NATIONAL ENERGY RESOURCES AUSTRALIA

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Collaborative Seismic Environment Plan

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Acronyms

Term/Acronym	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences.
AAPA	Aboriginal Areas Protection Authority (NT)
ACMA	Australian Communications Media Authority
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrological Office
AIMS	Australian Institute of Marine Science
AIS	Automated Identification System
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APPEA	Australian Petroleum Production & Exploration Association
ASBTIA	Australian Southern Bluefin Tuna Industry Association
BACI	Before-After-Control-Impact
BIA	Biologically Important Area
BPMF	Broome Prawn Managed Fishery
CFA	Commonwealth Fisheries Association
CMC	Chief Minister and Cabinet
CMST	Centre for Marine Science and Technology
CPUE	Catch Per Unit Effort
CSEP	Collaborative Seismic Environment Plan
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DEPWS	Department of Environment, Parks and Water Security (NT)
DFAT	Department of Foreign Affairs and Trade (Commonwealth)
DIIT	Department of Industry, Tourism and Trade (NT)
DMIRS	Department of Mines, Industry Regulation and Safety (WA)
DNP	Director of National Parks
DoD	Department of Defence (Commonwealth)
DoT	Department of Transport (WA)
DPIRD	Department of Primary Industries and Regional Development (WA)

EEZ	Exclusive Economic Zone
EMBA	Environment that may be Affected
EP	Environment Plan
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
EPO	Environment Performance Outcome
EPS	Environmental Performance Standard
ESD	Ecologically Sustainable Development
GHG	Greenhouse Gas
HSE	Health, Safety and Environment
IAGC	International Association of Geophysical Contractors know called Energeo Alliance
IMO	International Maritime Organisation
IMT	Incident Management Team
IOGP	International Association of Oil and Gas Producers
IUCN	*International Union for Conservation of Nature*
JPDA	Joint Petroleum Development Area
JRCC	Joint Rescue Coordination Centre
KEF	Key Ecological Feature
KPMF	Kimberley Prawn Managed Fishery
LED	Light-emitting Diode
KPMF	Kimberley Prawn Managed Fishery
MAFMF	Marine Aquarium Fish Managed Fishery
MDO	Marine Diesel Oil
MGO	Marine Diesel Gas
MFO	Marine Fauna Observer
MMF	Mackerel Managed Fishery
MoC	Management of Change
NBPMF	Nickol Bay Prawn Managed Fishery)
NCWHAC	Ningaloo Coast World Heritage Advisory Committee
NDSMF	Northern Demersal Scalefish Managed Fishery
NOPSEMA	National Offshore Safety and Environment Management Authority
NPF	Northern Prawn Fishery
NTFJA	Northern Territory Fisheries Joint Authority

NTM	Notice to Mariners
NTSC	Northern Territory Seafood Council
NWST	North West Slop Trawl
OA	Operational Area
ONLF	Offshore Net and Line Fishery
OPEP	Oil Pollution Emergency Plan
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations
OPMF	Onslow Prawn Managed Fishery
OSMP	Operational & Scientific Monitoring Plan
PCMF	Pilbara Crab Managed Fishery
PDSF	Pilbara Demersal Scalefish Fisheries
PFTIMF	Pilbara Fish Trawl (Interim) Managed
PLF	Pilbara Line Fishery
PMST	Protected Matters Search Tool
POMF	Pearl Oyster Managed Fishery
PTMF	Pilbara Trap Managed Fishery
PTS	Permanent Threshold Shift
ROV	Remotely Operated Vehicle
SBT	Southern Bluefin Tuna
SEL	Sound Exposure Level
SIMA	Spill Impact Mitigation Analysis
SIMOPS	Simultaneous Operations
SOLAS	Safety of Life at Sea
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SPL	Sound Pressure Level
SPRAT	Species Profile and Threats Database
SSMF	Specimen Shell Managed Fishery
TAC	Total Allowable Catch
TRF	Timor Reef Fishery
TTS	Temporary Threshold Shift
UWA	University of Western Australia

