2017). The value of the catch cannot be reported to protect confidentiality. Recent effort has been focussed off NSW and South Australia (Figure 48).

Overlap between SPF Grounds and MSS Footprint

Less than 5 SPF vessels fished the area of interest during 2008–2017, and so catch, effort and value of the fishery in the area cannot be reported.

Likelihood of fishing grounds developing in the future

The lack of a market and processing facilities have resulted in low effort and catches in the fishery. These increased temporarily with the introduction of factory vessels into the fishery, but the subsequent ban on "super trawlers" (those over 130 m length) and a breakdown of commercial terms between a vessel and quota owner saw it leave the fishery. Give the experience of factory trawlers in the SPF, it is unlikely that there will be re-investment in this area in the near future.

The SPF fishery is represented by the Small Pelagic Fishing Industry Association whose contact is listed in Table 11.

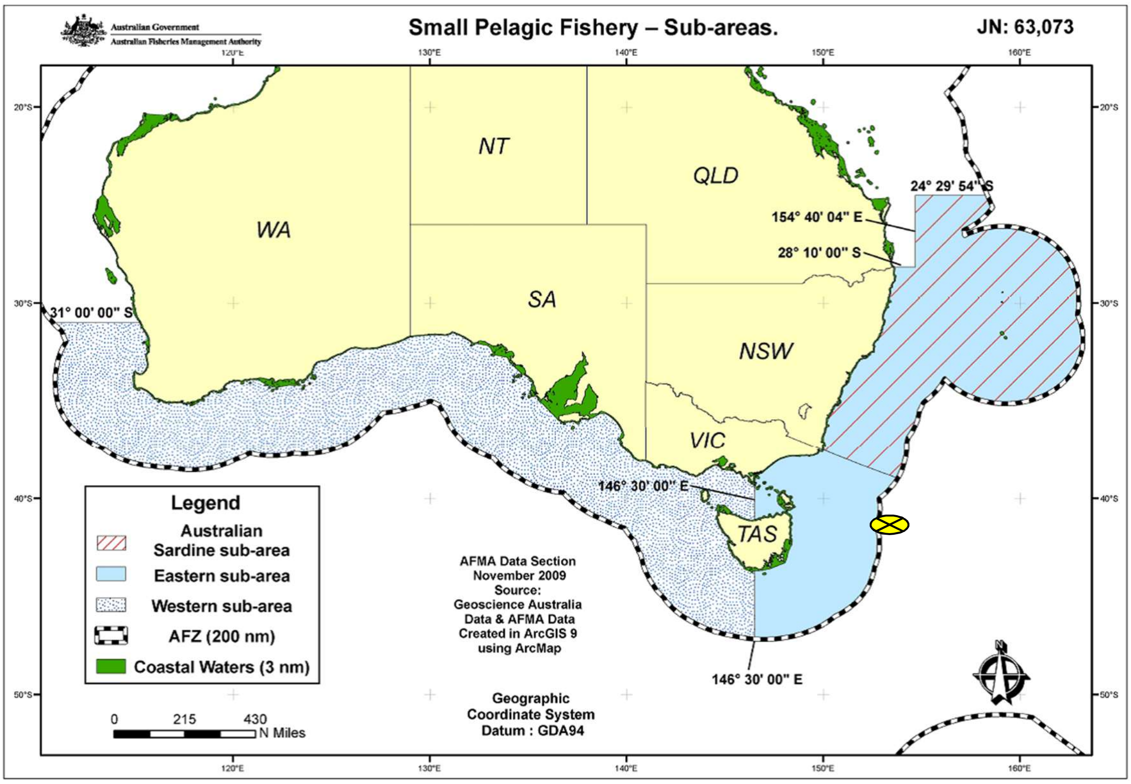


Figure 47 Area of the Small Pelagic Fishery (www.afma.gov.au). Very approximate location of seismic survey shown by yellow balloon.

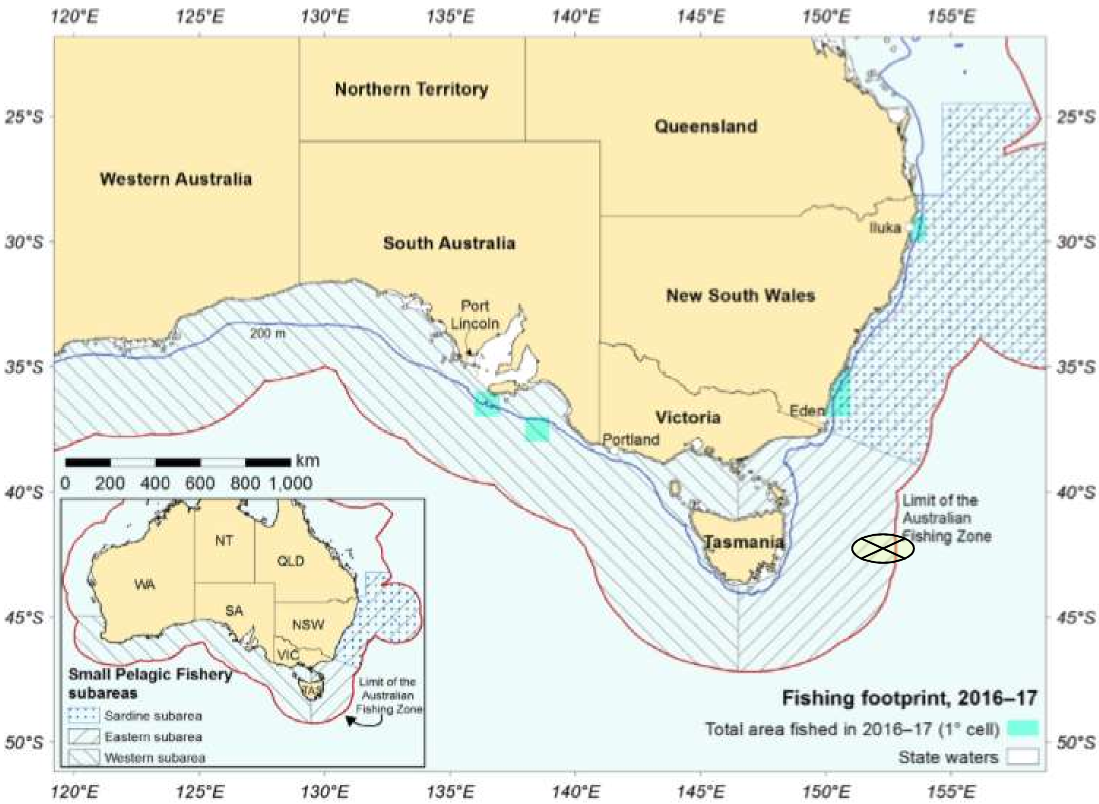


Figure 48. Small Pelagic Fishery (Patterson *et al*, 2017). Approximate location of proposed seismic survey area shown as yellow balloon.

6.8. Eastern Tuna and Billfish Fishery

The ETBF operates in the Exclusive Economic Zone across eastern Australia from Cape York to the South Australian–Victorian border (Figure 49), and on the high seas of the Pacific Ocean (Patterson *et al*, 2017). Most catch is taken using pelagic longlines, but minor-line methods are used in the fishery. Main species targeted are Albacore (*Thunnus alalunga*), Yellowfin Tuna (*Thunnus albacares*), Swordfish (*Xiphias gladius*), Bigeye Tuna (*Thunnus obesus*) and Striped Marlin (*Kajikia audax*).

Total catch by the fishery peaked in 2002 at more than 8,000 t, but fell to 4,200 t in 2013 before increasing to more than 6,000 t in 2016 (Figure 50) (Patterson *et al*, 2017). The 2016 catch was dominated by Yellowfin Tuna, Swordfish and Albacore. Effort and active vessels have declined since the late 1990s, and the number of longline boat SFRs approximately halved after the structural adjustment package in 1996 (Figure 51). There are 86 longline boat SFRs and 93 minor-line boat SFRs in the fishery, and in 2016, only 37 longline boat and 2 minor-line boat SFRs were active (Patterson *et al*, 2017). From 7.82 million hooks set in 2016, 5,139 t of fish was landed with a value of $47.1 million (Patterson *et al*, 2017). Most of the recent effort has been focussed off NSW and southern Queensland (Figure 52).

Overlap between SPF Grounds and MSS Footprint

Less than 5 ETBF vessels fished the area of interest during 2008–2017, and so catch, effort and value of the fishery in the area cannot be reported

Likelihood of fishing grounds developing in the future

The ETBF has traditionally focussed on waters further north than the MSS because that is the preferred habitat of the target species. Effort has decreased since the early 2000s, however catch remained relatively high, and has increased in recent years. Biomasses of the main species (except Bigeye Tuna) have been assessed as “not overfished” (Patterson *et al*, 2017). It is unlikely that the ETBF effort will increase in the MSS area in the near future, however increases in water temperature in the area due to climate change may result in a southward movement of pelagic fish stocks that could see a southward movement of fishing effort in the longer term.

The ETBF is represented by Tuna Australia whose contact is listed in Table 11.

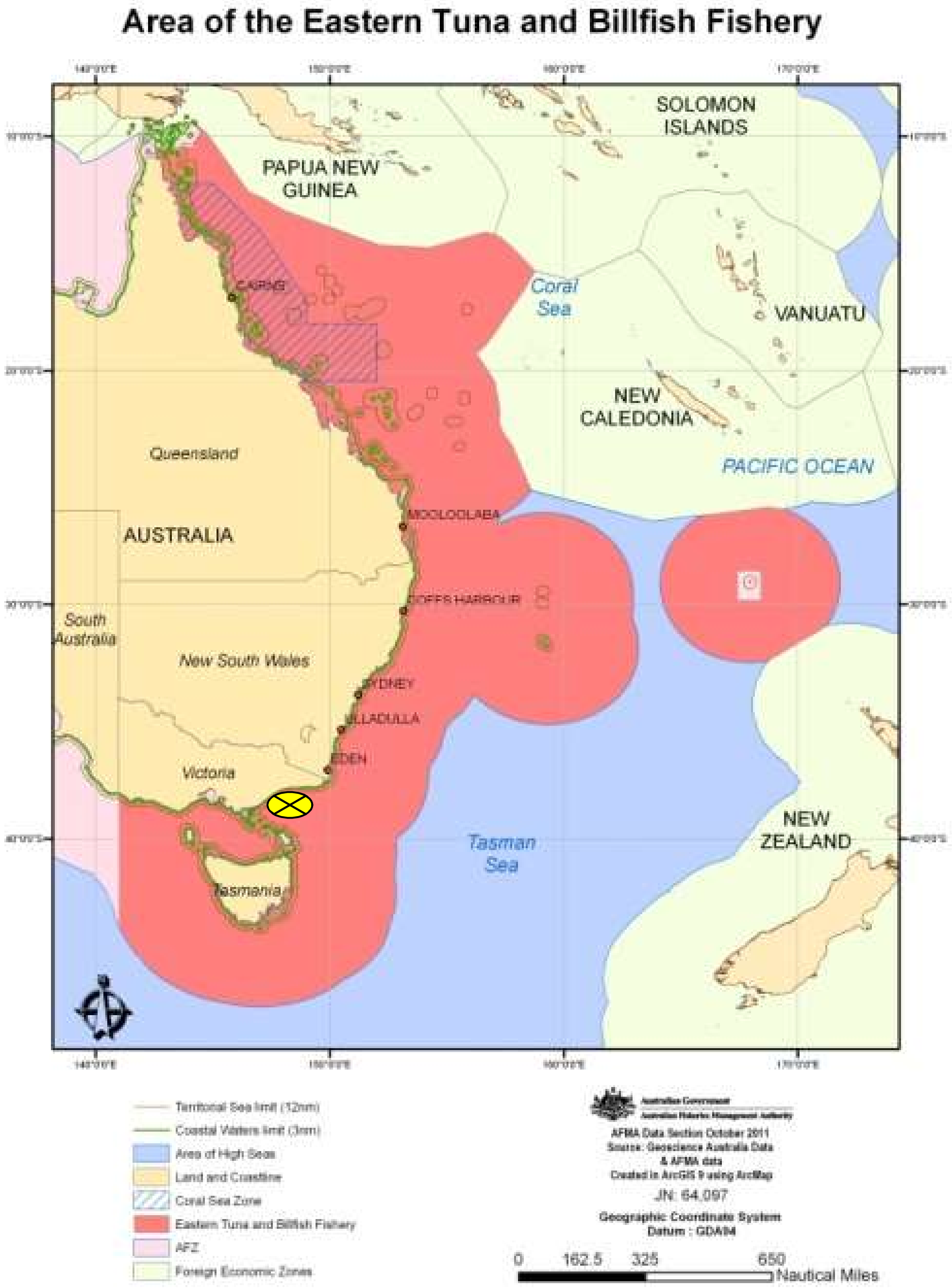


Figure 49 Area of the Eastern Tuna and Billfish Fishery (www.afma.gov.au). Very approximate location of seismic survey shown by yellow balloon.

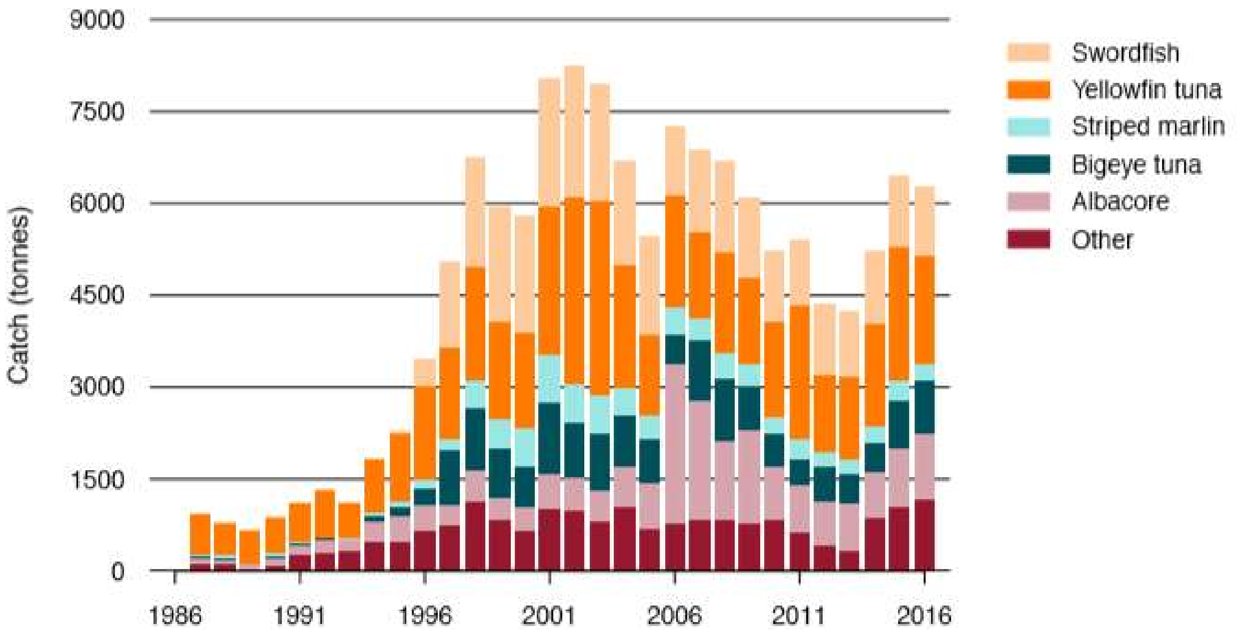
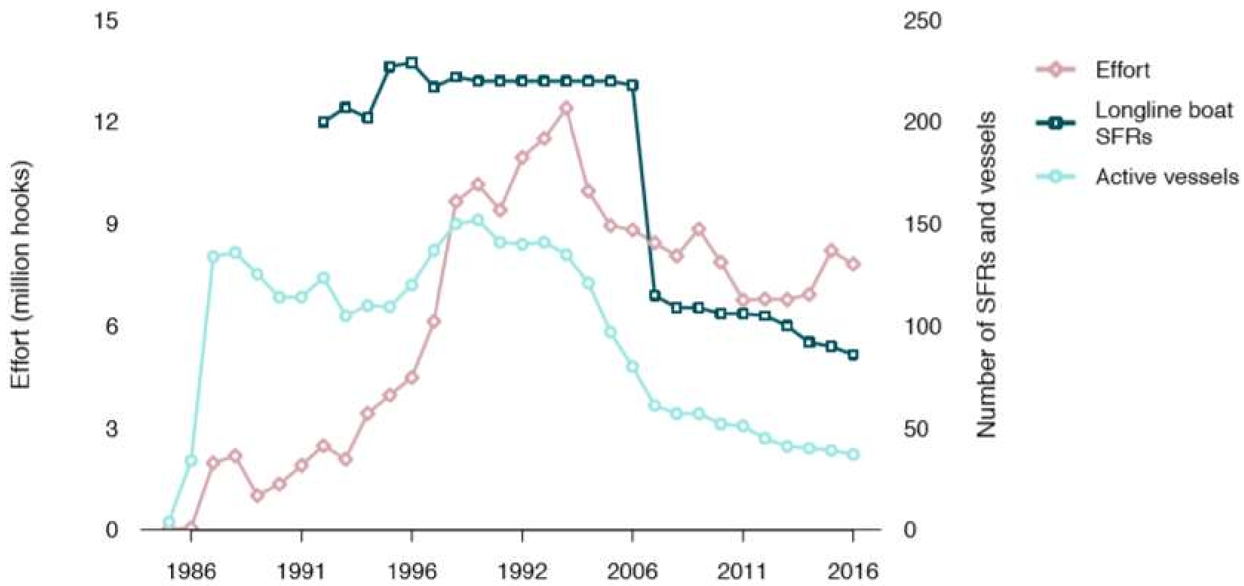


Figure 50. Catch in the ETBF from 1986–16 by species (Patterson *et al*, 2017).



Note: SFR Statutory fishing right.

Figure 51. Effort, number of SFRs and active vessels in the ETBF from 1986–16 (Patterson *et al*, 2017).

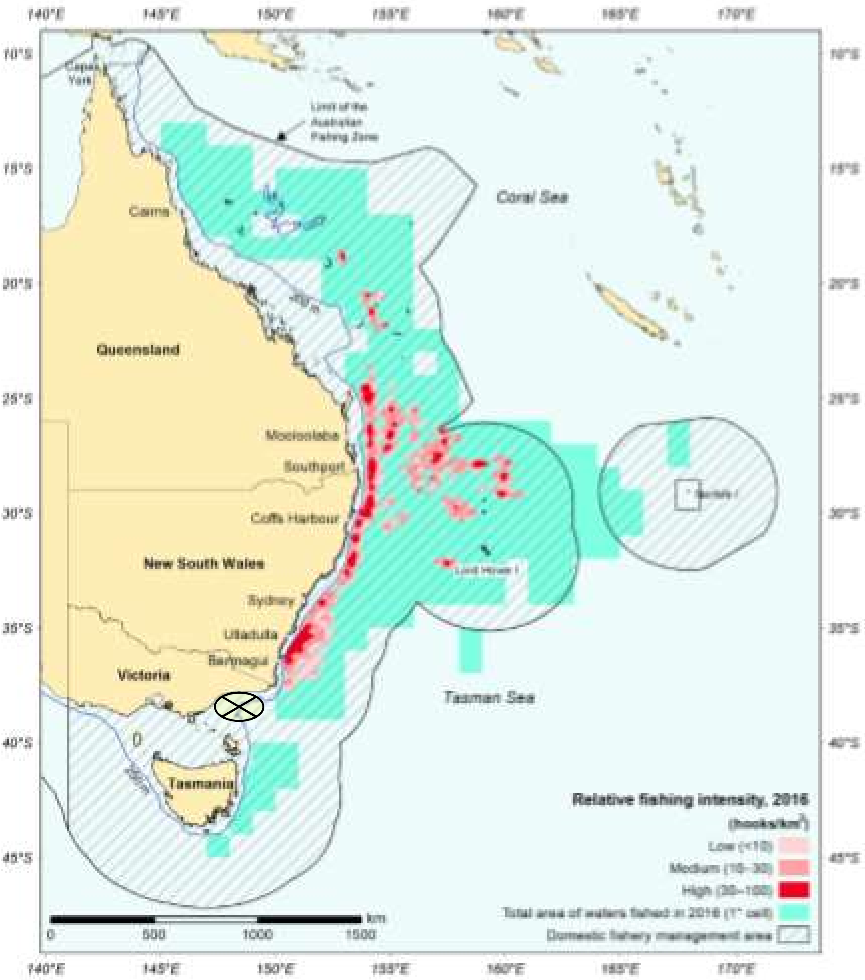


Figure 52. Eastern Tuna and Billfish Fishery (Patterson *et al*, 2017). Approximate location of proposed seismic survey area shown as yellow balloon.

6.9. Victorian Rock Lobster Fishery

The Victorian Rock Lobster Fishery is separated into two management zones at longitude 143° 40'E, with the MSS being in the Eastern Zone (Figure 53). Because of the small number of operators that fish the Eastern Zone, catch and effort data are broadly aggregated to conform with the Victorian Fisheries Authority's confidentiality policy.

The area of the Victorian Rock Lobster Fishery extends along the Victorian coast, out into Commonwealth waters (>3 nm offshore). The fishery targets Southern Rock Lobster (*Jasus edwardsii*), and is managed through both input and output controls, with limited entry, gear restrictions, effort limits and a Total Allowable Commercial Catch (TACC – The TACC for the Eastern Zone was 59 t in 2016–17 (Victorian Fisheries Authority, 2017). Baited pots are used to target lobster over reef substrate on coastal reefs to depths of 200 metres (Department of Environment and Heritage, 2004). The fishing season is open from 16 November to 14 September each year. Catches in the Eastern Zone have ranged between 41–149 t since 1982–83 (Victorian Fisheries Authority, 2017). During 2016–17, a total of 53 t of Southern Rock Lobster was landed from the Eastern Zone with a value of $4.3 million (Victorian Fisheries Authority, 2017). In comparison, 209 t was landed from the Western Zone. Effort during 2016/17 in the Eastern Zone was highest in August and December (19,000 and 20,000 pot-lifts), and apart from the closed season, effort was lowest during May (5,000 pot-lifts) (Figure 54). Catch largely followed a similar seasonal cycle to effort during 2016/17, with the highest catches in December, January and August.