WAFIC	WA Fishing Industry Association
WCRLMF	West Coast Rock Lobster Managed Fishery
WCDSCMF	West Coast Deep Sea Crustacean Managed Fishery
WDTF	Western Deepwater Trawl Fishery
WHA	World Heritage Areas
WTBF	Western Tuna and Billfish Fishery

1. Overview of Activity

In 2018, the National Energy Resources Australia (NERA) established an industry consortium to address long-standing issues affecting stakeholders, the environment, and proponents regarding potential marine seismic surveys offshore Australia. The project is called the Collaborative Seismic Environment Plan Project (CSEP Project).

The CSEP titleholders are:

- CGG Services (Australia) Pty Ltd
- ConocoPhillips Exploration Australia Pty Ltd.
- IPB Petroleum Limited
- Petroleum Geo-Services (PGS) Australia Pty Ltd
- Santos Limited
- Searcher Seismic Pty Ltd
- Shell Australia Pty Ltd
- TGS-NOPEC Geophysical Company Pty Ltd

The CSEP will allow for 2D, 3D and 4D seismic surveys within the CSEP Operational Area which is within Commonwealth waters with the following restrictions:

- The total combined 2D seismic surveys conducted under the CSEP within the CSEP Operations Area will not exceed 50,000 survey line km per calendar year.
- The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP within the CSEP Operations Area will not exceed 40,000 km^2 in any calendar year.
- The Acquisition Area of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP within the CSEP Operations Area will not exceed 10,000 km^2.

Spatial and temporal exclusion zones will be implemented to manage potential impacts to commercial fishers, marine fauna and marine protected areas including the Ningaloo Coast World Heritage Area.

1.1 Environment Plan Summary

The OPGGS(E) Regulations requires that within 10 days after receiving notice that the Regulator has accepted an environment plan (whether in full, in part or subject to limitations or conditions), the titleholder must submit a summary of the accepted plan to the Regulator for public disclosure.

Under changes to the OPGGS(E) Regulations which took effect on 25 April 2019, EPs are required to be published on NOPSEMA's website on acceptance. Given that EPs are published in full, the EP Summary requirements can be met through cross-referencing sections of the EP with EP Summary requirements as detailed in Table 1-1.

Table 1-1: CSEP Summary

EP Summary Material Requirement	Relevant EP Section
The location of the activity	Section 4.1
A description of the receiving environment	Section 5
A description of the activity	Section 4
Details of the environmental impacts and risks	Section 7
The control measures for the activity	Section 7 and Section 7.12
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 8
Response arrangements in the oil pollution emergency plan	CSEP OPEP
Consultation already undertaken and plans for ongoing consultation	Section 6
Details of the titleholders nominated liaison person for the activity	Section 1.2

1.2 Details of Titleholder and Liaison Person

Details of the titleholders and the CSEP liaison person are provided in Table 1-2 as per the requirement of the OPGGS(E) Regulations.

Arrangements for notifying the regulator of a change in the titleholder, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person are detailed in Section 8.3.2 .

Table 1-2: Details of Titleholder and Liaison Person

Titleholder	CGG Services (Australia) Pty Ltd
Australian Company Number	081 777 155
Business address	1 Ord Street, West Perth, 6005
Telephone number	08 9214 6200

Titleholder	ConocoPhillips Australia Exploration Pty Ltd
Australian Company Number	109 974 932
Business address	Level 1, 33 Park Road Milton, Qld, 4064
Telephone number	07 3182 7122

Titleholder	IPB WA 424P Pty Ltd
Australian Company Number	146 119 404
Business address	IPB Petroleum Ltd Suite 307, 530 Little Collins Street, Melbourne VIC 3000 Australia
Telephone number	03 9598 0188