As of September 2017, there were 36 Fishery Access Licences in the Eastern Zone (Victorian Fisheries Authority, 2017).

Overlap between Victorian Rock Lobster Fishery and the MSS area

Historical fishing effort by the Victorian Rock Lobster Fishery shows very little effort in the area of the proposed seismic survey, with every cell masked to protect confidentiality (Figure 55). Detailed catch and effort data was not provided by the Victorian Fisheries Authority to maintain confidentiality. In total from the fishing grids in the area of the MSS, 104 fishing days were reported during 2007/08 to 2016/17, with most of that from grid rows C and F (Figure 4, Figure 57 and Table 8). The small number of operators did not allow the catch by the fishery to be reported separately, however effort was recorded from reporting grid rows B, C, D, E, F, G and H (Table 8). Over all species caught in the overlapping grids from 2007/08 to 2016/17, 10,254 t was caught by the Rock Lobster, Ocean General, Ocean Purse Seine, Ocean Scallop, and Trawl (Inshore) fisheries (Figure 56). Anecdotally, less than 10% of the Eastern Zone TACC is caught from within the MSS area (Wayne Dredge, pers. comm.)

Likelihood of fishing grounds developing in the future

The TACC for the Victorian Rock Lobster Fishery in the Eastern Zone has decreased from 66 t in 2011–12 to 48 t in 2012–13 and up to 59 t in 2016/17 (Victorian Fisheries Authority, 2017). Given the relatively low catches coming from the Eastern Zone, the low level of effort from the MSS area, and the steady TACC, it is unlikely that effort by the Victorian Rock Lobster Fishery in the area will increase greatly in the near future.

The Victorian Rock Lobster Association and SIV represent Victorian Rock Lobster Fishery. Contact details for this industry association are provided in Table 10.

Figure 53. Extent of the Victorian Rock Lobster Fishery showing eastern and western zones. From Victorian Fisheries Authority (2018a).

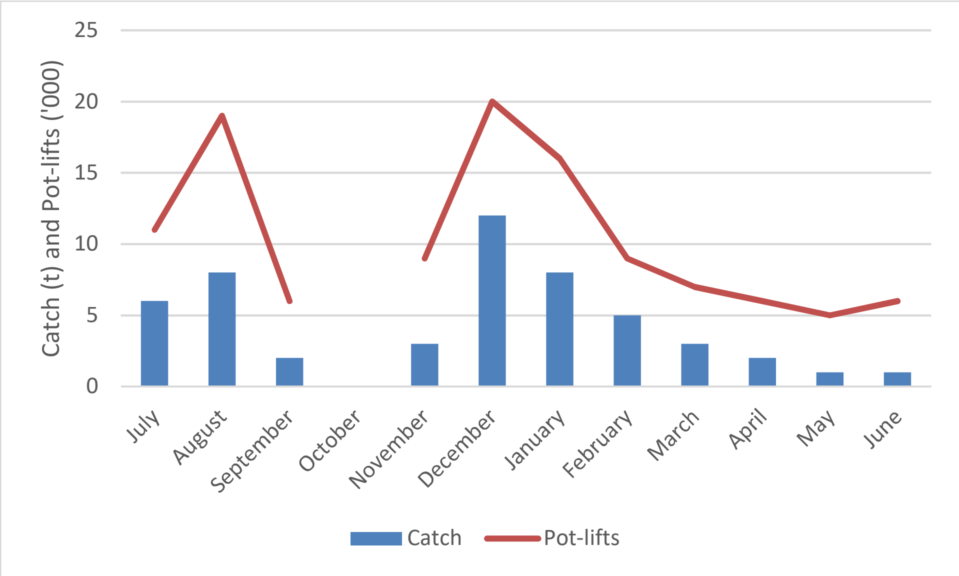


Figure 54. Catch (t) and number of pot-lifts ('000) in the Eastern Zone of the Victorian Rock Lobster Fishery for 2016-17. From Victorian Fisheries Authority (2018a).

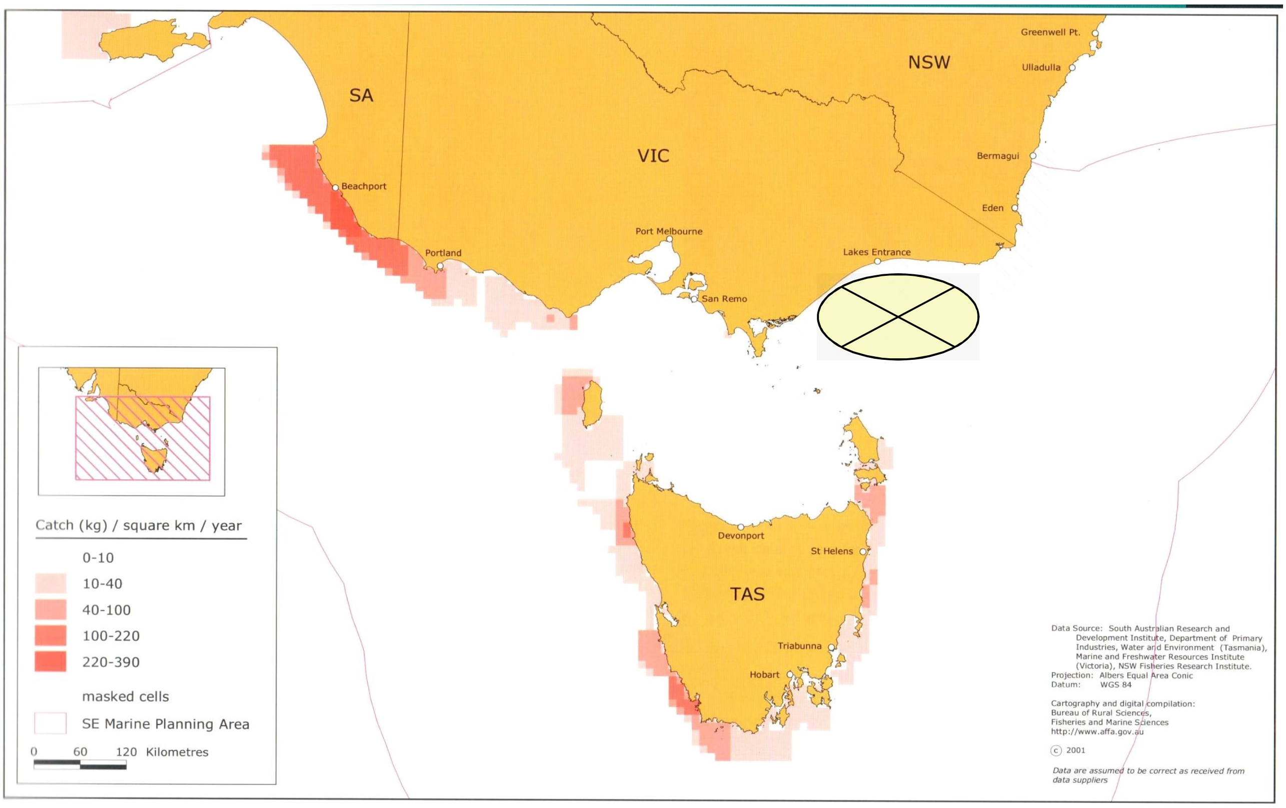


Figure 55 Catch rate (kg/square km/year) in the combined (Victorian and Tasmanian) Rock Lobster fisheries in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed seismic survey shown by yellow balloon. Note that we have unsuccessfully attempted to obtain higher quality images of historical catch rate.

Table 8. Summary of catch and effort by the Rock Lobster fishery and all other fisheries combined from reporting block rows that intersect with the MSS area from 2008–2017.

Block	Catch (t)	Number of unique years	Effort Rock Lobster	Effort Other Fisheries	Fisheries
C	3211	10	48	673	Ocean, Ocean Purse Seine, Ocean Scallop, Rock Lobster, Trawl (Inshore)
D	2290	10	14	277	Ocean, Ocean Purse Seine, Ocean Scallop, Rock Lobster, Trawl (Inshore)
E	1540	8	3	94	Ocean, Ocean Purse Seine, Ocean Scallop, Rock Lobster, Trawl (Inshore)
F	2159	9	22	421	Ocean, Ocean Purse Seine, Ocean Scallop, Rock Lobster.
G	1027	10	16	200	Ocean, Ocean Purse Seine, Ocean Scallop, Rock Lobster, Trawl (Inshore).
H	27	5	1	19	Ocean, Ocean Scallop, Rock Lobster, Trawl (Inshore)
J	id	3	0	5	Ocean, Ocean Purse Seine
K	0		0	0	
Total	10,254		104	1,689	

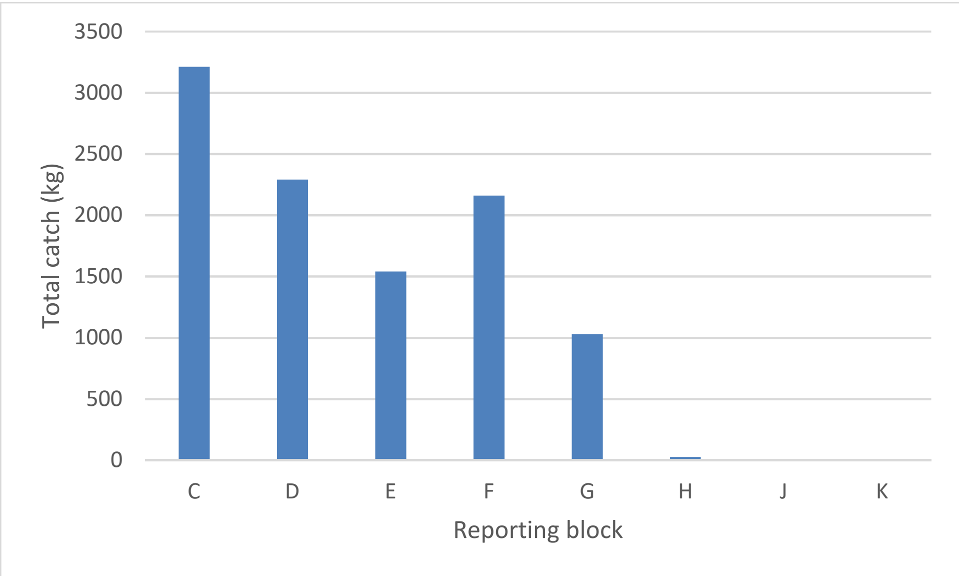


Figure 56. Total catch (t) of all species by reporting block rows that intersect with the MSS area form from 2008–2017.

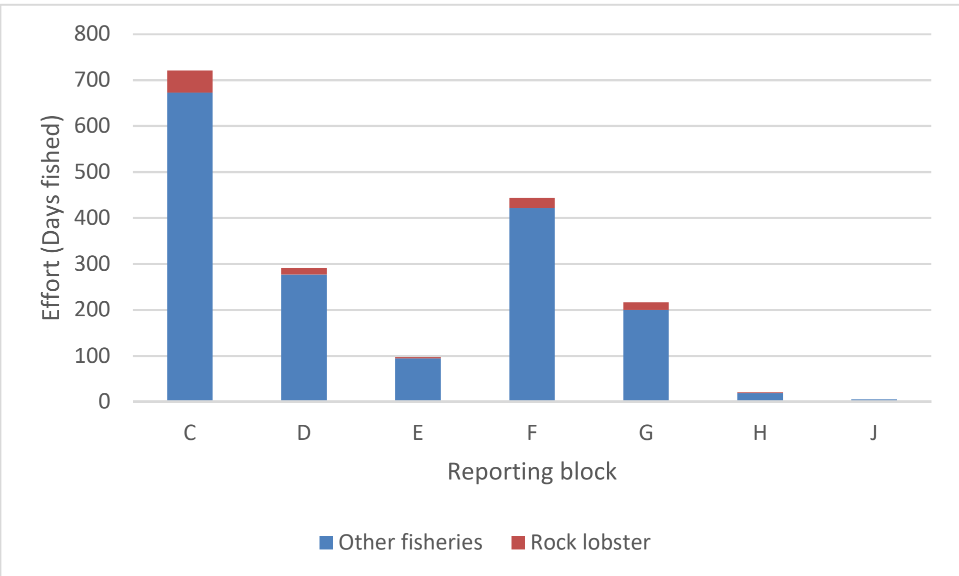


Figure 57. Fishing days reported by the Rock Lobster fishery and all other fisheries combined from reporting block rows that intersect with the MSS area from 2008–2017.

6.10. Victorian Ocean General, Ocean Wrasse, Purse Seine (Ocean) and Inshore Trawl Fisheries

These four Victorian managed sectors are covered in a single section in this report because it is difficult to separate catch and effort data because of the low number of operators.

The Victorian Ocean General Access Licence (including Wrasse) authorises the 193 licence holders (Victorian Fisheries Authority, 2017) to carry out fishing activities using a variety of gear types in marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea. Gear types permitted include line methods (dropline, long line, hand line), dip net, bait traps, octopus traps, landing nets, gaffs, seine nets, mesh nets and bait pumps. This fishery can land fish (mostly Snapper, octopus and Gummy Shark) other than abalone, jellyfish, Southern Rock Lobster, Giant Crab, Commercial Scallop and sea urchins. Main management methods are input controls including limited access and gear restrictions. The fishery usually conducts day trips operating out of small vessels (<10 m), and may fish at anchor or underway. Most of the fishing under these licences off Lakes Entrance occurs during April–July.

There is one Ocean Purse Seine Licence issued in Victoria (Victorian Fisheries Authority, 2017), and this vessel is currently domiciled in Lakes Entrance, and as a general rule only conducts day trips. That licence permits the operator to fish in marine waters other than Port Phillip Bay, Western Port, Gippsland Lakes and any inlet of the sea using a purse seine or lampara net. The Ocean Purse Seine targets Australian Salmon, Australian Sardine, Sandy Sprat and Australian Anchovy.

There are 54 Inshore Trawl Licences issued in Victoria (Victorian Fisheries Authority, 2017), however most of those are dormant (not used). These licences allow the operators to fish the same waters as the Ocean Fishery Access Licence and the Ocean Purse Seine Licence, using trawl nets.

Overlap between Victorian Ocean General, Ocean Wrasse, Ocean Purse Seine and Inshore Trawl Fisheries and the proposed seismic survey area

Historically effort by the Victorian Inshore Trawl Fishery was focussed off eastern Victoria, particularly close to Lakes Entrance (Figure 58). In comparison, only a small amount of the Ocean General Fishery effort is focussed off Eastern Victoria (Figure 59).

Across the State, Victoria's ocean fisheries (excluding rock lobster, abalone and scallops) landed 2775 t of fish during 2016/17, comprising mostly of "other species (2,346 t) (Victorian Fisheries Authority, 2017). It is likely that the vast majority of "other species" were species caught by the purse seine fishery, and that because there is only one operator, cannot be reported. Species targeted by that fishery include Australian Anchovy (*Engraulis australis*), Australian Sardine (*Sardinops sagax*) and Australia Salmon (*Arripis trutta*). 80 different species have been reported from these fisheries in the area of the MSS including finfish such as Eastern School Whiting, Tiger Flathead and Snapper, cartilaginous fish such as Gummy Shark and Angel Shark, molluscs such as octopus and Gould's Squid and crustaceans (Table 9). Crustaceans are a major target species of the Inshore Trawl Fishery, particularly Eastern King Prawn, Eastern School Prawn and Shovelnose Lobster.

Over 2008–2017 fisheries other than Rock Lobster (including Ocean Scallop) recorded 1,689 days of fishing within the MSS area, and together with the Rock Lobster Fishery landed 10,254 t of fish, mostly from reporting block row C (Table 8, Figure 56 and Figure 57).

The operator of the Victorian licenced purse seiner domiciled in Lakes Entrance estimates that they catch 125–250 tonnes of pilchards and Australian salmon within the MSS footprint. This is only 5-10% of their catch because they mostly work very close to shore. These figures are not included in Table 1.

Likelihood of fishing grounds developing in the future

There is considerable latent effort in the Ocean Fishery General Access and Inshore Trawl fisheries. It is uncertain what might trigger those licenses to become active.

Victoria's ocean fisheries are represented by Seafood Industry Victoria (SIV). Contact details for this industry association are provided in Table 10.

Table 9. Fish species reported by the Victorian Ocean General, Ocean Wrasse, Ocean Purse Seine and Inshore Trawl Fisheries during 2008–17. Original data source: Victorian Fisheries Authority).

Anchovy, Australian (whitebait)	Flathead, tiger	Prawn, Eastern King	Shark, Thresher
Australian salmon	Flathead, Unspecified	Prawn, Eastern School	Shells
Australian Sardine (Pilchard)	Flounder, Unspecified	Rays	Skates and Rays, Other
Baler shells	Gurnard perch, Common	Roach	Snapper
Barracouta	Gurnard, Unspecified	Rock lobster, Southern	Sole, Unspecified
Boarfish, Long-Snouted	Leatherjacket	Scallop, Commercial (meat)	Sprat, Blue
Bonito	Ling, Banded	Scallop, Commercial (shell)	Sprat, sandy
Bug (Shovelnose lobster)	Mackerel, Blue	Shark, angel	Squid, Goulds
Calamari, Southern (squid)	Mackerel, jack	Shark, Blue Pointer	Stargazer
Cod, Southern Rock	Mackerel, Unspecified	Shark, broadnose	Tailor
Cod, Unspecified	Morwong, banded	Shark, Bronze Whaler	Trevalla, Spotted
Crab, Hermit	Morwong, Jackass	Shark, Draughtboard	Trevally, silver
Crab, Other Unspecified	Morwong, Unspecified	Shark, Elephant	Trumpeter, Bastard
Crab, sand	Mullet, red	Shark, gummy	Trumpeter, Striped
Cuttlefish	Mullet, Unspecified	Shark, Hammerhead	Warehou, blue
Dory, John	Mullet, yelloweye	Shark, Other (Unspecified)	Whiting, King George
Dory, Other Unspecified	Octopus	Shark, Port Jackson	Whiting, school
Flathead, dusky	Octopus, Blue ringed	Shark, Rusty	Wrasse, blue throat
Flathead, southern bluespotted	Perch, estuary	Shark, saw	Wrasse, Unspecified
Flathead, southern sand	Pipi	Shark, school	Yellowtail Scad

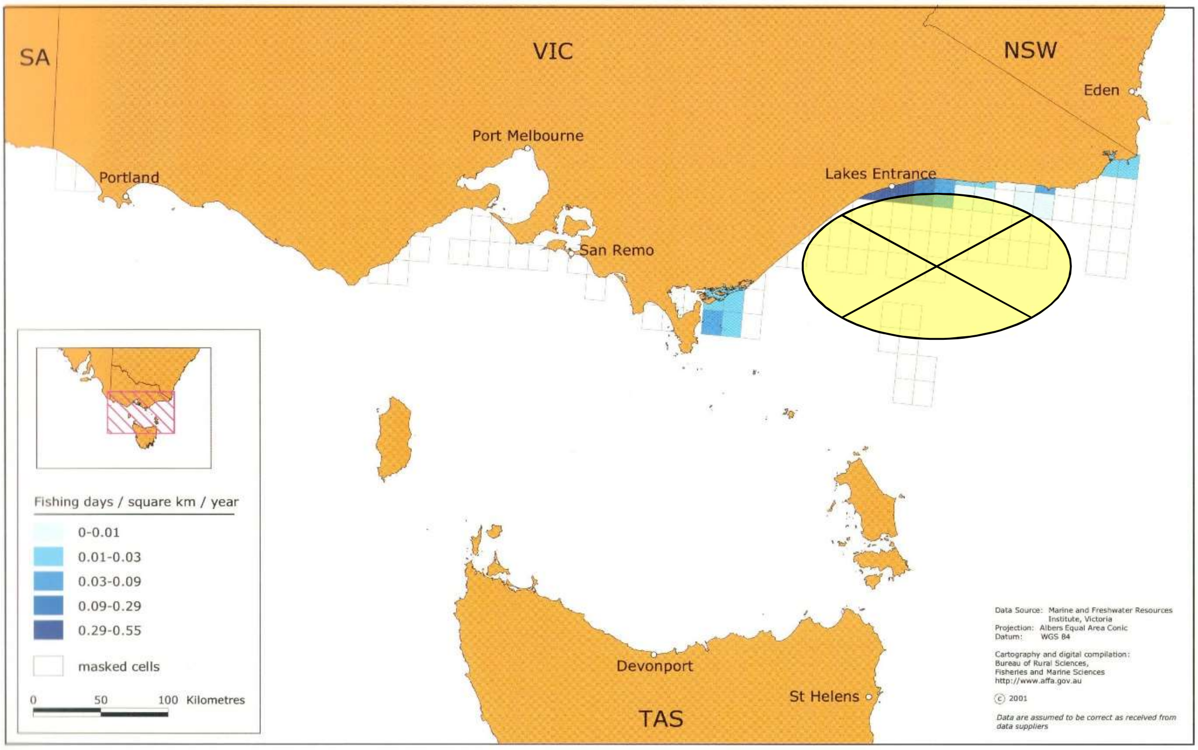


Figure 58. Effort (fishing days/square km/year) in the Victorian Inshore Trawl Fishery in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed seismic survey shown by yellow balloon.