Titleholder	PGS Australia Pty Ltd
Australian Company Number	077 150 415
Business address	Level 28, QV1, 250 St Georges Tce, Perth, 6000
Telephone number	08 9320 9000

Titleholder	Santos WA Northwest Pty Ltd
Australian Company Number	009 140 854
Titleholder	**Santos Offshore Pty Ltd**
Australian Company Number	005 475 589
Titleholder	**Santos WA Southwest Pty Limited**
Australian Company Number	050 611 688
Titleholder	**Santos (BOL) Pty Ltd**
Australian Company Number	000 670 575
Titleholder	**Santos WA East Spar Pty Limited**
Australian Company Number	008 674 413
Titleholder	**Santos WA Kersail Pty Ltd**
Australian Company Number	087 029 169
Titleholder	**Santos Limited**
Australian Company Number	007 550 923
Titleholder	**Santos Browse Pty Ltd**
Australian Company Number	083 868 259
Titleholder	**Bonaparte Gas & Oil Pty. Limited**
Australian Company Number	060 530 109
Titleholder	**Santos WA Energy Limited**
Australian Company Number	009 301 964
Titleholder	**Santos WA PVG Pty Ltd**
Australian Company Number	129 604 860
Titleholder	**Santos NA Barossa Pty Ltd**
Australian Company Number	109 974 932
Titleholder	**Santos NA Browse Basin Pty Ltd**

Australian Company Number	116 771 414
Titleholder	**Santos NA Energy Pty Ltd**
Australian Company Number	081 089 241
Titleholder	**Harriet (Onyx) Pty Ltd**
Australian Company Number	009 396 954
Titleholder	**Santos WA (Exmouth) Pty Ltd**
Australian Company Number	131 225 619
Titleholder	**Santos WA Varanus Island Pty Ltd**
Australian Company Number	130 391 730
Titleholder	**Santos (N.T.) Pty. Ltd.**
Australian Company Number	008 481 990
Titleholder	**Santos QNT Pty. Ltd.**
Australian Company Number	083 077 196
Titleholder	**Santos WA DC Pty Ltd**
Australian Company Number	637 575 350
Titleholder	**Santos Devil Creek Pty Ltd**
Australian Company Number	634 285 984
Titleholder	**Santos (JPDA 91-12) Pty Ltd.**
Australian Company Number	056 937 752
Titleholder	**Santos NA Darwin Pipeline Pty Ltd**
Australian Company Number	093 316 959
Titleholder	**Santos Resources Pty Ltd**
Australian Company Number	010 407 664
Titleholder	**Santos (TGR) Pty Ltd**
Australian Company Number	098 099 908
Titleholder	**Santos Timor Sea Pipeline Pty Ltd**
Australian Company Number	003 111 573
Business address	Level 7, 100 St Georges Terrace, Perth WA 6000
Telephone number	08 6218 7100

Titleholder	**Searcher Seismic Pty Ltd**
Australian Company Number	117 264 347
Business address	Level 4 South Shore Centre, 85 South Perth Esplanade, South Perth, 6151
Telephone number	08 9327 0100

Titleholder	Shell Australia Pty Ltd
Australian Company Number	009 663 576
Business address	Shell House, 562 Wellington Street, Perth, 6000
Telephone number	08 9338 6600

Titleholder	TGS-NOPEC Geophysical Company Pty Ltd
Australian Company Number	077 150 424
Business address	Ground Floor, 1110 Hay St. West Perth, 6005
Telephone number	08 948 00000

Titleholder's Liaison Person	
Name	Simon Molyneux
Business address	Level 2 East, The Wentworth Building 300 Murray Street, Perth 6000
Telephone number	1300 589 310
Email address	CSEPFeedback@nera.org.au

2. Environmental Impact and Risk Evaluation Process

2.1 Overview

This section outlines the environmental impact and risk evaluation methodology used for the assessment of the seismic survey activities. The methodology is consistent with the Australian and New Zealand Standard for Risk Management (AS/NZS ISO 31000:2018, Risk Management – Principles and Guidelines) and NOPSEMA's Guidance Note Environment Plan Content Requirements as detailed in Figure 2-1.

The application of the impact and risk evaluation process used in the CSEP differs from the global standard for risk assessment and risk management (AS/NZS ISO 31000), as it is required to meet the NOPSEMA's Guidance Note Environment Plan Content Requirements which defines:

- Environmental impacts as occurring from planned activities (i.e., noise, displacement) and does not consider the likelihood of the impact occurring as part of the evaluation.
- Environmental risks as an unplanned impact (i.e., loss of equipment) and does consider likelihood.

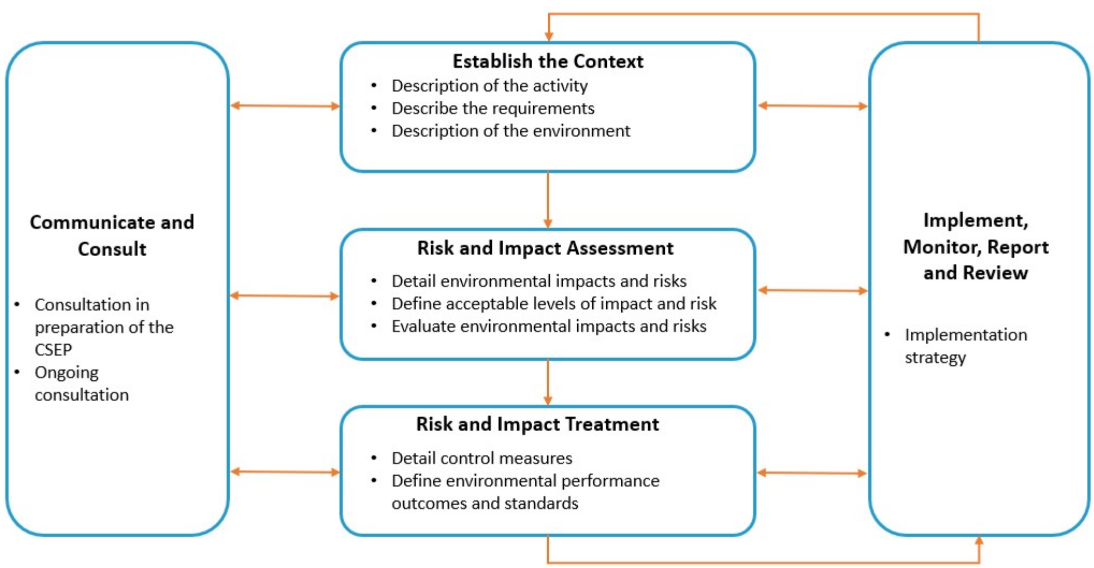


Figure 2-1: CSEP Environmental Impact and Risk Evaluation Methodology

2.1.1 Definitions

Definitions of the term used in the impact and risk assessment process are detailed in Table 2-1.