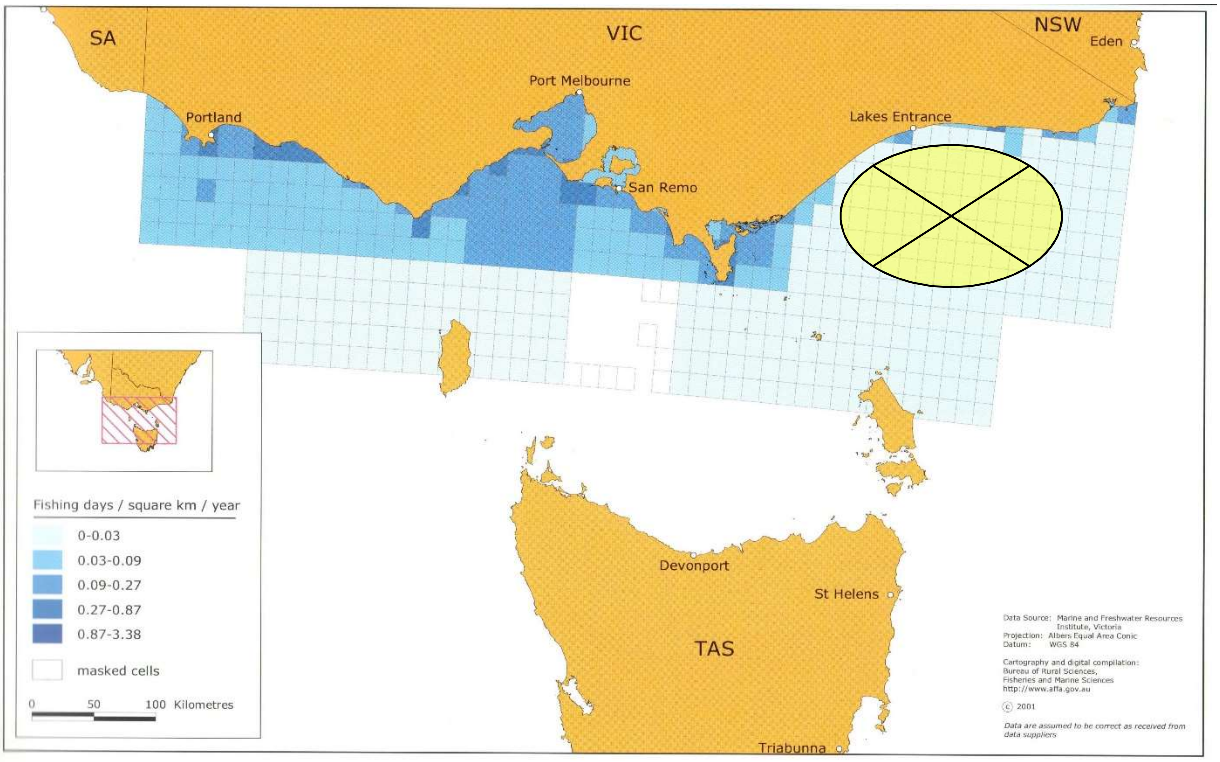


Figure 59. Effort (fishing days/square km/year) in the Victorian Ocean General Fishery in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed seismic survey shown by yellow balloon.

6.11. Victorian Ocean Scallop Fishery

The area of the Victorian Scallop Fishery extends along the Victorian coast, from the shore to 20 nm out, however the great majority of scallop fishing occurs off eastern Victoria (Anon, 2012). The Victorian Scallop Fishery uses scallop dredges to target the Commercial Scallop (*Pecten fumatus*). Most fishing takes place during the winter and spring months when the scallops are in their best condition, although the season is open year round (Bill Lussier, Victorian Fisheries Authority, pers. comm.). Off Lakes Entrance, Commercial Scallop spawn during spring or early summer, but there is also some evidence of lesser spawning events during autumn (Colman, 1988). The fishery is managed through both input and output controls, with limited entry, gear restrictions and a Total Allowable Commercial Catch (TACC). Total catches (fishery wide) are highly variable, ranging 266–1182 t during 2000–01 to 2009–10, but for the 2010–11, 2011–12 and 2012–13 seasons, a zero TACC was set. A total of 1.5 t per licence (totalling 135 t) has been allocated annually since the 2013–14 season to allow exploratory fishing only, however catches and participation have been low (Semmens *et al*., 2014). The most recent estimate of gross value production was for the 2006–07 season when 603 t was landed with a value of $908,000 (note that there has been catch landed since 2006–07, however there is insufficient data to report without breaching the confidentiality policy). There are 90 commercial licences in this fishery (Victorian Fisheries Authority, 2017), with about 12–20 vessels fishing those licences in any one year.

Overlap between the Victorian Scallop Fishery and the area of the proposed seismic survey

Publicly available historical data from the Victorian Scallop Fishery shows some historical effort in the area of the proposed seismic survey (Figure 60). More recent data (Colman, 2004) revealed that the 2002 fishing effort was concentrated in and around the catch and effort grids in the vicinity of the proposed seismic survey (Figure 61). Detailed catch and effort data were not provided due to the confidentiality policy, but catches have been zero to very low since 2010/11 to 2012/13, and no more than four vessels have reported effort in the fishery since 2012/13.

Likelihood of fishing grounds developing in the future

During the three consecutive years of closures during 2010–11, 2011–12 and 2012–13, there were encouraging signs for the Victorian Scallop Fishery, with good recruitment observed (anecdotally). This resulted in the opening of the fishery at a very limited TACC to allow for exploratory fishing. Scallop fisheries are renowned for their boom and bust cycles due to their highly variable recruitment. As recruitment processes off eastern Victoria are not understood, it is impossible to predict the likelihood of the fishery returning to its former catch and effort levels, however fishers off Eastern Victoria are continuing to see signs of a recovering fishery During 2017, the Victorian Fisheries Authority commissioned a resource survey, and has been writing a formalised harvest strategy. They are also encouraging fishing by reducing red tape. The resource survey which was undertaken in the summer of 2017/18 found that densities of Commercial scallop were low over much of the area of the fishery off eastern Victoria, with one moderately dense patch that falls within the MSS area (Figure 62 ;Koopman *et al*., 2018). With the one moderately dense bed identified, and government initiatives to stimulate interest in the fishery, it is likely that there could be an increase in catch and effort by the Victorian Scallop Fishery in the coming years (including this year).

The industry association for the Victorian Scallop Fishery is the Victorian Scallop Fishermen's Association and several operators in that fishery also hold Commonwealth Trawl Sector permits and are SETFIA members. Victorian Scallop Fishery are also represented by SIV. Contact details for these industry associations are provided in Table 10.

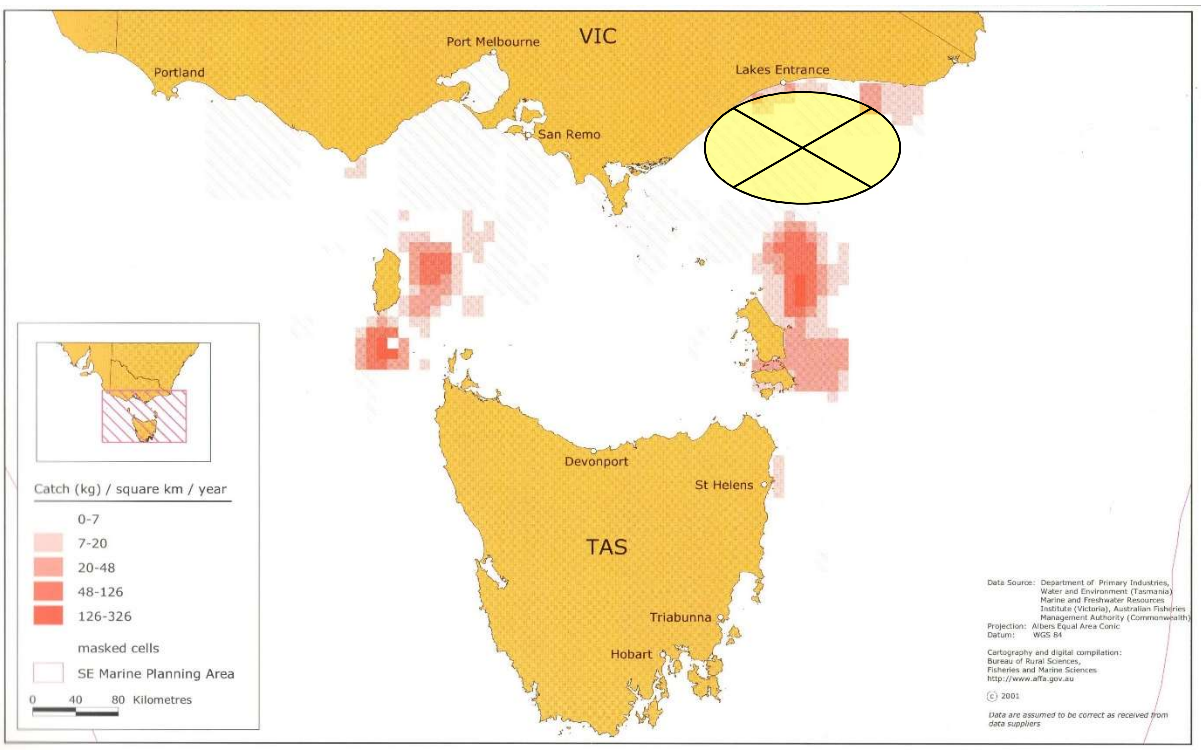


Figure 60 Catch rate (kg/square km/year) in the Commonwealth and State scallop fisheries in south east Australia during 1995 (fishery wide) 99 (Larcombe *et al.*, 2002). Approximate location of proposed seismic survey shown by yellow balloon.

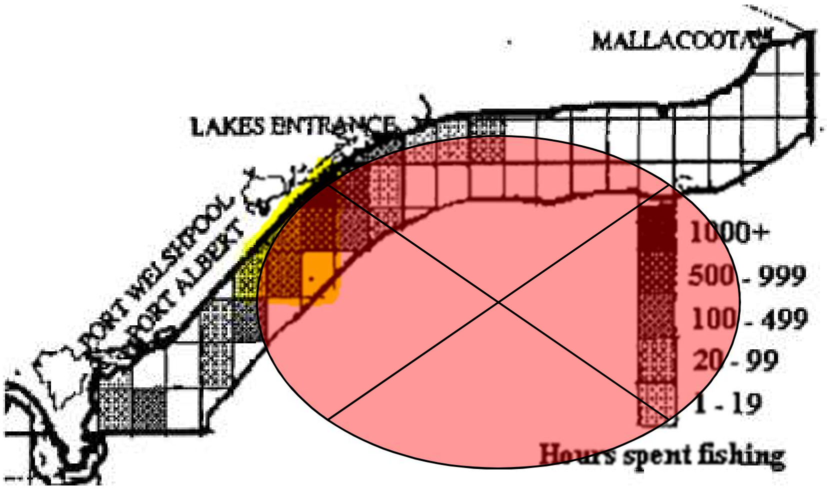


Figure 61. Effort (hours fishing) by the Ocean Scallop Fishery during 2002. Grids for which data are requested are highlighted yellow, and the approximate location of the proposed seismic survey shown by a red balloon. From Colman (2004).

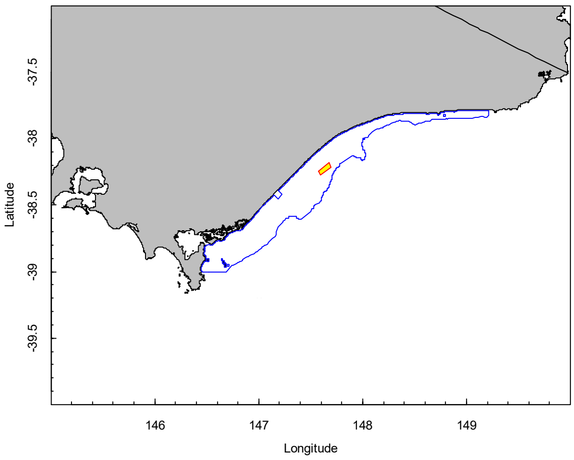


Figure 62. Location of scallop bed surveyed by Koopman *et al.,* (2018).

7. CONTACTS FOR FISHING SECTORS

Some sectors have their own representative body (or two), but both Commonwealth and State managed fisheries and are also represented by overarching representative bodies. Key contacts for each are listed in Table 10.

Table 10. Key contacts for representative bodies for each affected sector (alphabetical).

Consultation is recommended for embolden contacts.

Fisheries	Representative organisations	Key contact name	Key contact phone number	Key contact email address
Commonwealth Trawl Sector (CTS)	SETFIA	[redacted]	[redacted]	[redacted]
Eastern Tuna & Billfish Fishery	Tuna Australia	[redacted]	[redacted]	[redacted]
Shark Gillnet and Shark Hook Sector	Southern Shark Industry Alliance (SSIA)	[redacted]	[redacted]	[redacted]
Shark Gillnet and Shark Hook Sector	Sustainable Shark Fishing Inc.	[redacted]	[redacted]	[redacted]
Small Pelagic Fishery	Small Pelagic Fishery Industry Association	[redacted]	[redacted]	[redacted]
Victorian Rock Lobster Fishery	Victorian Rock Lobster Association (VRLA)	[redacted]	[redacted]	[redacted]
Victorian Rock Lobster Fishery Victorian Giant Crab Fishery	Seafood Industry Victoria	[redacted]	[redacted]	[redacted]
Victorian Rock Lobster Fishery EASTERN ZONE	EastRock	[redacted]	[redacted]	[redacted]
Victorian fisheries – all	Seafood Industry Victoria	[redacted]	[redacted]	[redacted]

Table 11 Contact details for some affected fishers, roughly in order of degree of potential effect on

(consultation to minimise effects is recommended as critical for embolden contacts)

Sector	Name	Phone	Vessel	Port of domicile
CTS Otter-board trawl	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS OBT & Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Otter-board trawl	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine (& squid, scallop)	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
CTS Danish seine	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GhaT gillnet shark	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHAT gillnet shark	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHAT gillnet shark	[redacted]	???	[redacted]	Lakes Entrance, Vic

Sector	Name	Phone	Vessel	Port of domicile
Dabnsh Seine & GHAT gillnet shark	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet		[redacted]	[redacted]	Apollo Bay, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	San Remo, Vic
GHaT shark gillnet		[redacted]	[redacted]	San Remo, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	San Remo, Vic
Cth scallop & Cth longline	[redacted]	[redacted]	[redacted]	Stanley, Tas
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Tasmania
GHaT shark gillnet	[redacted]	[redacted]		Port Fairy, Vic
GHaT scalefish hook	[redacted]	[redacted]	[redacted]	Devonport, Tas
GHaT scalefish hook	[redacted]	[redacted]	[redacted]	Hobart, Tas
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Lakes Entrace, Vic
GHaT shark gillnet	[redacted]	[redacted]	[redacted]	Port Welshpool, Vic
GHaT shark gillnet	[redacted]	???	[redacted]	Port Welshpool, Vic
Vic Octopus	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Vic: inshore trawl, purse seine & octopus	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Vic inshore trawl	[redacted]	???	[redacted]	Lakes Entrance, Vic

Sector	Name	Phone	Vessel	Port of domicile
Vic Hook	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Vic Hook	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	???	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	???	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	???	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	???	[redacted]	Lakes Entrance, Vic
Cth Scallop	[redacted]	[redacted]	[redacted]	Lakes Entrance, Vic

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RPS

Media communications

Passion for Geoscience

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GIPPSLAND'S 3D MARINE SEISMIC SURVEY INFORMATION

Questions & Answers

1. Who is CGG Australia?

CGG has had offices in Australia since 1983 and currently employs 133 people, in three locations. A leader in cutting-edge geoscience, we have a strong focus on innovation and a commitment to delivering the best sustainable solutions to our clients' energy challenges. We bring our clients a unique range of technologies, services and equipment designed to acquire extremely precise data and images of the Earth's subsurface. We also provide state-of-the-art software and services for analyzing that data and developing a deeper understanding of the subsurface for exploration, production and optimization of oil and gas reservoirs.

The Gippsland 3D Marine Seismic Survey will be carried out by CGG Services Australia Pty Ltd, operating under Australia Business Number 70 081 777 755.

2. What is 'multi-client data'?

Geophysical surveys are acquired in two ways, either as a multi-client survey or as a proprietary survey. A proprietary survey is acquired by a single company using a geophysical contractor, over its area of interest only. Multi-client data is acquired by a geophysical company and covers a larger area of interest. The data is licensed to clients on a non-exclusive basis. In both cases the data is ultimately owned by the Commonwealth of Australia.

The advantage of a multi-client approach is that a single survey will fulfill the requirements of a larger number of companies, rather than each of these companies acquiring separate surveys.

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3. What kind of activities are planned to be conducted in the Offshore Gippsland area?

The aim of the proposed Gippsland 3D Marine Seismic Survey (Gippsland MSS) is to explore the area in order to evaluate its potential natural resources. The survey vessel would operate over approximately 16,850 km^2 including approximately 14,100 km^2 where seismic data could be acquired (see map below).

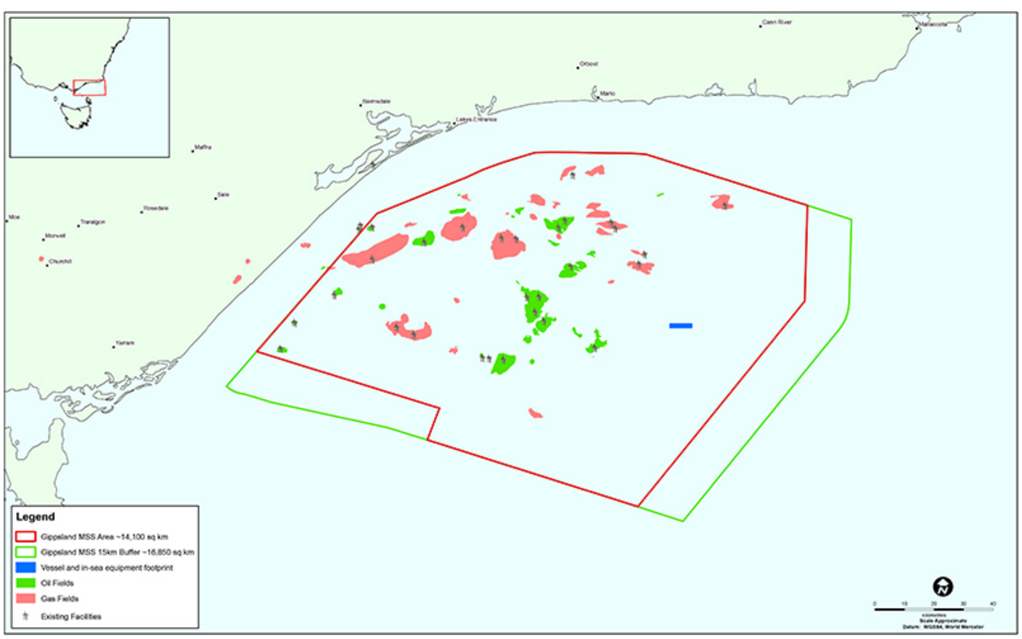
The survey vessel will be in Commonwealth waters, at least 12 km offshore of the coast.

The main purpose of seismic exploration is to render the most accurate possible graphic representation of specific portions of the Earth's subsurface geologic structure.

Acquisition of seismic data involves the transmission of controlled acoustic energy into the Earth, and recording the energy that is reflected back from geologic boundaries in the subsurface.

The images produced allow the evaluation of the area for its potential to yield natural resources.Seismic surveys are the main tool used in oil & gas exploration and are used routinely throughout the world and around Australia. Numerous 2D and 3D surveys have taken place in the Gippsland Basin for over half a century, alongside other activities, such as petroleum production and commercial fishing.

For more information on what seismic surveys are, please follow this link



Gippsland Acquisition Plan

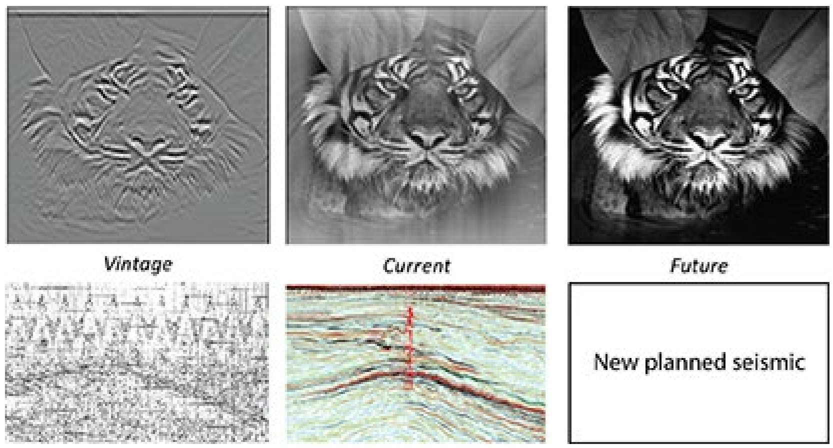
 Download the full size image.

 Top

4. Why is new data needed in this area?

The Gippsland Basin has been producing hydrocarbons since the early 1970's when several giant oil and gas fields were discovered. Since that time acquisition and processing technologies have advanced dramatically.

The examples below illustrate the improvement in imaging technology:



New acquisition is required to better image rocks beneath the coals which might contain new oil and gas deposits.

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5. How are seismic surveys authorized?

The Australian Government requires petroleum and greenhouse gas (GHG) companies to conduct their activities in a manner that meets a high standard of environmental protection. The seismic industry's environmental record in Australia, particularly in offshore areas, has been exemplary. No offshore seismic survey proposal would be approved unless the highest environmental standards had been met.

Under Environment Regulations, an operator is legally required to submit a Summary Environment Plan to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for public disclosure. Within ten days of receiving notification that the Environment Plan has been accepted, an electronic version of the summary must be submitted to NOPSEMA for publication online.

Summary Environment Plans submitted for petroleum activities in Commonwealth waters from January 2012 are available on the NOPSEMA website at this link.

CGG is currently commissioning a specialist environmental consultancy to prepare a detailed Environment Plan for NOPSEMA using the best available science. If this is accepted, a permit may be granted to conduct the seismic survey under the conditions agreed to in the environmental plan.

During the Environment Plan preparation phase, the environmental consultancy engages with stakeholders (local communities, fisheries representatives, conservation associations, regulatory bodies etc.) and addresses their potential concerns.

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6. Do CGG activities impact the environment?

CGG’s policy is to apply ecodesign principles and mitigations to prevent and remediate potential negative effects on the environment.

Our marine seismic surveys play an important role reducing environmental footprints. Seismic surveys are short term events that provide indirect environmental benefits. First, they reveal which areas are not viable prospects. Second, they reduce the number of wells required to locate and precisely delineate oil and natural gas resources. And third, they reduce the number of wells required to produce the resources that are discovered.

CGG diligently applies risk-based monitoring and mitigation measures which have been tailored to the local environment as a result of the Environmental Impact Assessment. These include specific measures protecting marine life in line with national requirements and international laws and regulations.

The seismic source is progressively started (‘soft-start’) over a period of 20 minutes starting from the smallest single source element to the entire array. Independent Marine Mammal Observers (MMOs) ensure a watch of 30 minutes prior to the soft start from the vessel bridge, monitoring a safety zone of 1000 meters from the seismic source.

If a whale is detected, the soft start cannot take place until a clear 30 minutes has passed without a further sighting. Throughout data acquisition, MMOs have the authority to stop the seismic source so as to prevent any risk of harm to the animal if a marine animal is sighted within the safety zone. Equivalent monitoring and mitigation measures are conducted with passive acoustic technologies, allowing the localization of marine mammals around the vessel through their vocalizations. Records from marine life monitoring and mitigations are sent to NOPSEMA.

Every year, CGG transparently reports its consolidated environmental performance in its sustainability report. Our 10th sustainable development report can be accessed at this link.

More information on the impact of seismic surveys on marine life at this link.

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7. Is there a potential impact on fish?

As part of its Care+Protect program, CGG is committed to further investigate the effects of operations on marine life and implement further measures of mitigation where necessary. CGG therefore recently commissioned original research from the UK Universities of Exeter and Bristol to assess the cumulative effect of seismic sound and other man-made sounds such as shipping and pile-driving on fish post-larvae, a very sensitive life-stage. The results, which are published in a high-level peer-reviewed scientific journal, are compelling. After having initially developed some levels of stress as a result of the exposure to seismic sound, the post-larvae have quickly developed a mechanism of tolerance to the seismic sound which has allowed them to eliminate any stress and grow the same way as the post-larvae raised in the same conditions without any exposure to man-made sound.

The Gippsland Environment Plan will assess and discuss potential impacts including on local fish species. Fish can respond differently to seismic sound depending on whether or not they have a swim bladder, a gas-filled chamber that can detect sound pressure. The research on post-larvae referenced above focused on the seabass, a model species with swim bladder. Fish with a swim bladder include blue warehou, jackass morwong, whiting, yellow eyed mullet, Australian sardine and Australian salmon and some species of flathead. Fish with no swim bladder are less susceptible to sound pressure impacts from seismic surveys. These include sharks, rays, mackerel, tuna, as well as many flatfish and flounder.

Past 3D seismic Environmental Impact Assessments (EIA) referenced on NOPSEMA's website have determined that potential impacts from the survey on all fish, including those with a swim bladder, has been assessed as minor or insignificant, localised, and temporary. It is to be noted that no cases of fish death have been reported from seismic surveys either.

Whenever possible, CGG is contributing to advancing science and bridging knowledge gaps on sound and marine life. This summer, CGG will be participating in the first ever test of the response of free-ranging fish to a real seismic survey by supplying one of its seismic source vessels to a world-class scientific research consortium led by the University of Leiden (Netherlands) and supported by the Joint Industry Program Sound & Marine Life. In such experiment, tagged free-ranging fish will be exposed during a week to the sound of a seismic survey and their behavior will be monitored.

More information on the cumulative impact of man-made sound on post-larval fish at this link.

□ Top

8. Will this survey mean all fishing in the area will have to be stopped for 5 months?

No, our seismic surveys are designed, planned and executed to prevent potential conflicts of usage with other sea users. Although the potential exists for short-term inconvenience and disruption to the patterns of fishing and aquaculture, the survey lines are therefore carefully planned and discussed with fisheries representatives and other interested parties ahead of and during operations. Early stakeholder engagement and local consultations aim to limit interference to the lowest levels possible. Ongoing communications with all interested parties are maintained throughout the survey.

The seismic vessel sails slowly (about 4.5 knots) and has limited maneuver capabilities due to the length of the towed cables. One or more support vessels escort the seismic vessel, with the duty to establish and maintain communications with other vessels in the area. The proposed program map (see question 3) shows the vessel and acquisition footprint to scale (blue rectangle), within the proposed acquisition area.

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9. What kind of consultation process has there been with the local stakeholders?

CGG has contracted RPS, an environmental consulting company, to assist us in communications with the stakeholders. Stakeholder engagement to date has included:

- Email consultation with government departments (state and commonwealth)
- Email and phone consultation with commonwealth fishing industry associations – fishing industry consultation representative from SETFIA
- Email and phone consultation with individual commonwealth fishers not in associations (e.g squid fishers)
- Consultation with state fishers - via Victorian Fisheries Authority and SIV
- Face to face meeting with Seafood Industry Victoria (SIV) and South East Trawl Fishing Industry Association (SETFIA)
- Face to face meeting with Lakes Entrance fishers
- Face to face meeting with representative from Tim Bull’s office
- Consultation with abalone fishing associations (5) by email
- Public information for broader engagement was provided on webpage and publicized in responses to media enquiries

A positive outcome, whereby the survey is completed safely and cost effectively and disruption of fishing activity is minimized, relies on open communications. CGG wants to work with fishers to minimize and mitigate any impacts and invites cooperation from the fishing industry in providing open and honest information on the key areas fished and where they plan to fish between November and June.

CGG thanks all fishers who have taken the time to provide feedback to date and encourages others to provide detailed information on any areas or times of particular importance to their fishery, such that impacts can be minimized further.

To contact RPS directly:

Phone 1 800 501 541
Email CGGgippsland@rpsgroup.com.au

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Offshore HSE

Safety is always of prime importance. Standard training and strict environmental procedures are enforced on all vessels.

Read More

Reduce Exploration Risk

We have a range of technology available for exploration surveys, including some solutions specifically designed for areas where the time window for acquisition is limited.

Read More

Social Responsibility

CGG contributes to the economic and social development of the communities in which we have the privilege to operate.

Read More

MEDIA & EVENTS

News

Gippsland's 3D Marine Seismic Survey Information

HSE POLICY

Our Health, Safety, Security, Environment and Social

CONTACT US

Have questions, concerns, or comments about the Gippsland Acquisition?

Responsibility commitments.

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Public Notices

TRASH & TREASURE
Market at BRIAGOLONG THIS SUNDAY!
20 stalls of treasures waiting to be found
Fully catered: BBQ, cafe lunch, takeaway coffee, fresh roasted coffee.
Lots of gorgeous stock in Briag's artisan and antique shops.
JOIN US! BEHIND BRIAGOLONG CAFE SUNDAY, SEPT. 9 8AM - 1PM
Briagolong Cafe

MATHS TUTORING
All ages and standards. Individual and group sessions. Working with children check. References available. Call Marcus 0439 077 079

ON THE BUSES
Merimbula Melb Cup Trip 3-7 Nov. Coach, accommodation, breakfast plus Cup Day Luncheon. All incl. $425. Ph: Kim 0408 388 672 after 5pm. Proceeds to Royal Childrens Hospital.

Public Notices

RAFFLE RESULTS
Cancer Council Victoria (Sale Branch).
1st: M. Manners. 2nd: T. McRae. 3rd: S. Browne. 4th: S. Clavarino. 5th: J. Schumann.

Public Notices

LATROBE VALLEY AUTHORITY
VICTORIA State Government

CALL FOR SUBMISSIONS
Latrobe Valley new energy projects

We are keen to learn about business projects and ideas that may build local capacity to deliver renewable energy and new energy technology projects in the Baw Baw, Wellington and Latrobe City council areas, and to further build our supply chain networks and services.

For details on submission requirements go to: www.lva.vic.gov.au/new-energy-prospectus

Submissions must be made by Friday 21 September 2018.

VG4427

Meetings

AGM
City of Sale Eisteddfod annual general meeting will be held on Tuesday, September 11 at 7pm at the Eisteddfod office, 6 Invictus Court, Sale. Everyone welcome. Call Kate 0419 568 915.

Meetings

AGM
Macalister Irrigation Council Inc. Notice of AGM to be held at 12:30pm on Monday 10th September at the Maffra Community Sports Club 122-126 Johnson Street, Maffra.

Meetings

AGM
Sale Business and Tourism Association annual general meeting will be held on Thursday, September 13, 7.15am for 7.30am start at Wild Honey Cafe, Sale.

For all classifieds phone 5143-9333

Public Notices

Sale Cricket Club Season 2018/19
SALE CRICKET CLUB
CRICKET BLAST

JUNIOR REGISTRATION DAY
Friday September 14, 5-6:30pm
Sale Cricket Club Social rooms
(cnr Cunninghame and Palmerston Streets, Sale)
T20 BLAST (U11's), U/12's, U/14's, U/16's
Woolworths Junior Blasters (5-8 yrs)
Go to **salecricketclub.com.au**
to register online for Junior Blasters (Milo Cricket).
Enquiries phone:
Cathy Dobson on 0409 488 374 or
Rodney Jones on 0437 355 825.

1569216

Meetings

AGM
Sale Golf Club Ladies Annual General Meeting will be held on Tuesday September 11, 2018 at 2pm at the clubhouse. All players are encouraged to attend.

footprints FOUNDATION

AGM
The Footprints Foundation annual general meeting will be held on Wednesday, September 19 at 7.30pm at Sporting Legends Sale in the meeting room between the TAB and the Sports Bar.
Email: info@footprints foundation.org.au

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We have been guiding you in the right direction for over 150 years and will continue to for the next 150 years
GIPPSLAND Times
Phone 5143 9333

Public Notices

ADVERTISE
in The Gippsland Times and Latrobe Valley Express
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A total of 16 issues!
Twice a week for 4 weeks in both papers.
***Price includes Headline plus 4 lines of type.** Additional lines $7.50 per line.

Cash or credit card, through our Sale office only.

DECLARATION
Fire Restrictions

CFA and FFMVic will be introducing Fire Restrictions (Fire Danger Period and Prohibited Period respectively) for all private land within the municipalities listed below.

The Fire Restriction Period will commence at 0100 hours on the date shown and unless varied by a subsequent declaration, will end at 0100 hours on 1st May 2019.

Municipality	Date of Commencement
East Gippsland	10/09/2018
Wellington	10/09/2018

Certain restrictions on the lighting of fires are in force during the Fire Restriction Period. Information about fire restrictions within the Country Area of Victoria can be obtained from www.cfa.vic.gov.au, your local CFA District Office or Municipal Fire Prevention Officer.

Information about fire restrictions within the Fire Protected Area can be obtained from www.ffm.vic.gov.au, or your local FFMVic Fire District Officer.

Steven Warrington
Chief Officer – CFA
Chris Hardman
Chief Fire Officer – FFMVic

CFA
FOREST FIRE MANAGEMENT VICTORIA

Motoring Classifieds

Cars

TOYOTA Corolla sedan, 6 speed manual, grey, a/c, p/s, tinted windows, service history, r.w.c., 68,000km, 1KN-1ER $9500. Ph 0456 045 051.

Hyundai Elantra
2002, 334,938km, reg. RZM-161, Vin no. KMHD MCR240418631, $3000, Phone 0417 504 776.

2011 Kia Rio Sports, hatch, special edition, manual, r.w.c., 138,867km YHW-837, service history, excellent condition $6000. Phone 0421 631 704.

FORD Focus, 4 cyl, auto sedan. e.c., very reliable, reg. svcd, pwr steer, a/c, cent. locking, CD, stereo, current r.w.c., 3 months reg. vin no. WF0FXX WPDF4L19681, $2950. Ph 0412 516 666 anytime.

GRAND CHEROKEE
WH 4WD Jeep Laredo 2005, V6 diesel, 6mths reg., 244,000kms, EC, TPV-667, $9000. Phone 0427 444 392

Cars

HOLDEN Berlina, 1993, LX auto, V6, good cond., P/S, cruise, c/lock, new battery/steering lock/ignition key, RYH-943, $1,900. Ph 5135 6126.

Holden Commodore
wagon, 2005, good cond. WTZ-012, reg. till Dec., $4000 o.n.o. Phone 0481 349 883, or 0413 036 183.

HOLDEN Vectra, 4 cyl. auto, sedan 2002, a/c, p/s, CD, nothing to spend, exc. mech., tyres, body, int., current r.w.c. 3 mths reg., vin. 0L0JBF1911199 781 $2950. Phone 0412 516 666 anytime.

MERCEDES Vito 2006, turbo diesel, full r/rack, HR towbar, c/lock., e/wind's, spent $2700 on r.w.c., tyres as new, UNK-309 $8200. Ph 0439 999 373.

NISSAN MICRA
2012, red, good condition, air cond., p/windows, low kms, registered, ZFQ-964 $5750. Ph 0407 828 948.

TOYOTA Corolla Ascent 88,000km, air cond, one owner, service books with r.w.c., $8950 o.n.o. YUQ-225, Phone 0403 419 545.

Motorcycles

SUZUKI 750, 2 stroke triple, 1975 $7500. Z1300, 6 cyl., 1984 $8,000. Z900, 1976 $14,000. CB Honda, 125, twin, 1975 $1800. 1972 H2 750 Triple 2 stroke, show bike $21,000. Phone Steve 0498 346 427.

SUZUKI BANDIT
2009 GSF 125OSA, full service and tune incl.valve clearance. New rear disc and pads, battery, foot and hand grips. Ventura rack fitted. 2B7GU and RWC. $6000. Phone 0403 619 777.

Caravans

19' ROYAL Flair Enhance, 2013. 1 owner, exc. cond., sold due to ill health, stored under cover, sep. toilet/shower, 2 single beds, solar, a/c. $39,900 neg. Ph 0407 847 668.

JAYCO 19'6"
2007 Outback Discovery, p/t, toilet/shower combo, solar panels, battery pack plus many extras. EC, $25,500. Ph. 0459 251 351.

JAYCO Finch 2003 Pop-top, e.c., ample storage, 2-way stove/fridge, sleeps 5, electronic braking, solar panel, extras $12,000 o.n.o. Ph 0499 993 402.

MDC Camper Trailer
2013, reg'd Jan. 2019, 7x5, 2 rooms, exc. cond. $4000. Ph 0407 505 008.

ROYAL FLAIR 16'
2001 Van Royce pop top, ex. cond., 3-way fridge, 4-burner stove, double island bed, ample storage, new awning, as new annexe. $13,990 ONO. Phone 0408 471 936.

WANT TO HIRE
Small caravan for towing, short trips, pensioner, no kids or dogs, have insurance. Ph 0456 422 666.

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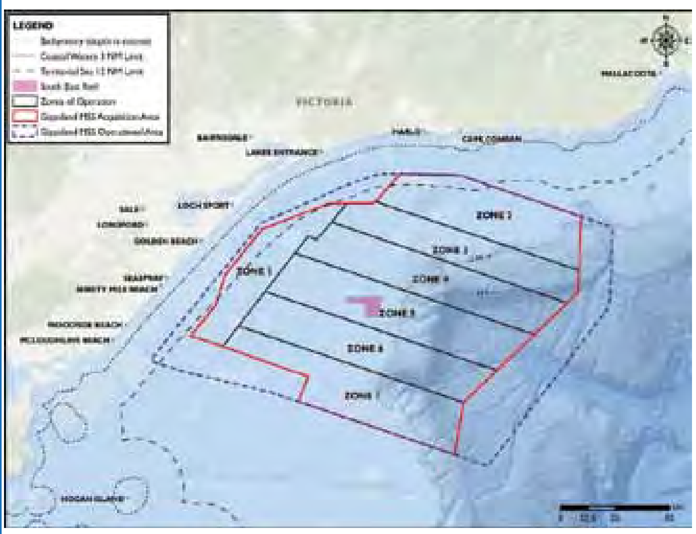
Our email address is classifieds@gippslandtimes.com.au

Gippsland 3D Marine Seismic Survey

November 2018 to June 2019

RPS CGG



CGG Australia Pty Ltd (ABN 70 081 777 755) is proposing a 3D marine seismic survey in the Gippsland Basin. The survey vessel would operate over approximately 16,850 km^2 including approximately 14,100 km^2 where seismic data could be acquired (see Acquisition Area in map). The survey vessel will remain in Commonwealth waters offshore of the Victorian coast.

Numerous 2D and 3D surveys have taken place in the Gippsland Basin over the last 50 years, and the area continues to support important petroleum production and commercial fishing industries. We recognise that both industries are important to the Gippsland community and are working to ensure they continue to co-exist successfully. CGG has commissioned RPS in Australia to prepare a detailed Environment Plan using the best available science. If this is accepted by the commonwealth regulator NOPSEMA the survey is planned to start in November or December 2018.

CGG is currently engaging with stakeholders in the area (local communities, fisheries representatives, conservation associations, regulatory bodies etc.) to explain the project, understand concerns and work with affected relevant stakeholders to mitigate any effects of the survey.

Effect on marine life

The EP will assess and discuss potential impacts to the environment, including on local fish species. Fish can respond differently to seismic sound depending on whether they have a swim bladder. The potential impacts from the survey on all fish, including those with a swim bladder, have been assessed as minor (localised and temporary). No cases of fish death have been reported from seismic surveys to date.

CGG is contributing to the advancement of science on sound and marine life by participating in the first ever test on the response of free-ranging fish to a real seismic survey. The test is being led by the University of Leiden (Netherlands) and supported by the Joint Industry Program Sound and Marine Life.

Southeast Reef has been identified as a key fishing area during consultation and CGG has developed management controls to minimise effects on this area. The controls include dropping plans to “undershoot” around the petroleum platforms in this area, using a much smaller sound source (< 150 cui) in this area and avoiding as much of the main spawning period for commercial fish species in the area (acquisition limited to March – April) as possible. No key fishing or spawning areas have been identified by stakeholders to date for invertebrate fisheries.

Impact on marine users

Our seismic surveys are designed, planned and executed to prevent potential conflicts with other sea users. The acquisition footprint (vessel and towed equipment) is ~11sq km; fishers and other vessels are able to continue operations at a safe distance alongside the vessel. One or more support vessels will escort the seismic vessel with the duty to establish and maintain communications with others in the area. As the seismic vessel sails slowly (~4.5 knots) and has limited manoeuvring capabilities due to the length of the towed cables, other vessels may have to give-way. After the seismic vessel has passed activities can resume as normal. Although the potential for this short-term inconvenience exists, the survey lines are carefully planned and discussed with fisheries representatives and other interested parties ahead of and during operations.

Ongoing consultation

Stakeholder engagement to date has included consultation with:

- government departments (state and commonwealth)
- commonwealth fishing industry associations (fishing industry consultation representative from South East Trawl Fishing Industry Association)
- individual commonwealth fishers not in associations (e.g. squid fishers)
- state fishers via Victorian Fisheries Authority and Seafood Industry Victoria
- SIV and SETFIA, Lakes Entrance fishers and a representative from Tim Bull's office
- abalone fishing associations

Information has been provided by email, letter, phone, on the CGG webpage and publicised in responses to media enquiries.

CGG recognises the fishing industry's concerns and seeks a positive outcome, whereby the survey is completed safely and cost effectively and disruption of fishing activity is minimised. This relies on open communications and CGG wishes to continue to work with fishers to minimise any impacts. We invite cooperation from the fishing industry in providing open and honest information on the key areas fished and where they plan to fish between November 2018 and June 2019.

CGG thanks all fishers who have taken the time to provide feedback to date and encourages others to provide information on any areas or times of importance to their fishery, such that impacts can be minimised further.

For further information or to discuss potential impacts contact:
phone 1 800 501 541
Email CGGgippsland@rpsgroup.com.au
Web https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information

RPS

Stakeholder consultation letters

First stakeholder consultation letter

RPS

First stakeholder consultation letter - general - rev 0

Gippsland Marine Seismic Survey

Introduction

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 16,850 km^2 including approximately 13,000 km^2 where seismic data would be acquired (see attached figure). The survey vessel will be at least 12 km offshore in Commonwealth waters. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2,676 m in the Bass Canyon.

Proposed Activity

The survey area is the area within which the seismic source (airguns) will be operational and seismic data will be acquired, including soft start procedures and run-outs (required to obtain full fold coverage). The seismic source will not be operational outside of the survey area. An operational area or 'buffer' around the survey area is required for activities including streamer deployment and retrieval, maintenance and recovery, and vessel manoeuvring (line turns). There will be no seismic operations in the buffer area. Transit to and from the survey area is excluded from the scope of this EP.

The survey is currently planned to commence in early November 2018 and continue for no more than five months, allowing for some downtime due to weather, avoiding conflicts with other users and marine megafauna, and maintenance. The timing of the activity is subject to availability of the survey vessel for conducting the survey, client data requirements, sea state conditions suitable for marine seismic acquisition, and granting of the required regulatory approvals and access authorities. Seismic data will be acquired over a 24-hour period, with shut downs for routine and reactive maintenance, repairs, transit and line turns, fauna and stakeholder avoidance.

Operational Activities

The proposed activity is a typical 3D survey similar to the majority of others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. CGG is committed to minimising potential for interactions with other marine users and welcomes early engagement. The specific survey vessel that will be used for the survey is yet to be determined, but will be conducted using a purpose-built seismic vessel similar in specifications to the *M/V Geo Coral*.

During the proposed activity, the survey vessel will traverse a series of pre-determined sail lines within the survey area at a speed of approximately 4.5 to 5 knots (8 to 9.3 km/hr). As the vessel travels along the survey lines a series of noise pulses (every 5-6 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranges along a number of hydrophone cables (streamers) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The receiver array will comprise of 8 to 12 solid streamers, with a maximum length of 8,100 m. Streamer spacing will be between 50 and 100 m and survey line spacing will be between 500 and 1,000 m. The acoustic source (airgun array) will be towed at 5 to 9 m (+/-1 m) below the sea surface, and the streamer tow depth will be 12-18 m.

There will be three source arrays, but only one will be discharged at each shotpoint which are spaced 12.5 m apart ('flip/flop/flap' firing sequence). Each source array has a maximum volume of 3,000 cubic inch (in^3), operated at a pressure of 2000 psi.

Undershooting will occur around the platforms within the survey area. During undershooting, a second vessel with an identical source will be positioned approximately 4 km from the main survey vessel on the opposite side of the platform. This secondary source vessel will have a similar source set-up as described above.

A support vessel will accompany the survey vessel to maintain a safe distance between the towed array and other vessels, and to manage interactions with shipping and fishing activities, if required. The support vessel will also re-supply the survey vessel with fuel and other logistical supplies. During the survey, it is possible that the survey vessel will be refuelled at sea using the support vessel, either within or immediately adjacent to the survey area. At sea refuelling will only take place during daylight hours, and outside the boundaries of any Commonwealth or State marine protected areas. Helicopter transfers may also be planned to facilitate crew changes.

The Gippsland MSS comprises two zones (see attached figure): the Main zone has sail lines running in ESE and WNW directions (108°); the Shallows zone has sail lines running in NE and SW directions (41°). The Main zone would take about three months to survey and the Shallows would take about 3-5 weeks. Undershooting is anticipated to take approximately two weeks. Start dates and durations of individual areas have not been determined at this time. Note that the some areas could also be broken down into smaller sub-areas with variable start dates and durations. Seismic acquisition in the shallows zone would use an eight streamer configuration.