Table 2-1: Impact and Risk Evaluation Process Definitions

Term	Definition
Activity	Refers to a 'petroleum activity' as defined under the OPGGS(E) Regulations as: petroleum activity means operations or works in an offshore area undertaken for the purpose of: • exercising a right conferred on a petroleum titleholder under the Act by a petroleum title; or • discharging an obligation imposed on a petroleum titleholder by the Act or a legislative instrument under the Act. For the CSEP the "activity' is the seismic surveys conducted under the CSEP which includes the use of vessels and seismic equipment and activation of the seismic source (See Section 4).
As low as reasonably practicable (ALARP)	The ALARP principle is that the residual impacts and risk shall be `as low as reasonably practicable'. It has connotations as a route to reduce impacts and risks when considering law, regulation, and standards. For an impact or risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the impact or risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent on the attempt of reducing a risk to zero. It should not be understood as simply a quantitative measure of benefit against detriment. It is more a best common practice of judgement of the balance of impact or risk and environmental/societal benefit.
Consequence	The consequence of an environmental impact is the potential outcome of the event on affected receptors (particular values and sensitivities). Consequence can be positive, negative or neutral.
Control measure	Defined under the OPGGS(E) Regulations as a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks.
Duration	How often and how long the impact will interact with the environment.
Emergency condition	An unplanned event that has the potential to cause significant environmental damage or harm to MNES. An environmental emergency condition may, or may not, correspond with a safety incident considered to be a Major Accident Event.
Environmental hazard (aspect)	An element or characteristic of an operation, product, or service that interacts or can interact with the environment. Environmental aspects can cause environmental impacts.
Environmental impact	Defined under the OPGGS(E) Regulations as any change to the environment, whether adverse or beneficial, that wholly or partially results from an activity.
Environmental performance outcome	Defined under the OPGGS(E) Regulations as 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	Defined under the OPGGS(E) Regulations as a statement of the performance required of a control measure.
Environmental risk	An unplanned environmental impact has the potential to occur, due either directly or indirectly from undertaking the activity.

Term	Definition
Extent	The area that may be affected by the impact.
Likelihood	The is the chance of the impact occurring as defined by the Table 2-5.
Measurement criteria	A verifiable mechanism for determining control measures are performing as required.
Operation	Refers to a component or task undertaken to facilitate a petroleum activity. Each operation is likely to have one or more associated environmental aspects.
Residual risk	The risk remaining after control measures have been applied (i.e., after risk treatment).
Severity	The level of environmental impact determined by the consequence category in Table 2-4.

2.2 Summary of the Environmental Impact and Risk Evaluation Approach

Figure 2-2 summarises the environmental impact and risk evaluation process undertaken for the CSEP.

Context for the evaluation process was established by:

- understanding the legislative and other requirements that apply to the activity (Section 3: Environmental Requirements).
- identifying the environmental hazards of the activity that will or may cause environmental impacts or may present risks to the environment (based upon the activity description described in Section 4).
- identifying the environment that may be affected by planned and unplanned components of the activity (Section 5).
- feedback from consultation with stakeholders (Section 6).