Communication Commitments

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period.

If you would like to comment, or would like additional information, please do not hesitate to contact CGG using the details below. CGG will also be available for face-to-face meetings to discuss any concerns. All communication received will be acknowledged, assessed and appropriately responded to.

Please advise if you do not want to receive further updates.

In the event that your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

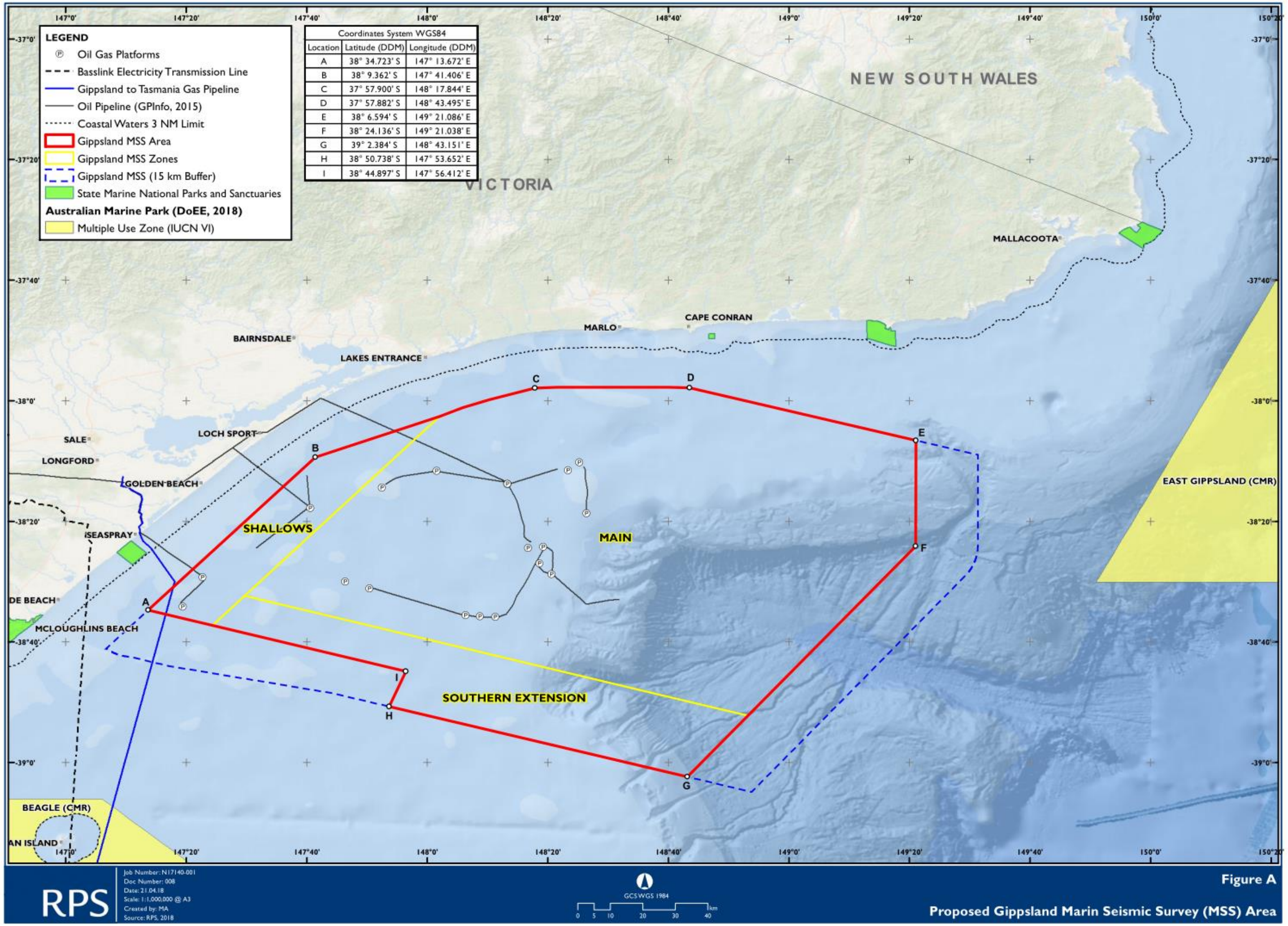
Details of all consultations will be provided to NOPSEMA as required under legislation.

Thank you for your engagement in the Stakeholder Consultation process.

Contact

Phone:	1800 501 541
Email:	CGGgippsland@rpsgroup.com.au

Location



LEGEND
Oil Gas Platforms
Basslink Electricity Transmission Line
Gippsland to Tasmania Gas Pipeline
Oil Pipeline (GPInfo, 2015)
Coastal Waters 3 NM Limit
Gippsland MSS Area
Gippsland MSS Zones
Gippsland MSS (15 km Buffer)
State Marine National Parks and Sanctuaries
Australian Marine Park (DoEE, 2018)
Multiple Use Zone (IUCN VI)
Coordinates System WGS84
Location | Latitude (DDM) | Longitude (DDM)
A | 38° 34.723' S | 147° 13.672' E
B | 38° 9.362' S | 147° 41.406' E
C | 37° 57.900' S | 148° 17.844' E
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H | 38° 50.738' S | 147° 53.652' E
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NEW SOUTH WALES
VICTORIA
MALLACOOTA
CAPE CONRAN
MARLO
BAIRNSDALE
LAKES ENTRANCE
LOCH SPORT
SALE
LONGFORD
GOLDEN BEACH
SEASPRAY
SHALLOWS
MAIN
SOUTHERN EXTENSION
EAST GIPPSLAND (CMR)
MCLOUGHLINS BEACH
BEAGLE (CMR)
Job Number: N17140-001
Doc Number: 008
Date: 21.04.18
Scale: 1:1,000,000 @ A3
Created by: MA
Source: RPS, 2018
GCS WGS 1984
Figure A
Proposed Gippsland Marin Seismic Survey (MSS) Area

RPS

First stakeholder consultation letter - general - rev 1

Gippsland Marine Seismic Survey

Introduction

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 15,500 km^2 including approximately 13,000 km^2 where seismic data would be acquired (see attached figure). The survey vessel will be at least 12 km offshore in Commonwealth waters. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2676 m in the Bass Canyon.

Proposed Activity

The survey area is the area within which the seismic source (airguns) will be operational and seismic data will be acquired, including soft start procedures and run-outs (required to obtain full fold coverage). The seismic source will not be operational outside of the survey area. An operational area or 'buffer' around the survey area is required for activities including streamer deployment and retrieval, maintenance and recovery, and vessel manoeuvring (line turns). There will be no seismic operations in the buffer area. Transit to and from the survey area is excluded from the scope of this EP.

The survey is currently planned to commence in November/December 2018 and continue for no more than six and a half months, allowing for some downtime due to weather, avoiding conflicts with other users and marine megafauna, and maintenance. The timing of the activity is subject to availability of the survey vessel for conducting the survey, client data requirements, sea state conditions suitable for marine seismic acquisition, and granting of the required regulatory approvals and access authorities. Seismic data will be acquired over a 24-hour period, with shut downs for routine and reactive maintenance, repairs, transit and line turns, fauna and stakeholder avoidance.

Operational Activities

The proposed activity is a typical 3D survey similar to the majority of others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. CGG is committed to minimising potential for interactions with other marine users and welcomes early engagement. The specific survey vessel that will be used for the survey is yet to be determined, but will be conducted using a purpose-built seismic vessel similar in specifications to the *M/V Geo Coral*.

During the proposed activity, the survey vessel will traverse a series of pre-determined sail lines within the survey area at a speed of approximately 4.5 to 5 knots (8 to 9.3 km/hr). As the vessel travels along the survey lines a series of noise pulses (every 8-10 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranges along a number of hydrophone cables (streamers) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The seismic array will comprise of 8 to 12 solid streamers, with a maximum length of 8,100 m. Streamer spacing will be between 50 and 100 m and survey line spacing will be between 500 and 1,000 m. The acoustic source (airgun array) will be towed at 5 to 9 m (+/-1 m) below the sea surface, and the streamer tow depth will be 6 m at the head of the streamers and 50 m at the tail.

There will be three source arrays, but only one will be discharged at each shotpoint which are spaced 18.75 m apart ('flip/flop/flap' firing sequence). Each source array has a maximum volume of 3,000 cubic inch (in^3), operated at a pressure of 2000 psi.

Undershooting will occur around the platforms within the survey area. During undershooting, a second vessel with an identical source will be positioned approximately 4 km from the main survey vessel on the opposite side of the platform. The sources from each vessel would be fired alternately every 16-20 seconds.

A support vessel will accompany the survey vessel to maintain a safe distance between the towed array and other vessels, and to manage interactions with shipping and fishing activities, if required. The support vessel will also re-supply the survey vessel with fuel and other logistical supplies. During the survey, it is possible that the survey vessel will be refuelled at sea using the support vessel, either within or immediately adjacent to the survey area. At sea refuelling will only take place during daylight hours, and outside the boundaries of any Commonwealth or State marine protected areas. Helicopter transfers may also be planned to facilitate crew changes.

The Gippsland MSS comprises three zones (see attached figure):

- Main zone (acquisition along ESE/WNW sail lines)
- Shallows zone (acquisition along NE/SW sail lines)
- Southern survey zone (acquisition along ESE/WNW sail lines)

The main zone would take about 3 months in total to survey and the other areas would take about 3-5 weeks each. Start dates and durations of individual areas have not been determined at this time. Note that the main area could also be broken down into smaller sub-areas with variable start dates and durations. The southern extension zone would only be undertaken if there was sufficient time following the surveys in the main and shallows zones. Seismic acquisition in the shallows zone would use an eight streamer configuration.

Communication Commitments

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period.

If you would like to comment, or would like additional information, please do not hesitate to contact CGG using the details below. CGG will also be available for face-to-face meetings to discuss any concerns. All communication received will be acknowledged, assessed and appropriately responded to.

Please advise if you do not want to receive further updates.

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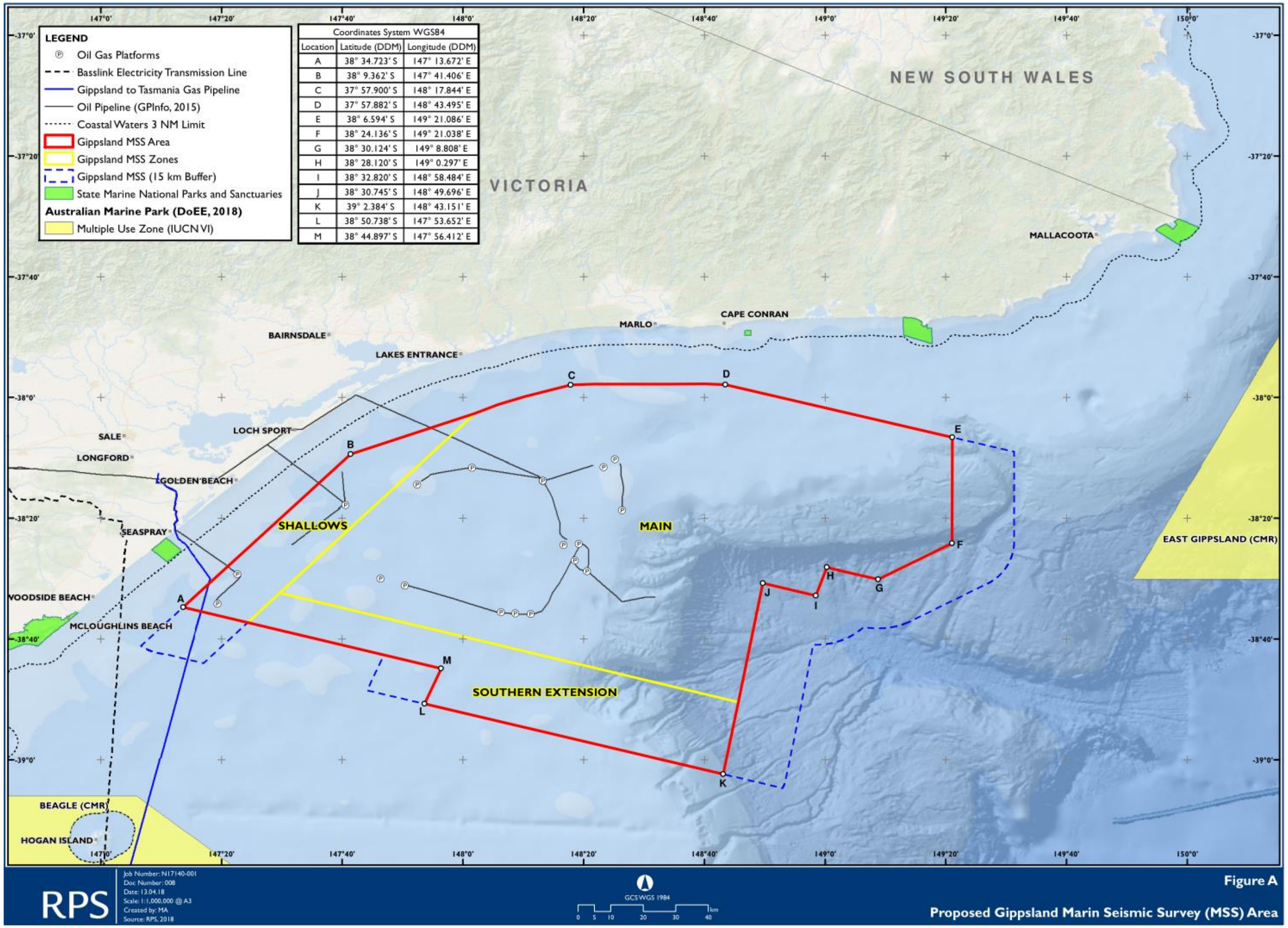

Coordinates System WGS84		
Location	Latitude (DDM)	Longitude (DDM)
A	38° 34.723' S	147° 13.672' E
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F	38° 24.136' S	149° 21.038' E
G	38° 30.124' S	149° 8.808' E
H	38° 28.120' S	149° 0.297' E
I	38° 32.820' S	148° 58.484' E
J	38° 30.745' S	148° 49.696' E
K	39° 2.384' S	148° 43.151' E
L	38° 50.738' S	147° 53.652' E
M	38° 44.897' S	147° 56.412' E

RPS

First stakeholder consultation letter - general - rev 2

Gippsland Marine Seismic Survey

Introduction

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 15,500 km^2 including approximately 13,000 km^2 where seismic data would be acquired (see attached figure). The survey vessel will be at least 12 km offshore in Commonwealth waters. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2676 m in the Bass Canyon.

Proposed Activity

The survey area is the area within which the seismic source (airguns) will be operational and seismic data will be acquired, including soft start procedures and run-outs (required to obtain full fold coverage). The seismic source will not be operational outside of the survey area. An operational area or 'buffer' around the survey area is required for activities including streamer deployment and retrieval, maintenance and recovery, and vessel manoeuvring (line turns). There will be no seismic operations in the buffer area. Transit to and from the survey area is excluded from the scope of this EP.

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- Southern survey zone (acquisition along ESE/WNW sail lines)

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Communication Commitments

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period.

If you would like to comment, or would like additional information, please do not hesitate to contact CGG using the details below. CGG will also be available for face-to-face meetings to discuss any concerns. All communication received will be acknowledged, assessed and appropriately responded to.

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In the event that your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

Details of all consultations will be provided to NOPSEMA as required under legislation.

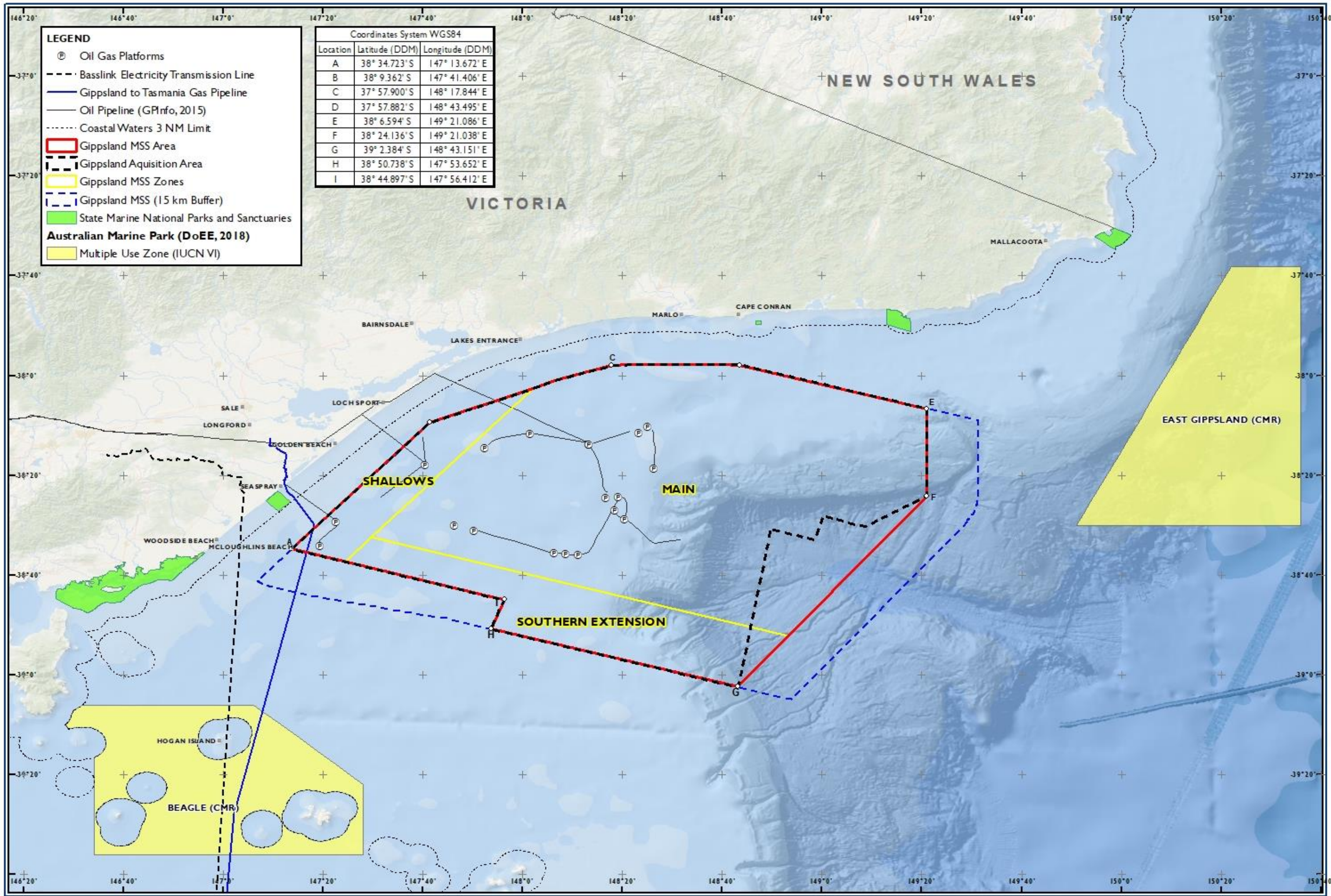
Thank you for your engagement in the Stakeholder Consultation process.

Contact

Phone: 1800 501 541

Email: CGGgippsland@rpsgroup.com.au

Location



Coordinates System WGS84		
Location	Latitude (DDM)	Longitude (DDM)
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G	39° 2.384' S	148° 43.151' E
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I	38° 44.897' S	147° 56.412' E

RPS
Job Number: N17140-001
Doc Number: 008
Date: 07.08.18
Scale: 1:1,250,000 @ A3
Created by: VB
Source: RPS, 2018

Figure A

Proposed Gippsland Marin Seismic Survey (MSS) Area

RPS

Second stakeholder consultation letter

RPS

Second stakeholder consultation letter – general – rev 0

Gippsland Marine Seismic Survey

Stakeholder Update 4 September 2018

Project Update

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 16,850 km^2 including approximately 14,100 km^2 where seismic data would be acquired. The survey vessels (primary and secondary seismic vessels, support and chase vessels) will be at least 12 km offshore in Commonwealth waters. Two seismic vessels would work together for “undershooting”; surveying the geology underneath the existing petroleum platforms. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2676 m in the Bass Canyon. The spatial extent of the area in which seismic data will be acquired (the ‘Acquisition Area’) and additional area required for turning the seismic vessel (the ‘Operational Area’) are shown in Figure 1. The survey is intended to commence in November / December 2018 and run for approximately 6.5 months.

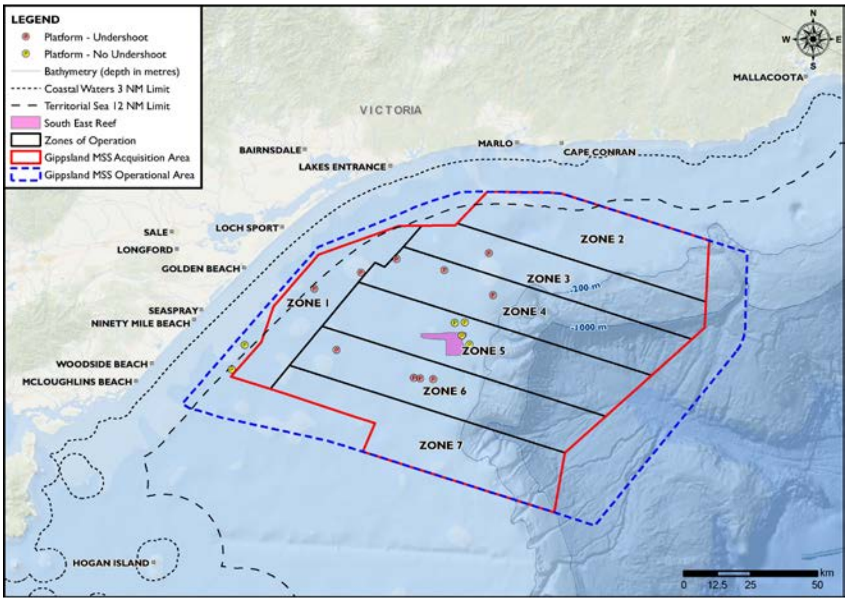

Figure 1: The Gippsland MSS Acquisition and Operational Areas Showing Survey Zones and Undershooting Locations

Displacement of other marine users

The seismic vessel will be towing long “streamers” bearing hydrophones for recording seismic data and will have restricted ability to manoeuvre on the water. It must stick to pre-determined “sail-lines” to create a reliable seismic dataset and enable assessment of the regional geology. For this reason, other vessels on the water will need to take evasive action to avoid the seismic vessel; however, no vessels will be excluded from the whole area for the duration of the survey.