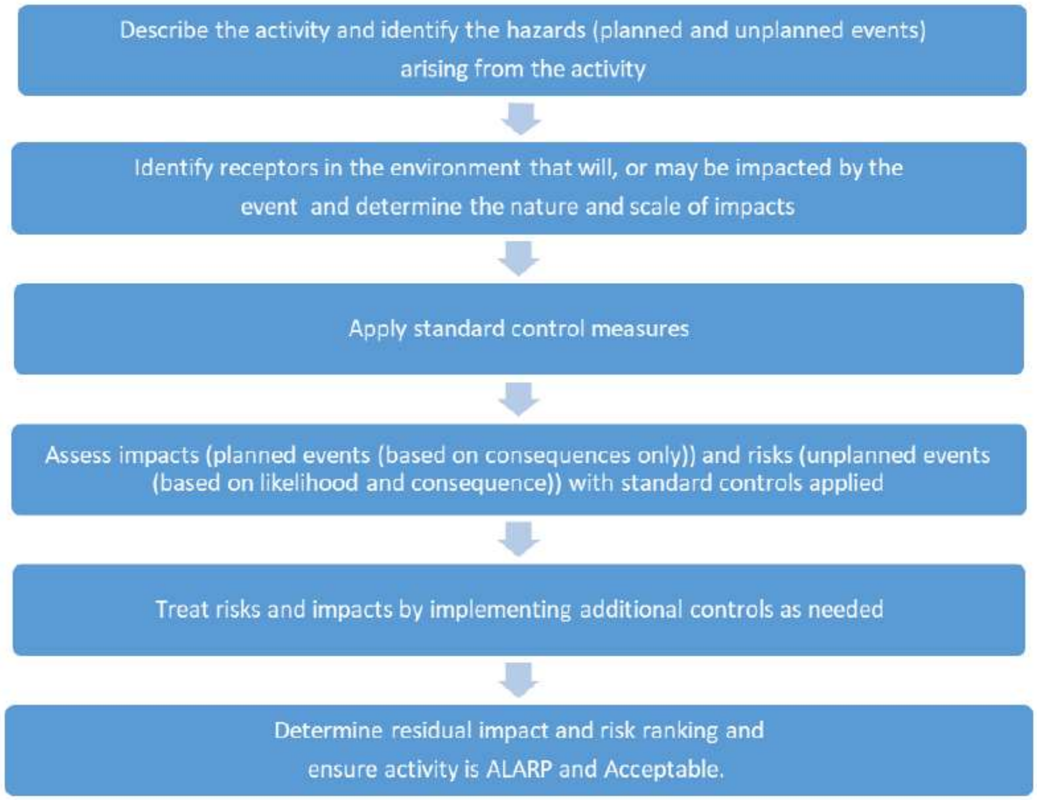


Figure 2-2: Summary of Environmental Impact and Risk Evaluation

2.2.1 Describe Activity and Hazards

A description of the activity is required to determine the planned events that will take place and the credible unplanned events that may occur. Section 4 provides a description of the activity.

Planned events give rise to environmental impacts, while unplanned events pose a risk of environmental impact if they occur. The cause-effect pathway by which environmental and social receptors may be impacted may occur directly or indirectly and by one or multiple hazards of the activity.

Potential impacts (planned) and risks (unplanned) associated with the environmental hazards of the activity were identified based on previous experience, reviewing accepted seismic EPs and via stakeholder consultation.

2.2.2 Identify Receptors and Determine Nature and Scale of Impacts

A description of the environment (natural and socio-economic) within which hazards from the activity will, or may occur, is required, and is detailed in Section 5.

The extent of actual impacts from each planned activity or risks from each unplanned activity, are assessed using, where required, modelling and scientific reports. This is detailed in Section 7.

2.2.3 Assess Impacts and Risks

This step looks at the causal effect between the hazard and the identified receptor. Impact mechanisms and any thresholds for impacts are determined and described, using scientific literature, and modelling where required. Impact thresholds for different critical life stages are also identified where relevant.

This process determines a consequence level, based on set criteria for each receptor category, and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem, or industry level.

As planned events are expected to occur during the activity, the likelihood of their occurrence is not considered during the assessment, and only a consequence level with best practice controls is assigned (refer to Table 2-4).

For unplanned events, the consequence level of the impact with best practice controls (Table 2-4) is combined with the likelihood of the impact occurring (Table 2-5), to determine a residual risk ranking (Table 2-6).

2.2.4 Treatment of Impacts and Risks

The purpose of the impact and risk evaluation is to assist in making decisions, based on the outcomes of the analysis, about the control measures required to reduce an impact or risk to the acceptable level/s and to ALARP. The process for applying controls to meeting the acceptable level and ALARP is shown in Figure 2-3.