CGG has considered the feedback from stakeholders to date and devised a zoning scheme breaking the survey area into smaller blocks where other users will only be excluded for a short period (Figure 1). This will enable marine users to plan their activities around the location and forward plans of the seismic vessel.

Zone 1 will be acquired in November-December to avoid interfering with migrating humpback whales. Zone 5 will be surveyed in March-April to minimise impacts to spawning fish near South East Reef. The other zones will be surveyed as appropriate to meet survey efficiency objectives and to cooperate with petroleum facility activities.

Ongoing consultation

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period. CGG plans to hold an additional face-to-face meeting in the Lakes Entrance area in response to stakeholder requests.

If you would like to comment, or would like additional information, please do not hesitate to contact us using the details below. All communication received will be acknowledged, assessed and appropriately responded to.

Please advise if you do not want to receive further updates on this project.

CGG has endeavoured to reach all relevant persons, but recognises that further persons may self-identify or come to our attention in coming weeks. Please advise CGG, or pass this update on, if you are aware of any other relevant parties whose interests, functions or activities may be affected by the planned survey.

In the event that your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

Details of all consultations will be provided to NOPSEMA as required under legislation.

Thank you for your ongoing engagement in the Stakeholder Consultation process.

Contact CGG

Phone: 1800 501 541

Email: CGGgippsland@rpsgroup.com.au

Website: https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information

Marine seismic research link: http://www.soundandmarinelife.org/?_sm_au_=iFVFqS62kQjf3SQ5

RPS

Second stakeholder consultation letter – fishers and fisheries – rev 0

Gippsland Marine Seismic Survey

Stakeholder Update 4 September 2018

Introduction

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 16,850 km2 including approximately 14,100 km2 where seismic data would be acquired. The survey vessels (primary and secondary seismic vessels, support and chase vessels) will be at least 12 km offshore in Commonwealth waters. Two seismic vessels would work together for "undershooting"; surveying the geology underneath the existing petroleum platforms. Undershooting would not require more frequent seismic pulses but would require the lines to be closer together to maintain data quality. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2676 m in the Bass Canyon. The spatial extent of the area in which seismic data will be acquired (the 'Acquisition Area') and additional area required for turning the seismic vessel (the 'Operational Area') are shown in Figure 1. The survey is intended to commence in November / December 2018 and run for approximately 6.5 months.

Since May this year CGG has been undertaking consultation to inform and gain feedback from stakeholders whose functions, interests or activities may be affected by the proposed MSS. The purpose of this letter is to update relevant stakeholders on revised survey strategies, based on stakeholder feedback and updated underwater sound modelling, that aim to minimise impacts to stakeholders such as commercial fishers.

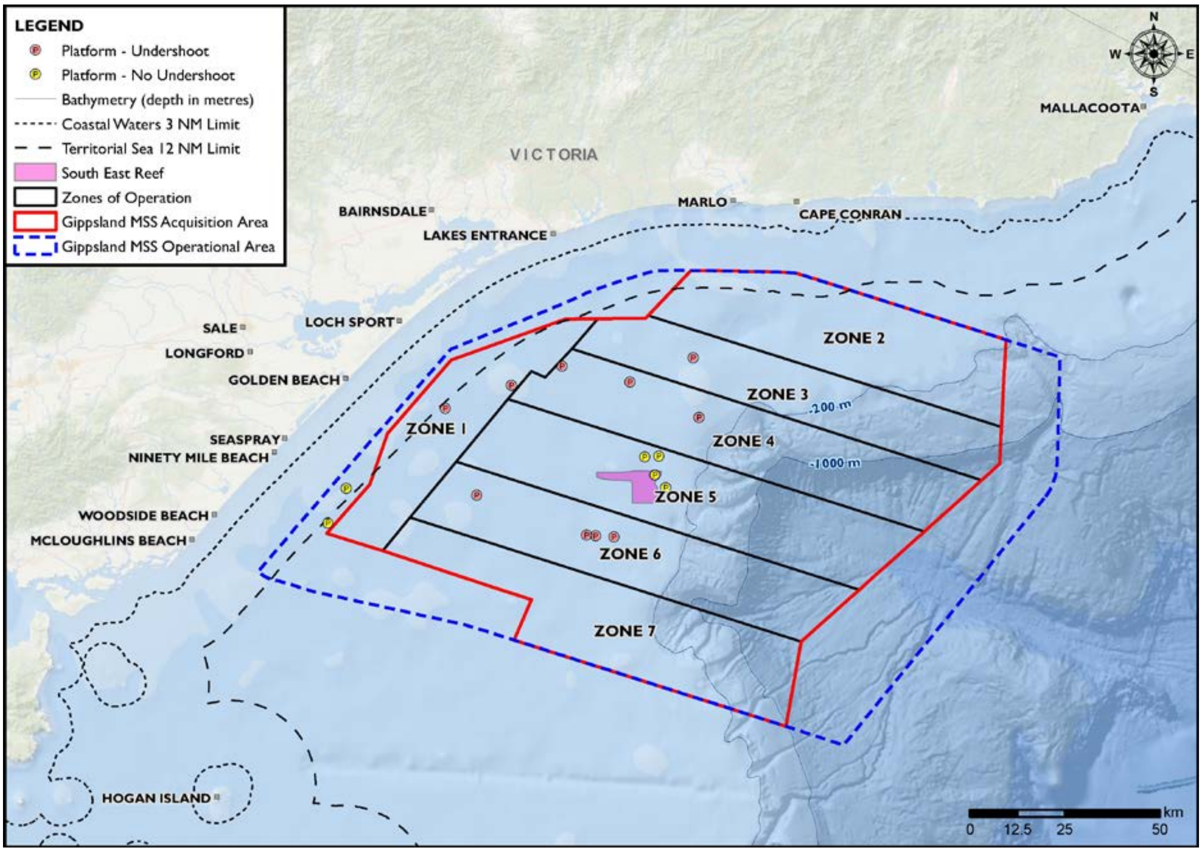

Figure 1: The Gippsland MSS Acquisition and Operational Areas Showing Survey Zones and Undershooting Locations

Why is this survey needed

The Gippsland marine seismic survey is a typical 3D survey similar to the majority of seismic surveys conducted in Australian marine waters in terms of technical methods and procedures. While there have been seismic surveys in the Gippsland Basin over the last ~50 years, this survey has been proposed because CGG has identified a number of issues with previous surveys that prevent a comprehensive regional geological evaluation of the Gippsland Basin. This survey is intended to resolve these issues by achieving a basin-wide coverage of seismic data to accurately map the extent of geological structures within the basin with confidence. Discovery of further hydrocarbon reserves could extend the working life of the existing petroleum industry in the region. Further details of the proposed survey have been described in previous correspondence and are available at CGG's website (https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information).

Effects of seismic surveys

Consultation carried out to date with relevant stakeholders for the Gippsland MSS has identified specific concerns over the impacts of seismic activities on commercial fisheries which are widely held in the local fishing industry and amongst other interested parties. These concerns can be summarised into three key areas:

- loss of access to fishing grounds (displacement)
- impacts of seismic sound on the health and reproduction of commercially fished species, or on the planktonic eggs and larvae of commercially important species
- uncertainty in the effects of seismic sound on fish.

A review of these potential impacts, the impact assessment which CGG has conducted and the associated controls to minimise them are provided in the following sections.

Displacement of other marine users

Fishing industry stakeholders have identified concern over the loss of access to fishing grounds throughout the survey and interference with fishing gear (e.g. entanglement). The seismic vessel will be towing long “streamers” bearing hydrophones for recording seismic data and will have restricted ability to manoeuvre on the water. It must stick to pre-determined “sail-lines” to create a reliable seismic dataset and enable assessment of the regional geology. For this reason, other vessels on the water will need to take evasive action to avoid the seismic vessel; however, no vessels will be excluded from the whole area for the duration of the survey.

CGG has considered the feedback from stakeholders to date and devised a zoning scheme breaking the survey area into smaller blocks where other users will only be excluded for a short period. This will enable fishers and other marine users to plan their activities around the location and forward plans of the seismic vessel.

No long-term displacement or significant disruption to fishing activities is expected because the Acquisition Area has been divided into 7 zones (Figure 1) and the seismic vessels will only be in any zone for a maximum of one month at a time. During the month each of these zones is being surveyed, the broader area will remain completely open to fishing and other activities. The timing of the acquisition within each zone will be determined by weather, avoidance of whales (if necessary), petroleum activities and avoiding impacts to fish spawning in key areas.

Zone 1 will be acquired in November-December to avoid interfering with migrating humpback whales. Zone 5, encompassing Southeast Reef which was identified as an important fishing and spawning area, will be surveyed in March-April when fish spawning is at its lowest for most species. The other zones will be surveyed as appropriate to meet survey efficiency objectives and to cooperate with petroleum facility activities.

Relevant fishers will be kept informed of survey activities so that their fishing operations can be planned to avoid the area in which the survey vessels are active. A Notice to Mariners will provide official notification of the exclusion zones. Pre-survey notifications will commence four weeks prior to the start of the survey so that fishers have time to remove fishing gear, with ongoing communication happening 7 to 10 days prior to the survey (“look aheads”) and daily updates during the survey period.

Impacts of seismic sound

The dominant source of underwater noise during the Gippsland MSS will be from the operation of the seismic source (airgun array), which is proposed to be in frequent operation for the duration of the survey. The source will have a maximum volume of 3000 cubic inch (in3) which is smaller than the seismic survey sources used in many other surveys. During the proposed activity, the seismic survey vessel will traverse a series of pre-determined sail lines within the Acquisition Area at a speed of approximately 4.5 to 5 knots (8 to 9.3 km/hr). Seismic data will be acquired in water depths of 35 to 2650 m. The seismic array is highly directional; focussing sound energy towards the seabed, but will also ensonify the surrounding water column to a lesser extent. The underwater sound generated by the array will be strongest at the source and rapidly decrease with distance from the source.

Marine biota in the area of ensonification will be exposed to different received levels of sound energy, depending on their behaviour, physiology and where they are in relation to the source. However, actual near-field and far-field received sound levels are influenced by a number of factors including the overall size (volume) of the acoustic source, the array configuration, water depths in the area, position in the water column, distance from the source and geoacoustic properties of the seabed.

CGG carried out underwater sound propagation modelling for the sound generated by the seismic source within the Gippsland MSS Acquisition Area, to enable prediction of the spatial extent of the underwater sound impacts on marine fauna. The modelling and impact assessment used highly conservative assumptions around the predicted levels of noise and also the extent of environmental effects from the sound pulses. CGG also comprehensively analysed historic underwater sound data from the Gippsland Basin to cross-calibrate the model and ensure it reflects the real situation in this area. Details of the underwater sound modelling and impact assessment are provided below in Appendix 1.

The impacts to marine fauna were based on widely accepted threshold levels, exposure levels or criteria for impacts; in line with international practice in assessing underwater sound impacts.

Impacts to invertebrates (including bivalves and cephalopods)

The underwater sound modelling was used to predict the area over which impacts to marine invertebrates may occur and included the area along the borders of the Acquisition Area where sound would extend beyond that area. For invertebrate species, the largest area of effect was based on the potential for a range of sub-lethal effects to occur as reported by Day et al. (2016, 2017), ranging from physiological to behavioural disturbance effects. The modelled distances from the vessel at which invertebrates may be affected by the seismic sound are shown in Table 1.

Table 1: Modelled Impact Ranges for Invertebrates

Invertebrate Group	Species	Exposure Level Reference	Predicted Maximum Impact Distance	
			Shallow water (<200 m)	Midwater (200-1000 m)
Crustaceans	Rock lobsters Prawns	209 dB re 1µPa (Lpk-pk) Sub-lethal effects Day et al. (2016)	92 m	160 m
Bivalves	Scallops	191 dB re 1µPa (Lpk-pk) Sub-lethal effects Day et al. (2016)	625 m	Species does not occur
Cephalopods	Squid, octopus	162 dB re 1µPa^2.s (SEL) Behavioural effects McCauley and Fewtrell (2012)	1.4 km	2.2 km

Impacts of the Gippsland MSS on southern rock lobster and prawns are expected to be minor. For benthic adults potential effects will be limited to temporary effects in small areas (<100 m) directly under the source in areas associated with reefs or outcroppings, where depths are less than the maximum depth limit of 200 m for these species.

Impacts of the proposed survey on scallops are also expected to be minor and limited to short-term effects within 625 m of the seismic source. Commercial scallops are mainly found at depths of 10-20 m but may also occur down to 60 m. The main scallop grounds are in less than the minimum depth of the survey area (34 m) and are mainly to the south of the operational area. There are no known areas of importance for scallops within the Acquisition Area, and a very low level of commercial fishing effort within the Gippsland Basin.

No mortality of scallops or lobsters are predicted as a result of exposure to single pulses of seismic sound; however, Day et al. (2016) observed that it is possible that repeated seismic exposure could cause physiological damage leading to mortality during undershooting. Repeated exposure during normal survey operations is unlikely given that adjacent lines will generally be acquired more than 24 hours apart and biota can recover between exposures which will diminish as the vessel moves to further lines. CGG has also revised survey plans to avoid intensive undershooting activities in the vicinity of South East Reef, which is expected to be important lobster habitat.

Impacts on squid and octopus are predicted to be limited to behavioural disturbance up to 1.4 km (in <200 m water depth) and up to 2.2 km (in 200 to 1000 m depth) from the seismic source. Squid and octopus within the Acquisition Area are expected to be predominantly found in depths of <200 m; however, can occur down to 825 m. The area of ensonification for these species could therefore extend a distance of 1.4 km from the boundary of the Acquisition Area in the inshore direction and 2.2 km from the 825 m depth contour in the offshore direction. This however, is an over-estimation of the extent of behavioural disturbance effects as the whole of this area will not be permanently ensonified for the whole duration of the survey and animals avoiding the seismic sound can return to areas previously acquired, or not yet acquired. Squid and octopus exposed to received sound levels eliciting a behavioural response will recover between sail lines and no long-term effects are predicted.

For planktonic stages of commercial invertebrates, exposure to the seismic sound would be transient as the vessel will be constantly moving and the plankton is constantly moving under the influence of oceanographical processes. Planktonic assemblages are very widely spread at sea and localised impacts on their populations are expected to be very localised and short-term, with negligible population level effects compared to the natural high rates of planktonic turnover.

Impacts to fish (including sharks)

The effects of underwater noise on fish within the vicinity of the Gippsland MSS may be either physiological injury (no fish mortality is expected) or behavioural disturbance. Behavioural changes are expected to be localised and temporary, with displacement of pelagic or migratory fish likely to have insignificant repercussions at a population level.

The ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014) gathered relevant scientific experts and regulators to define acoustic impact guidelines for fish. Popper et al. (2014) cite studies on seismic sound effects on fish and confirm that no studies have linked mortality of fish, with or without swim bladders, to seismic noise from airguns or in experimental studies replicating seismic sound fields (Popper et al. 2005; Boeger et al. 2006; Popper et al. 2007; Hastings et al. 2008; Halvorsen et al. 2011, 2012; Casper et al. 2012; McCauley and Kent 2012; Miller and Cripps 2013; Popper et al. 2015). Empirical evidence comes from a study by Wagner et al. (2015) which exposed gobies to seismic sound at a level greater than the mortality and potential mortality threshold previously proposed by the Popper et al. (2014). The fish were exposed to six discharges at an average peak sound pressure level (SPLpeak) of 229 dB re 1 µPa. Fish were monitored for 60 hours post exposure and no mortality or significant physiological damage (hair cell or otolith damage) were observed. In another study, individuals of four fish species were exposed to piling noise levels above a peak SPL of 207 dB re 1 µPa, but did not suffer any mortal or potentially mortal injuries (Casper et al. 2012).

A range of responses have been observed when studying the behaviour of wild fish species in the presence of anthropogenic sounds. Some fishes have shown changes in swimming behaviour and orientation, including startle reactions (Pearson et al. 1992; Wardle et al. 2001; Hassel et al. 2004). Sound can also cause changes in schooling patterns and distribution (Pearson et al. 1992). However, researchers have observed that once acoustic disturbances are removed, fish return to normal behaviour within about an hour (Pearson et al. 1992; McCauley et al. 2000; Wardle et al. 2001).

Potential recovery in European seabass and European eel exposed to seismic sound was investigated by Bruintjes et al. 2016 and Radford et al. 2016. European seabass experienced 12 weeks of impulsive noise showed no differences in stress, growth or mortality compared to those reared with exposure to ambient-noise playback (Radford et al. 2016). Anthropogenic noise-induced effects quickly dissipated and European eel and European seabass showed rapid recovery of startle responses and startle latency within 2 minutes after noise cessation (Bruintjes et al. 2016). Seabass also showed complete recovery of ventilation rate when exposed to peak SPLs of ~200 dB re 1 µPa; whereas eels showed rapid albeit incomplete recovery compared with ambient conditions.

The areas of ensonification predicted by the underwater sound modelling for fish were based on the largest area of effect within the survey area. The largest predicted area of ensonification for fish was based on the potential for temporary threshold shift (TTS) effects, i.e. effects that are temporary but recoverable.

Although potential injury could occur directly below the source and within a few hundred meters (Table 2), this is a conservative approach because in reality there would be a range of effects within these impact ranges, including recoverably injury (Popper et al. 2014). Furthermore, these mobile species are likely to avoid the approaching airgun well before the noise reaches injurious levels, highlighting the fact that behavioural effects are more likely than physical and physiological effects at lower sound levels (Carroll et al. 2017), and are the most ecologically realistic consideration when assessing the impacts of seismic surveys (Bruce et al. 2018). Based on the expert review carried out by Popper (2018), it is highly unlikely that there would be physical damage to fishes as a result of a seismic survey unless the animals are very close to the source (perhaps within a few meters), with TTS being the most likely (if any) level of effect.

Popper (2018) further concludes that if TTS does take place, the duration of exposure to the most intense sounds that could result in TTS will be over just a few hours, and therefore, accumulation of energy over longer periods than a few hours is probably not appropriate. If TTS takes place, Popper (2018) concludes that it is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity, with recovery within 24 hours. Any fish species that occurs with 500 m to 1.5 km of the seismic source could experience TTS, however effects are recoverable once the seismic vessel has passed overhead.

For the undershoot areas, as the seismic vessels will acquire adjacent sail lines between 500 and 1000 m from the preceding sail line less than 24 hours apart, cumulative exposure is possible (if the fish don't move); however, recovery is still expected to occur as soon as the loudest sound passes overhead. CGG has modelled accumulated sound levels for TTS over periods of 24 hours to determine if there may be potential effects from sound received from shots received over a 24 hour period. Modelling received sound levels over 24 hours or longer assumes that very distant single shot SELs will be audible to fish and contribute to hearing fatigue that may eventually result in TTS. An independent review carried out by Popper in 2018 on cumulative TTS levels stated that in reality, fish will not hear sound over these distances, hence including the accumulated sound energy from distant shots over a full 24 hour period SELcum is considered to be highly conservative. Popper (2018) highlighted that it is important to consider how much of the sound is received (heard) by individual fish in a population. Fish will only hear and be exposed to relatively "loud" sounds close to the sound source for a relatively short period of time. Popper (2018) further explains that the effects of TTS are unlikely to show up in fishes until the intensity of the sound is well above the fish's hearing threshold. For fish species that are free swimming (which include key commercially targeted species) it is likely that there would be no TTS effect whatsoever since fish will likely move away from the sound source as the vessel approaches.

There is likely to strong response from fish within tens of meters of the operations and moderate level effects within hundreds of meters, with a low risk of disturbance >1000 m (Popper et al. 2014). Behavioural effects include changes in schooling and feeding behaviour, decreased predatory avoidance (although predators are also likely to be similarly impacted), and disruption to spawning. However, such behavioural changes are expected to be temporary as the seismic vessel traverses each survey line, localised in spatial extent, and most relevant to continental slope habitat which comprises only a small part of the overall survey area. Further, any effects are expected to be short-term and limited to duration that the fish is exposed to the source, which for a pelagic (free swimming) species would be limited to the time taken for the fish to swim away from the source.

Fisheries stakeholders have identified Southeast Reef as an important fish habitat and possibly spawning area and CGG has agreed to significantly reduce the power of the source array when running over the top of this area (< 150 in3 compared to 3000 in3) and to avoid any undershooting in this area.

For fish planktonic stages, the potential impacts of seismic sound will be similar to those described above for the planktonic stages of invertebrates, and relative to the large area of southern Australian waters where these planktonic stages will occur the impacts on their biomass is expected to be very localised and short-term, with negligible population level effects compared to the natural high rates of planktonic turnover. No medium or long-term effects are therefore predicted for fish species as a result of seismic operations. No significant effects on key biological process of spawning, feeding, breeding or migration, are predicted for commercially important species.

Table 2: Modelled Impact Ranges for Fish (including Sharks)

Fish Group	Popper *et al.* (2014) Exposure Level	Predicted Maximum Impact Distance		
		Shallow water (<200 m)	Midwater (200-1,000 m)	Deep water (>1,000 m)
Fish: No swim bladder (also applied to sharks)	213 dB re 1µPa (Lpk-pk) Mortality and potential mortal injury / recoverable injury	80 m	115 m	120 m
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing	207 dB re 1µPa (Lpk-pk) Mortality and potential mortal injury / recoverable injury	145 m	210 m	232 m
Fish: ALL GROUPS (No swim bladder (also applied to sharks), Swim bladder not involved in hearing, Swim bladder involved in hearing)	186 dB re 1µPa^2.s (SEL_{24h}) TTS	500 m	1.1 km	1.5 km

Mitigating impacts to fisheries

Stakeholder feedback identified concern over the longer-term effect of seismic activity on fish catchability. This is difficult to assess because of the confounding influences of other factors such as fishing pressure, climatic changes and variation in natural population dynamics. A series of studies have been undertaken to determine the effects of seismic surveys on fish catches and distribution, primarily in California (Greene 1985, Pearson et al. 1992), Norway (Dalen and Knutsen 1987; Lokkeborg and Soldal 1993) and the UK (Pickett et al. 1994). While the conclusions from these studies were largely ambiguous due to the inherently high levels of variability in catch statistics, one study noted that pelagic species appear to disperse, resulting in a decrease in reported catches during the surveys (Dalen and Knutsen 1987).