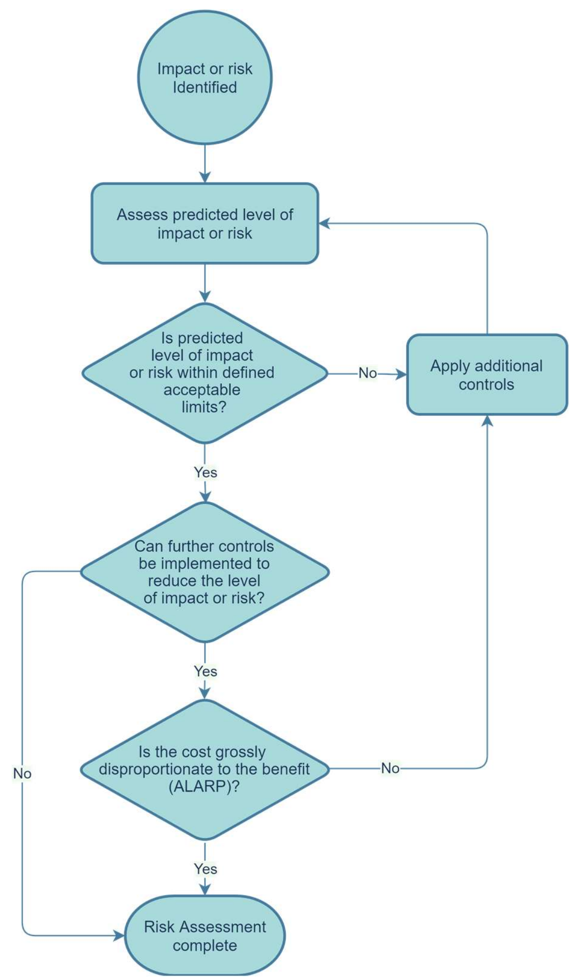


Figure 2-3: Process for applying controls to meet the acceptable level and ALARP

2.2.5 Evaluating Impact and Risk Acceptability

Evaluating environmental impacts and risks involves comparing the predicted levels against the defined acceptable levels of environmental impact and or 'tolerable' levels of risk. This comparison is done considering typical (best practice) controls. If the predicted level of impact is greater than the defined acceptable level further controls or changes to the activity are required to ensure the environmental impact or risk can be managed to the defined acceptable level.

An 'acceptable level' is the specified amount of environmental impact and risk that an activity may have which is tolerable, is consistent with all relevant principles, and does not compromise the management/conservation/protection objectives of the environment.

To define the acceptable level of impact and risk the criteria in Table 2-2 are used.

Table 2-2: Acceptability Evaluation Criteria

Context	Acceptability Evaluation Criteria
Principles of Ecologically Sustainable Development (ESD)	Activity to be carried out in a manner consistent with the relevant ESD principles, specifically: • For an impact, the consequence category is moderate or below and a risk is medium or below. • The precautionary principle is applied in the presence of scientific uncertainty. Section 2.2.5.1 details the assessment of the ESD principles to identify appropriate acceptability evaluation criteria.
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.
External Context – relevant persons	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.

2.2.5.1 Ecologically Sustainable Development

Section 3A of the EPBC Act defines ecologically sustainable development (ESD), which is based on Australia's National Strategy for Ecological Sustainable Development (1992) that defines ESD as:

'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.'

The ESD principles and how they are addressed by the Acceptability Evaluation Criteria (detailed in Table 2-2) is detailed in Table 2-3.

Table 2-3: ESD Principles and How Addressed by the Acceptability Evaluation Criteria

ESD Principle	How Addressed by the Acceptability Evaluation Criteria
Integration Principle: Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations.	This principle is inherently met through the EP evaluation process and is addressed by the Acceptability Evaluation Criteria as they consider long-term and short-term economic, environmental, social, and equitable considerations based on: • Consultation with relevant persons. • Environment requirements including government legislation, conservation advice, recovery plans and management plans.
Precautionary principle: 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.	This principle is met by the Acceptability Evaluation Criteria. The precautionary principle will be applied in the presence of scientific uncertainty for all levels of impacts and risks not just those of serious or irreversible environmental damage.
Intergenerational principle: 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.	This principle is met by the Acceptability Evaluation Criteria as the level of acceptable impact and risk has been set at a level that ensures impact and risk do not result in serious or irreversible environmental damage, thus ensuring the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
Biodiversity principle: The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.	This principle is met by the Acceptability Evaluation Criteria as the level of acceptable impact and risk has been set at a level that ensures biological diversity and ecological integrity is maintained.
Valuation principle: Improved valuation, pricing and incentive mechanisms should be promoted.	The CSEP through the application of controls provides for titleholders to bear the cost of environmental management for the activity to ensure that the environmental impacts and risks are managed to ALARP and to an acceptable level. Consequently, this principle is not considered separately for each acceptability evaluation.