More recently, the potential impact on the catchability of commercially important fish species was investigated using a 2D seismic survey in the Gippsland Basin to quantify fish behaviour and commercial fisheries catches across the region before and after airgun operations (Bruce et al. 2018). This study monitored acoustically tagged species (gummy shark, swell shark, tiger flathead) before, during and after the seismic survey and found little evidence of consistent behavioural responses, except for flathead, which increased their swimming speed during the seismic survey period and changed their diel movement patterns after the survey (Bruce et al. 2018). Modelling of logbook data for 15 commercially fished species and two gear types (Danish seine, gillnet) showed that catch rates following the seismic survey were significantly different than predicted in 9 out of the 15 species, with six species (tiger flathead, goatfish, elephantfish, boarfish, broadnose shark and school shark) showing increases in catch following the seismic survey, and three species (gummy shark, red gurnard, and sawshark) showing some reductions (Bruce et al. 2018).

The results of this study on fish catch rates in the Gippsland Basin are directly relevant to CGG's proposed survey. Catch rates for commercially important fish and invertebrate species are expected to be unaffected or to recover rapidly following the seismic. Fish and invertebrate species are expected to recover within 24 hours, with recovery beginning as soon as the loudest (most intense) sound passes overhead and they are expected to be catchable when access to the zone is reinstated. The consultation process identified Southeast Reef as an important area for commercial fishing and CGG's strategy to reduce airgun volume to <150 in3 over the reef will be effective in mitigating any impacts on fisheries in this area.

Mitigating impacts on spawning fish

Commercially important fish species that occur within the area that might be affected by the seismic activity are predominantly broadcast spawners (species that release vast numbers of sperm and eggs into the water column), but some such as octopus deposit them on the seabed. Several species form spawning aggregations on the continental shelf, shelf break and slope; however, no significant spawning aggregation areas are known to occur in the vicinity of the survey area, although information regarding fish spawning is generally not well documented.

Recognising the uncertainty in the location of spawning areas, CGG has adopted a control measure to mitigate possible impacts on spawners by assessing spawning periods for key species of Commonwealth and State-managed fisheries expected to be active within area that might be affected by the seismic activity. These species are likely to spawn on or around large reef systems such as Southeast Reef. Note that this table does not include information for species that do not spawn within the south-east marine region (tuna, billfish, gemfish west, John and mirror dory, and school and king prawns) or do not spawn during the proposed November-June survey window (sawshark and ribaldo).

March and April were identified as the months with the lowest sensitivity for spawning (Table 3). As such, and in recognition of the importance this reef has to fishers (as identified from stakeholder feedback), CGG has committed to acquiring seismic data within the zone that encompasses Southeast Reef in March / April.

Table 3 Spawning times for key commercially fished species

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blue grenadier												
Tiger flathead												
Rock lobster												
Pink ling												
Blue warehou												
Eastern school whiting												
King George whiting												
Snapper												
Gummy shark												
School shark												
Scallop												
Pale/Maori Octopus												

+ Dark blue cells indicate spawning period.
** Green cells indicate months of lowest sensitivity.

Addressing uncertainty in effects of seismic sound on fish

CGG recognises that there are gaps in the scientific understanding of how underwater sound affects marine life, including commercially fished species. Stakeholders identified this as a concern and identified efforts made by CarbonNet for an adjacent survey in funding research to help address the gaps in understanding. CGG acknowledges the initiative by CarbonNet and will assess the findings of that study in terms of the impact assessment for the current survey as soon as they are released publicly. Since the CarbonNet initiative, the Bruce et al (2018) research has been released which provides solid support for CGG's assessment of likely impacts to fish and fisheries in the Gippsland Basin area.

Where there is scientific uncertainty in the assessment, whether it be in relation to modelling, effect thresholds, species sensitivities or occurrence and behaviour, a conservative approach has been taken. This ensures a greater level of protection for important fisheries resources.

CGG conducts seismic exploration in many parts of the word and recognises the importance of robust scientific evidence to support sound impact assessments in general. In order to improve the understanding and impact assessment for future projects, CGG has contributed to dedicated research programs.

Whenever possible, CGG is contributing to advancing science and bridging knowledge gaps on sound and marine life. This northern summer, CGG participated in the first ever test of the response of free-ranging fish to a real seismic survey by supplying one of its seismic source vessels to a world-class scientific research consortium led by the University of Leiden (Netherlands) and supported by the Joint Industry Program Sound & Marine Life. In the experiment, tagged free-ranging fish were exposed to seismic sound and their behaviour was be monitored. The results of this study are not yet available, but will be assessed and made available to inform future impact assessments.

Controls adopted in response to stakeholder feedback

CGG has responded to specific concerns raised by fishers and other stakeholders by adopting the following controls to reduce environmental impacts to ALARP:

- The seismic source (airguns) will be reduced to a low power setting when acquiring sail lines within the boundary of Southeast Reef and a buffer area of 500 m around the reef (Figure 1). The airgun array volume will be reduced to <150 in^3 over this area. The 500 m buffer provides protection for any fish at the edge of the reef as the seismic vessel approaches and is based on the distance at which behavioural effects are predicted for fish.
- There will be no seismic undershooting of the four existing platforms over or in the vicinity of Southeast Reef (Fortescue, Halibut A, Cobia A and Mackerel A). These were included in CGG's initial undershooting plans for the survey.
- Seismic activity within Zone 5 that encompasses Southeast Reef will be completed during the March - April period, as these months have been identified as having the lowest sensitivity for spawning of commercially important fish and invertebrate species.
- Adjacent sail (survey) lines will not be acquired (shot) during the main survey over a period of <24 hours to allow recovery of fish species. This does not include the undershoot areas which need to be more intensively surveyed.
- The Acquisition Area will be divided into 7 zones and fishers and other marine users will be advised ahead of time where the seismic vessel will be operating. This will allow fishers to plan their activities around the presence of the seismic vessel.
- Regular and effective communications will be maintained throughout the survey to ensure fishers remain aware of the areas of exclusion and where the vessel will be at any time.

Ongoing consultation

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period. CGG plans to hold an additional face-to-face meeting in the Lakes Entrance area in response to stakeholder requests.

If you would like to comment, or would like additional information, please do not hesitate to contact us using the details below. All communication received will be acknowledged, assessed and appropriately responded to.

Please advise if you do not want to receive further updates on this project.

CGG has endeavoured to reach all relevant persons, but recognises that further persons may self-identify or come to our attention in coming weeks. Please advise CGG, or pass this update on, if you are aware of any other relevant parties whose interests, functions or activities may be affected by the planned survey.

In the event that your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

Details of all consultations will be provided to NOPSEMA as required under legislation.

Thank you for your ongoing engagement in the Stakeholder Consultation process.

Contact CGG

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Website: https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information

Marine seismic research link: http://www.soundandmarinelife.org/?_sm_au_=iFVFqS62kQjf3SQ5

Appendix 1 Underwater Sound Impacts

CGG has analysed historic seismic survey data within the Gippsland Basin, and more specifically within the proposed Gippsland MSS Acquisition Area. Two historic surveys were selected for the analysis as their spatial extents covered seabed areas and water depths across the Gippsland MSS Acquisition Area. The seismic streamer data from selected sail lines considered representative of the Gippsland MSS acquisition area were analysed to produce measured sound levels close to the surface (i.e. where the streamers are). These measured levels were compared with the predicted sound levels from the underwater sound modelling to provide some form of validation of the modelled levels. The modelled levels were found to be significantly lower than those predicted by the modelling, which provides an additional level of conservatism and precaution in the impact assessment which is based on the predicted impact ranges based on the modelling.

Plankton, Fish Larvae and Eggs

Guideline thresholds for mortality to eggs and larvae have been proposed based on the sound exposure guidelines by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014). These guidelines represent the Working Group's efforts to establish broadly applicable guidelines for ichthyoplankton (fish eggs and larvae). The criteria that Popper et al. (2014) suggest for mortality in eggs and larvae are based on levels measured in the study by Bolle et al. (2012) that indicated no damage was caused by simulated repeated pile driving at 207 dB re 1 µPa SPLpeak.

More recently, McCauley et al. (2017) reported apparent zooplankton mortality at received levels of 178 dB re 1 µPa (SPLpk-Lpk) up to 1.2 km from a seismic airgun. Although this is not a peer reviewed and accepted threshold this level has also been compared with received levels predicted by the underwater sound modelling.

Lobsters and Scallops

There are no peer-reviewed or recognised sound exposure criteria for invertebrates. Research on the impacts of low frequency sound to marine invertebrates is limited (Caroll et al. 2016). Day et al. (2016) assessed the impact of seismic sound on rock lobsters and their larvae, and scallops. Day et al. (2016) concluded in their paper that the results of their study were broadly applicable to lobster and scallop fisheries throughout the world, and to crustaceans and bivalves in general. The exposure levels from that study have been compared with predicted modelled received levels for benthic invertebrates.

Exposure to the maximum measured SPL of 209 to 212 dB re 1µPa (Lpk-Lpk) did not result in mortality of any adult lobsters or a reduction in the quantity or quality of larvae; however, a range of sub-lethal effects to adults were observed (Day et al. 2016). Exposure to air gun signals did not result in any mortality in any of the experiments on lobster conducted in the Day et al. (2016) study; therefore, lobsters and other crustacean species are not expected to be killed at these sound levels.

Exposure to the maximum measured SPL of 191 to 213 dB re 1µPa (Lpk-Lpk) did not result in immediate mass mortality in adult scallops; however, increases in the level of exposure (i.e. repeated exposure to air gun passes) were found to significantly increase mortality. Overall mortality rates in the exposed scallops were at the low end of the range of naturally occurring mortality rates documented in the wild, with control scallops having a total mortality rate of ≤5% and exposed scallops showing a mortality rate of 9-11% (Day et al. 2016).

Cephalopods – Squid and Octopus

There are no peer-reviewed or recognised sound exposure criteria for cephalopods. There have been no observed cephalopod mortalities directly associated with seismic surveys. Anecdotal evidence from studies exposing cephalopods to near-field low-frequency sound have shown received levels may cause anatomical damage, however research is limited to experiments in artificial tanks, rather than in the wild, and researchers have cautioned extrapolation of the conclusions of these results (Goodall et al., 1990; Popper et al., 2001; Montgomery, 2006; Gray et al., 2016). There is limited information on the hearing sensitivity of octopus to sound stimuli. Kaifu (2008) studied Octopus ocellatus and concluded that the statocyst was responsible for the observed responses kinetic sound energy (particle motion).

McCauley et al. (2000) studied captive squid (Sepioteuthis australis) responses during a seismic survey, where squid showed a strong startle response to nearby air-gun start up and evidence that they would significantly alter their behaviour at an estimated 2 to 5 km from an approaching seismic source. McCauley and Fewtrell (2012) studied the behavioural responses of squid to seismic sound levels. In general, squid displayed an increased frequency of alarm responses, particularly at higher sound levels, and increased swimming speed in the direction of the surface as the airgun approached and remaining relatively stationary near the water surface as the airgun signal became most intense.

The exposure level (162 dB re 1µPa2.s (SEL)) that elicited a strong alarm (avoidance) responses in squid (i.e. squid inking) in the study by McCauley and Fewtrell (2012) has been compared with predicted modelled received levels for the cephalopod species that may occur within the survey area, namely squid and octopus.

Fish

The thresholds for harm to fish species have been based on the sound exposure guidelines for fish proposed by the ANSI-Accredited Standards Committee S3/SC 1, Animal Bioacoustics Working Group (Popper et al. 2014). The guidelines represent the Working Group's consensus efforts to establish broadly applicable guidelines for fish, with specific criteria relating to mortality and potential mortal injury, recoverable injury and TTS.

The Working Group defines the criteria for injury and TTS as follows:

- mortality and potential mortal injury – immediate or delayed death
- impairment:
  - recoverable injury – injuries, including hair cell damage, minor internal or external haematoma, etc (none of these injuries is likely to result in mortality)
  - TTS – short or long-term changes in hearing sensitivity that may or may not reduce fitness (defined as any persistent change in hearing of 6 dB or greater).

Table A: Summary of Fish Injury Exposure Guidelines

Type of Fish	Mortality and Potential Mortal Injury (dB re1 µPa)	Impairment (dB re1 µPa)	
		Recoverable Injury	TTS
Fish: no swim bladder (particle motion detection)	>213 dB peak (Lpk)	>213 dB peak (Lpk)	>186 dB SEL_{cum}
Fish: swim bladder is not involved in hearing (particle motion detection)	>207 dB peak (Lpk)	>207 dB peak (Lpk)	>186 dB SEL_{cum}
Fish: swim bladder involved in hearing (primarily pressure detection)	>207 dB peak (Lpk)	>207 dB peak (Lpk)	186 dB SEL_{cum}
Fish: swim bladder involved in hearing (primarily pressure detection)	N/A	170 dB SPL_{rms}	158 dB SPL_{rms}

Source: Popper et al. (2014)

The guideline levels for each of the criteria above have been derived from a number of sources. The mortality and recoverable injury guidelines are based on predictions derived from effects of impulsive sounds from piling (Halvorsen et al. 2011), since there are no quantified data for acoustic sources. Halvorsen et al. (2011, 2012) measured the 'response severity index (RSI)' of fish species exposed to pile driving. From this study, the authors identified that an RSI of 2 would be an acceptable level of physiological injury for the fish exposed to pile driving, which corresponded to a peak SPL level of 207 dB re 1 µPa. It should be noted that the RSI ranking of 2 relates to 'mild' and 'non-life threatening' injuries.

There are few data on the physical effects of seismic airguns (e.g. mortality, barotrauma) on fish, and of these none have shown mortality (Popper et al. 2014; Carroll et al. 2017). Popper et al. (2014) cite studies on seismic sound effects on fish and state that no studies have linked mortality of fish, with or without swim bladders, to seismic sound from airguns or in experimental studies replicating seismic sound fields (Popper et al. 2005; Boeger et al. 2006; Popper et al. 2007; Hastings et al. 2008; Halvorsen et al. 2011, 2012; Casper et al. 2012; McCauley and Kent 2012; Miller and Cripps 2013; and Popper et al. 2015). Empirical evidence comes from a study by Wagner et al. (2015) which exposed gobies to seismic sound at a level greater than the mortality and potential mortality threshold proposed by the Popper et al. (2014). The fish were exposed to six discharges at an average peak SPL of 229 dB re 1 µPa. Fish were monitored for 60 hours post exposure and no mortality or significant physiological damage (hair cell loss or otolith damage) were observed.

Casper et al. (2012) further investigated the RSI for several fish species; representative of the three fish groups identified by Popper et al. (2014):

- Group1: fish without swim bladders (sharks, rays, flatfish)
- Group 2: fish with swim bladders not involved in hearing (salmonids, sturgeons, jewfish, snapper)
- Group 3: fish with swim bladders involved in hearing and structurally connected to the inner ear, (herring, perch, bass, rockfish).

The study did not identify any mortal or potentially mortal injuries in the four fish species exposed to piling sound levels above an SEL of 177 dB re 1 µPa2.s (or 207 dB re 1 µPa SPL peak). This level was concluded by the authors as being the potential onset of physiologically significant injuries (Casper et al. 2012) rather than mortality, highlighting the highly conservative and precautionary nature of the guideline levels proposed by Popper et al. (2014). It is, however, important to note that the intent of authors in proposing these thresholds was as "a first step in setting guidelines that may lead to the establishment of exposure standards for fish (and sea turtles)" (Popper et al. 2014).

The actual impacts associated with sound levels for the tentative thresholds for mortality/potential mortal injury and recoverable injury proposed by Popper et al. (2014) are therefore deemed to represent the level at which physiological damage may start to occur, as evidenced in the studies by Halvorsen et al. (2011, 2012) and Casper et al. (2012). They do not represent a likely mortal impact zone and empirical field data indicates mortality will not occur at these levels.

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RPS

Second stakeholder consultation letter – titleholders – rev 0

Gippsland Marine Seismic Survey

Stakeholder Update 4 September 2018

Project Update

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. The Gippsland MSS would operate over approximately 16,850 km2 including approximately 14,100 km2 where seismic data would be acquired. The survey vessels (primary and secondary seismic vessels, support and chase vessels) will be at least 12 km offshore in Commonwealth waters. Two seismic vessels would work together for “undershooting”; surveying the geology underneath the existing petroleum platforms. Water depths within the survey area range from a minimum of 34 m along Ninety Mile Beach to a maximum of 2676 m in the Bass Canyon. The spatial extent of the area in which seismic data will be acquired (the ‘Acquisition Area’) and additional area required for turning the seismic vessel (the ‘Operational Area’) are shown in Figure 1. The survey is intended to commence in November / December 2018 and run for approximately 6.5 months.

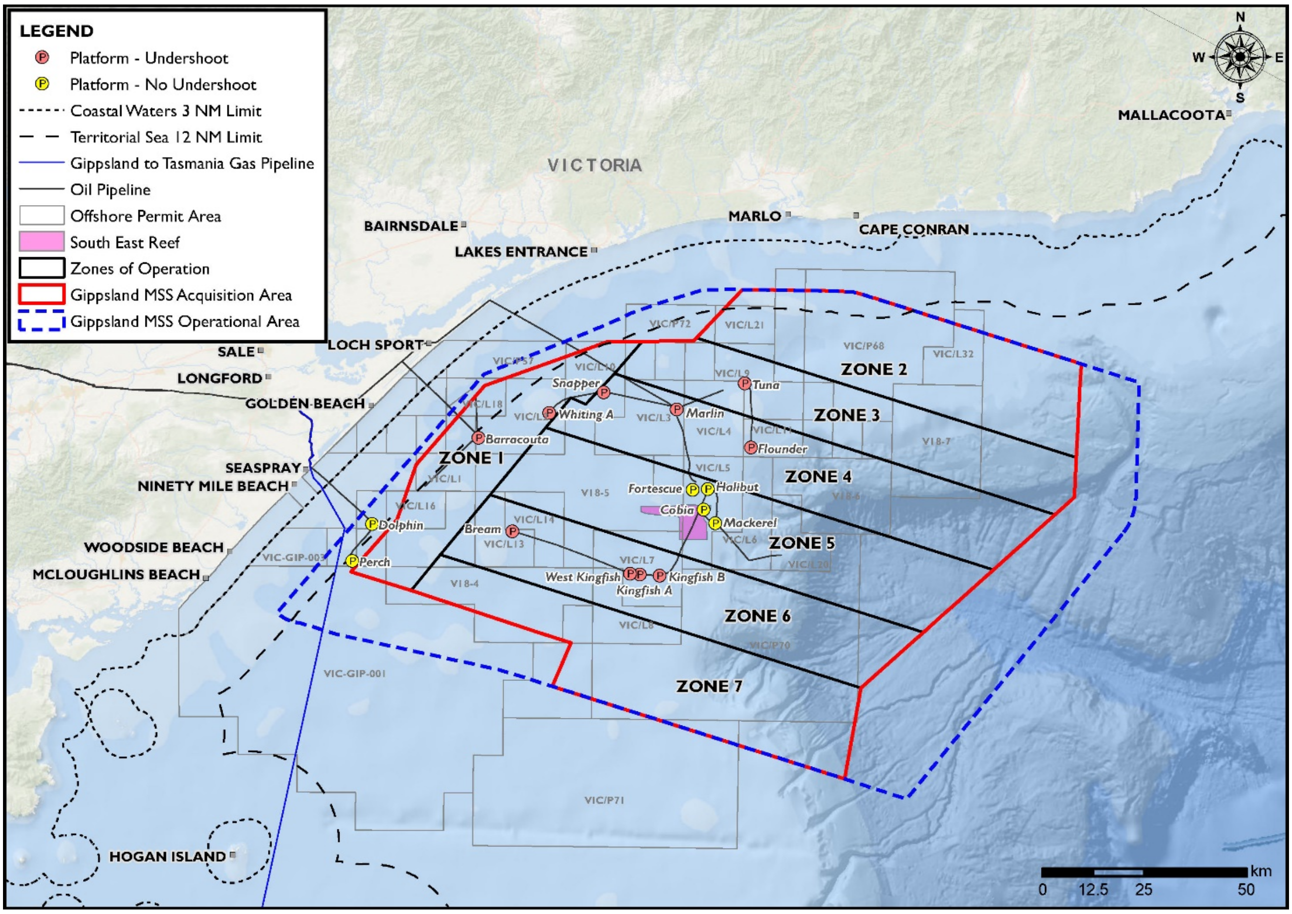

Figure 1: The Gippsland MSS Acquisition and Operational Areas Showing Survey Zones and Undershooting Locations

Displacement of other marine users

The seismic vessel will be towing long “streamers” bearing hydrophones for recording seismic data and will have restricted ability to manoeuvre on the water. It must stick to pre-determined “sail-lines” to create a reliable seismic dataset and enable assessment of the regional geology. For this reason, other vessels on the water will need to take evasive action to avoid the seismic vessel; however, no vessels will be excluded from the whole area for the duration of the survey.

CGG has considered the feedback from stakeholders to date and devised a zoning scheme breaking the survey area into smaller blocks where other users will only be excluded for a short period. This will enable marine users to plan their activities around the location and forward plans of the seismic vessel.

Zone 1 will be acquired in November-December to avoid interfering with migrating humpback whales. Zone 5 will be surveyed in March-April to minimise impacts to spawning fish near Southeast reef. The other zones will be surveyed as appropriate to meet survey efficiency objectives and to cooperate with petroleum facility activities.

SIMOPS Plan

CGG will develop a SIMOPs Plan for the Gippsland MSS in agreement with the relevant operators in the Operational Area (Figure 1). As part of the SIMOPS Plan, CGG will establish a communications protocol outlining all key contacts, confirming schedules and identifying constraints and buffer distances that need to be observed for all known concurrent operations. In areas where diving operations are planned to take place, specific dive procedures will be defined in the SIMOPS Plan, including an extension of the Cautionary Zone to 10 km, and the requirement for a joint risk assessment in advance of any SIMOPS.

Ongoing consultation

CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address any valid concerns raised throughout the EP preparation, pre-survey and survey period. CGG plans to hold an additional face-to-face meeting in the Lakes Entrance area in response to stakeholder requests.

If you would like to comment, or would like additional information, please do not hesitate to contact us using the details below. All communication received will be acknowledged, assessed and appropriately responded to. Please advise CGG, or pass this update on, if you are aware of any other relevant parties whose interests, functions or activities may be affected by the planned survey.

Please advise if you do not want to receive further updates on this project.

In the event that your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

Details of all consultations will be provided to NOPSEMA as required under legislation.

Thank you for your ongoing engagement in the Stakeholder Consultation process.

Contact CGG

Phone: 1800 501 541

Email: CGGgippsland@rpsgroup.com.au

Website: https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information

Marine seismic research link: http://www.soundandmarinelife.org/?_sm_au_=iFVFqS62kQjf3SQ5

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Third stakeholder consultation letter

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Third stakeholder consultation letter – general – rev 0

Gippsland Marine Seismic Survey

Stakeholder Update 21 November 2018

Introduction

CGG Services (Australia) Pty Ltd (CGG) is proposing a three dimensional (3D) marine seismic survey (MSS) in the Gippsland Basin. Offshore petroleum activities such as this must comply with the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and associated Regulations. In addition, the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) specifically governs the assessment of potential risks and impacts on 'matters of national environmental significance' such as national heritage places and migratory species (e.g. whales). The OPGGS and EPBC Acts are administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), and requires an Environmental Plan (EP) be developed to demonstrate that the CGG MSS will be carried out in a manner that is consistent with the principles of ecologically sustainable development (as described in the EPBC Act), and that the environmental impacts and risks associated with the MSS will be reduced to as low as reasonably practicable and are acceptable.

The CGG MSS EP was submitted to NOPSEMA on 7 September 2018 for assessment, and a response received back on 8 October 2018. CGG is currently undertaking a comprehensive review of the EP to address NOPSEMA's comments. The review is focussed on stakeholder consultation, the impacts of seismic sound on cetaceans and commercial fish and invertebrate species, and the impacts of survey activities on fishers.

In addition, CGG is initiating new studies and activities aimed at addressing knowledge gaps in impact assessments of seismic surveys, which were discussed during a third workshop with commercial fishers at Lakes Entrance on 2 November 2018. Representatives from a range of fisheries attended, including trawl/Danish seine, shark, small pelagics, octopus, rock lobster, scallop, squid and charter sectors. Mark Stanley, Regional Geoscience Manager for CGG presented an update on survey plans and new initiatives. Discussion among participants was robust and CGG appreciates that there are ongoing concerns about potential impacts of the seismic survey among the fishing community. CGG has been looking at options for addressing these concerns, as discussed by Mark during the meeting.

As this is the first Stakeholder Update since submission of the EP a summary of updated survey plans and new initiatives is provided below.

Changes to the area and timing of the survey

The initial area of the Gippsland MSS was 16,850 km^2 which included 14,100 km^2 where seismic data would be acquired (the Acquisition Area). The size of this area is driven by a need for basin wide coverage of seismic data to resolve issues identified with previous seismic surveys and to accurately map the extent of geological structures within the basin. It is worth bearing in mind that any discovery of hydrocarbon reserves as a result of this survey will be of great benefit in extending the working life of the existing petroleum industry in the region.

Nevertheless, CGG appreciates stakeholder concerns about the size of the survey and has therefore refined it by removing most of the nearshore and northern zones (Zones 1 and 2) to minimise the environmental footprint whilst still ensuring the survey aims are met. Figure 1 shows the new Operational Area is 13,351 km^2, which includes the revised Acquisition Area of 10,793 km^2. This represents a decrease of 21% and 23%, respectively, and removes overlap with the nationally important 'Big Horseshoe Canyon' – an area of high ecological value – to the northeast of the survey area. It also reduces overlap with fishing habitat in this area, in particular grounds targeted by Danish seiners and an important nearshore scallop bed. It should be noted that the smaller overall decrease in the size of the Operational Area is to allow room to manoeuvre the survey vessel in the deeper offshore waters.

As shown in Figure 1 and described in previous Stakeholder Updates, the Acquisition Area will be divided into zones and fishers and other marine users will be advised ahead of time where the seismic vessel will be operating. This will allow fishers to plan their activities around survey activities. While the number of zones has been reduced in line with reductions in the survey size, the zone numbering system used previously has been retained to avoid confusion.

Additionally, the timing of the survey has been revised so that it is now planned to occur from January to the end of July. This shift avoids impacts on humpback whales transiting through the area in November/December and alleviates concerns expressed by charter fishers and seafood suppliers over potential impacts to their operations during the busy Christmas holiday period. With that in mind, survey activity will commence in Zone 7 to minimise impact to nearshore fishing during summer. CGG intends to complete the survey during 2019, but if necessary, data may also be acquired during the same January – July period in 2020. Importantly, the survey will be completed within six months, regardless of whether it extends over one or two years.

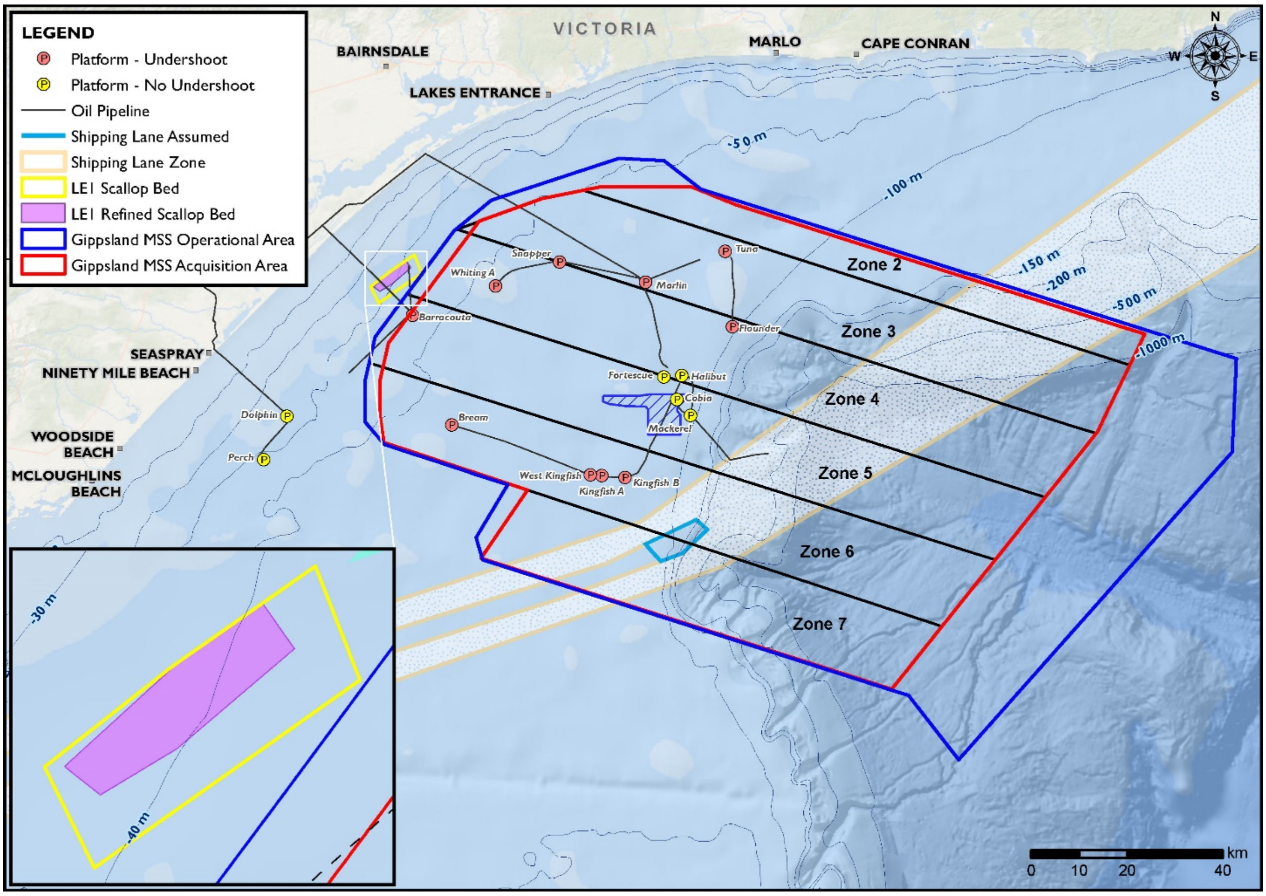

Figure 1: The Gippsland MSS Acquisition and Operational Areas showing revised survey zones

Formation of a Scientific Advisory Committee

CGG believes in an open and balanced approach in addressing the concerns raised by fishers. Formation of a Scientific Advisory Committee comprised of persons with a range of knowledge and experience has been identified as the most useful way of achieving this. The Committee is comprised of scientists, fishing industry reps and fishers.

It will be responsible for providing advice on matters identified during consultation with the fishing industry. The first meeting taking place on 23 November 2018 and will focus on stakeholder concerns around impacts to octopus, scallops and Danish seine fishers. The following sections describe potential studies that will be presented to the committee for discussion.

Research into the impacts on octopus and associated fishery

A concern raised during workshops with fishers is the potential impacts to octopus and those fishers who target them. There is little information on these impacts in the scientific literature, however CGG recognises that octopus are less mobile than many other commercially targeted species and therefore less able to move away from the approaching survey vessel. This makes octopus potentially more vulnerable to the effects of underwater seismic noise. Associated with this is the potential impacts to catches by the octopus fishers, which is compounded by the fact that their fishable habitat is restricted, and they are not easily able to relocate their pots between survey zones to remain clear of the survey vessel.

CGG is currently in discussion with octopus fishers and a university collaborator to develop a scientifically rigorous, field-based study of the impacts of seismic noise on octopus and fishers. The intent is to work with the fishers and incorporate their everyday fishing activity into the experiment in a unique, reality-based study, and publish the data for public use. As with any field-based collaborative research there is still a lot of detail to work through with this study, and it is one of the agenda items for the first meeting of the Scientific Advisory Committee.

Research into the impacts on Danish seine fishers

The area off east Gippsland is the main fishing ground for the Danish seine fishing sector. Danish seine nets are different to trawl nets both in design and operation, being relatively light-weight and used to target flathead and other species over soft, sandy habitat. CGG acknowledges the overlap between habitat fished by this sector and the survey area, and the concerns expressed by fishers over potential impacts to their catch. CGG is therefore investigating ways of working with fishers to monitor these impacts during the survey, and this will be one of the first items to be addressed by the Scientific Advisory Committee.

Managing potential impacts of seismic noise on scallops

Although there has been minimal fishing for scallops in the past few years, the results of the 2017/18 scallop survey by Koopman et al. (2018) highlighted the presence of a scallop bed inshore of the MSS area (shown in Figure 1). Feedback from fishers during the previous consultation meeting at Lakes Entrance has also confirmed the importance of this scallop bed. The impacts of seismic sound on scallops is a contentious issue in southeast Australia where seismic surveys have been blamed for devastating scallop beds, although the variable recruitment rates of scallops confound the ability to distinguish natural from human-induced impacts (seismic or fishing) on scallop populations. Other natural events such as spikes in water temperature have also been linked to major mortality events in southeast Australia during 2010 (Przeslawski et al. 2018). Nevertheless, CGG appreciates that the scallop bed identified inshore of the MSS area is, through the lack of similar beds found elsewhere in the area, important to fishers. CGG has therefore refined the survey area to ensure that no seismic acquisition will occur over the scallop bed defined by Koopman et al. (2018).

Deployment of underwater noise logger

CGG is examining the practicality and usefulness of deploying noise loggers. Unfortunately, the earliest date that they may be available is March 2019. The Scientific Advisory Committee will be asked to consider the value of a late deployment of loggers or alternative way of measuring the seismic amplitudes in the environment such as ocean bottom seismometers.

Control measures adopted in response to stakeholder feedback

In addition to the information described above, CGG has adopted the following control measures (documented in previous stakeholder updates) in response to specific concerns raised by fishers and other stakeholders to reduce environmental impacts to as low as reasonably practicable (ALARP):

- The seismic source (airguns) will be reduced to a low power setting when acquiring sail lines within the boundary of Southeast Reef and a buffer area of 500 m around the reef. The airgun array volume will be reduced to <150 in^3 over this area. The 500 m buffer provides protection for any fish at the edge of the reef as the seismic vessel approaches and is based on the distance at which behavioural effects are predicted for fish.
- There will be no seismic undershooting of the four existing platforms over or in the vicinity of Southeast Reef (Fortescue, Halibut A, Cobia A and Mackerel A). These were included in CGG's initial undershooting plans for the survey.
- Seismic activity over Southeast Reef will be completed during the March-April period, as these months have been identified as having the lowest sensitivity for spawning of commercially important fish and invertebrate species.
- Adjacent sail (survey) lines will not be acquired (shot) during the main survey over a period of <24 hours to allow recovery of fish species. The undershoot areas may need lines to be acquired closer than 24 hours but only a very small area will be affected by this.

- Regular and effective communications will be maintained throughout the survey to ensure fishers and other marine users are aware of the areas of exclusion and where the vessel will be at any time. A Notice to Mariners will provide official notification of the exclusion zones. Marine users will be kept informed of survey activities so that their fishing operations can be planned to avoid the area in which the survey vessels are active. Pre-survey notifications will commence four weeks prior to the start of the survey so that fishers have time to remove fishing gear, with ongoing communication occurring 7 to 10 days prior to the survey ("look aheads") and on a daily basis during the survey.

Ongoing consultation

CGG would like to thank all stakeholders who have provided feedback to date on the proposed survey. CGG is committed to ongoing consultation with all relevant stakeholders regarding the proposed activity and will continue to address stakeholder concerns raised throughout the EP preparation, pre-survey and survey periods.

If you would like to comment, or would like additional information, please do not hesitate to contact us using the details below.

If your feedback is received post EP acceptance, your feedback will be documented and where additional or new concerns or issues are raised, CGG will evaluate your concerns and respond with details on how they will be dealt with. If necessary, additional control measures will be developed to ensure all impacts and risks are managed to as low as reasonably practical and are acceptable.

Please advise if you do not want to receive further updates on this project.

CGG has endeavoured to reach all relevant persons but recognises that further persons may self-identify or come to our attention in coming weeks. Please advise CGG, or pass this update on, if you are aware of any other relevant parties whose interests, functions or activities may be affected by the planned survey.

Details of all consultations will be provided to NOPSEMA in the EP as required under legislation.

Thank you for your ongoing engagement in the stakeholder consultation process.

Contact CGG

Phone: 1800 501 541

Email: CGGgippsland@rpsgroup.com.au

Website: https://www.cgg.com/en/Media-and-Events/Media-Releases/2018/06/Gippsland-3D-marine-seismic-survey-information

Marine seismic research link: http://www.soundandmarinelife.org/?_sm_au_=iFVFqS62kQjf3SQ5.

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Other consultation records for relevant stakeholders

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Government agencies, authorities and representatives – general

RPS

Aboriginal Victoria

Australian Maritime Safety Authority

RPS

Commonwealth Department of Agriculture and Water Resources

Commonwealth Department of Defence / Australian Hydrographic Office

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Victorian Department of Economic Development, Jobs, Transport and Resources

RPS

Victorian East Gippsland Shire Council

Victorian Environmental Protection Authority

RPS

Victorian Office of the Hon Daniel O'Brien (member for Gippsland South)

RPS

Victorian Office of the Hon Darren Chester (member for Gippsland)

Victorian Office of the Hon Tim Bull (member for East Gippsland)

RPS

Victorian South Gippsland Shire Council

Victorian Wellington shire council

Government agencies – fisheries

RPS

Australian Fisheries Management Authority

Victorian Fisheries Authority

Fisheries associations

RPS

Abalone Council Australia Ltd

RPS

Abalone Victoria Ltd (Central Zone)

RPS

Commonwealth Fisheries Association

Eastern Zone Abalone Industry Association

RPS

EastRock

RPS

Lakes Entrance Fisherman’s Co-operative Ltd (LEFCOL)

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Scallop Fishermen’s Association of Tasmania

RPS

Scuba Divers Federation of Victoria

RPS

Seafood Industry Victoria

RPS

South East Trawl Fishing Industry Association

Southern Rocklobster Ltd

RPS

Southern Shark Industry Alliance

RPS

Sustainable Shark Fishing Association

RPS

Victorian Abalone Council

RPS

Victorian Abalone Diver's Association

Victorian Rock Lobster Association

RPS

Victorian Scallop Fisherman’s Association

RPS

VRFish

RPS

Fishing companies and fishers

RPS

Tourism and recreation

RPS

Cross Diving Services

RPS

East Gippsland Charters

RPS

Lake Tyers Charters

RPS

Lakes Charter Fishing

RPS

Sea Myth Fishing Charters

Research

RPS

CO2CRC

RPS

CSIRO

RPS

CarbonNet (Victorian Department of Economic Development, Jobs, Transport and Resources)

RPS

University of Melbourne

Industry operators

3D Oil

Basslink

RPS

Cooper Energy

RPS

Emperor Energy

RPS

ExxonMobil (Esso Australia Pty Ltd)

RPS

GB Energy

Hibiscus Petroleum

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Llanberis Energy

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SGH Energy

Appendix J

MFO and PAM operating procedures

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Appendix J MFO and PAM operating procedures

MFOs/PAM Operators' communication and operational procedures: Standard

UHF	Channel xx						
Phone nos. seismic	Observers xx	Bridge – seismic vessel	xx	PAMOs	xx	MFO	xx

Agreed communication channels between all parties will be tested prior to the first use of the airgun array.
Observers contact seismic vessel MFOs/PAMO at least 40 min before soft start or source tests
Seismic vessel MFOs/PAM conduct minimum **30 min pre-start-up monitoring** of 3 km observation zone

NO CETACEANS SIGHTED/DETECTED <2 KM

Daytime/good visibility
Observers contact MFOs
MFOs give "ALL CLEAR"
Soft start can commence

Night-time/low visibility
Observers contact PAM operators
PAMOs give "ALL CLEAR"
Soft start can commence

CETACEANS SIGHTED/DETECTED <2 KM

Daytime/good visibility
Observers contact MFOs
MFOs confirm "DELAY SOFT START" until cetaceans leave 2 km zone or not seen for 30 min
Then MFOs give "ALL CLEAR"

Night-time/low visibility
Observers contact PAMO on seismic vessel. IF PAM not working and ≥3 cetacean- instigated low power or shut-downs in preceding 24 hours
"SOFT START cannot commence**"**

IF PAM validation with MFO observations is successful, then PAM will be used for start-up and soft start procedures at night-time or in low visibility:
Observers contact PAMO
If confirmed* cetacean detection within 2 km **"**DELAY SOFT START"
until 30 min with no further detections
Then PAMO gives **"**ALL CLEAR**"** Soft start can commence

Soft Start 30 min (minimum)
Full Power Line Acquisition

Daytime/good visibility
If large cetacean enters 2 km zone
MFOs contact Observers to "POWER DOWN"
If any cetacean enters 500 m zone
MFOs contact Observers to "SHUT-DOWN"

Night-time/low visibility
If large cetacean detected in 2 km zone
PAMO contact Observers to "POWER DOWN"
If any cetacean detected in 500 m zone
PAMO contacts Observers to "SHUT-DOWN"

Daytime/good visibility
When cetacean leaves 2 km, or not seen for 30 min
MFOs give **"**ALL CLEAR**"**
Soft start can commence

Night-time/low visibility
Observers contact MFO/PAM or SEA
If <3 cetacean-instigated low power or shut downs in preceding 24 hours
Soft start can commence

Effectiveness of communication channels will be monitored. If they prove ineffective, a full review of the communications between the Operator/ PAMO/MFO and undershoot vessel will be conducted and procedure re-written. The delay between the communication and an appropriate response will take into account the time required to safely perform the response. Any change will be included in the MFO report to DoEE.

*NB: A 'confirmed whale detection' requires three or more detection records for an individual whale or PAMO is confident in species ID and distance estimation

RPS

MFOs/PAM Operators' communication and operational procedures: Undershoot

UHF	Channel xx	Seismic vessel name	xx	Undershoot vessel name	xx		
Phone nos. seismic	Observers xx	Bridge – seismic vessel	xx	PAMOs	xx	MFO	xx
Phone nos. undershoot	Observers xx	Bridge – undershoot vessel	xx	MFO	xx		

Agreed communication channels between all parties will be tested prior to the first use of the airgun array.
Observers on seismic and undershoot vessel will plan the synchronised soft-start and then contact MFOs on their own vessels (PAMO on seismic vessel) at least 40 min before Soft Start or Source tests. MFOs/PAMOs to conduct 30 minute (min) watch

NO CETACEANS SIGHTED/DETECTED <2 KM

DAY TIME/GOOD VISIBILITY
Observers contact MFOs
MFOs give **"ALL CLEAR"**
Soft start can commence

NO NIGHT-TIME / LOW VISIBILITY OPERATIONS

CETACEANS SIGHTED/DETECTED <2 KM

DAY TIME/GOOD VISIBILITY
Observers contact MFOs
MFOs confirm **"DELAY SOFT START" on Both Vessels**
Until cetaceans leave 2 km zone or not seen for 30 min
Then MFOs give **"ALL CLEAR"**

Soft Start 30 min (minimum)
Full Power Line Acquisition

DAY TIME/GOOD VISIBILITY
If large cetacean enters 2 km zone, then **MFOs contact Observers** to **"POWER DOWN"**
If any cetacean enters **500 m zone**, then **MFOs contact Observers** to **"SHUT-DOWN"**

DAY TIME/GOOD VISIBILITY
When cetacean leaves 2 km, or not seen for 30 min
MFOs give **"ALL CLEAR"** then Soft start can commence

Effectiveness of communication channels will be monitored. If they prove ineffective, a full review of the communications between the Operator/PAMO/MFO and undershoot vessel will be conducted and procedure re-written. The delay between the communication and an appropriate response will take into account the time required to safely perform the response.

*NB: A 'confirmed whale detection' requires 3 or more detection records for an individual whale or PAMO is confident in species ID and distance estimation