2.2.6 Evaluating Impact and Risk are ALARP

For planned and unplanned events, an ‘as low as reasonably practicable’ (ALARP) assessment is undertaken to demonstrate that the control measures adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk' with more detail provided for impact where the consequence category is moderate or above and risk level of medium or above.

2.3 Environmental Performance Outcomes, Standards and Measurement criteria

The OPGGS(E) Regulations details that the environment plan must:

- set environmental performance standards (EPSs) for the control measures identified.
- set environment performance outcomes (EPOs) against which the performance of the titleholder in protecting the environment is to be measured.
- include measurement criteria that the titleholder will use to determine each EPO and EPS is being met.

These terms are defined in Table 2-1.

EPOs have been developed to be consistent with the principles of ecological sustainable development and representative of levels of environmental performance that are equal to or better than the defined acceptable level.

EPOs, EPSs and associated measurement criteria are detailed in Section 7.12.

Table 2-4: Environmental Consequence Categories

Consequence Category	Biodiversity and Ecosystem Function			Environmental Quality			Social	
	Protected Species	Commercial Species	Ecological Diversity	Water Quality	Sediment Quality	Air Quality	Protected Areas	Cultural
Catastrophic	Local population eradication and/or loss of critical habitats/ activities	Permanent eradication at regional scale	Permanent effects at regional scale	Permanent reduction in water quality. Known biological effect on a regional scale	Permanent contamination with known biological effect on a regional scale	Continuous damage to the environment and/or human health	Significant permanent effects on one or more of protected areas values	Significant, permanent effects on aesthetic, economic or recreational values. Overall societal benefits do not outweigh impacts
Massive	Extensive population-level effects. Significant effect on critical habitats/ activities	Large-scale, long term effects. Recovery >10 years, or effects permanent	Large-scale, long term effects. Recovery >10 years or effects permanent	Continuous or regular discharge. Known biological effect concentrations on large scale (1-100 km²)	Long term contamination above background. Known biological effect concentrations on large scale	Sustained, exceedance over national or international air quality standards. Potential harm to the environment or human health	Significant long-term effects on one or more of protected areas values	Significant long-term effects on aesthetic, economic or recreational values. Overall societal benefits do not outweigh impacts
Major	Minor disruption to significant portion of population. Minor effects on critical habitats/ activities. No threats to population viability	Localised but long-term effects. Recovery >10 years, or effects permanent	Localised, long term effects. Community maintains ecological integrity with significant change in composition	Continuous or regular discharge. Known biological effect concentrations on medium scale (1-10 km²)	Short to medium-term contamination above background. Known biological effect concentrations on large scale	Major and temporary exceedance over national or international air quality standards. Potential harm to the environment or human health	Minor but long term or permanent effects on one or more of protected areas values	Major effects on aesthetic, economic or recreational values. Overall societal benefits do not outweigh impacts

Consequence Category	Biodiversity and Ecosystem Function			Environmental Quality			Social	
	Protected Species	Commercial Species	Ecological Diversity	Water Quality	Sediment Quality	Air Quality	Protected Areas	Cultural
Moderate	Minor disruption to small portion of population. Minor, temporary effects on critical habitats/ activities. No threat to population viability	Localised, medium-term effects. Recovery 5-10 years	Localised, medium-term effects. Ecological integrity maintained with insignificant change to species composition	Continuous or regular discharge. Known biological effect concentrations on small scale (<1 km²)	Short to medium-term contamination above background. Known biological effect concentrations on medium scale	Moderate and temporary exceedance over national or international air quality standards. No harm to the environment or human health expected	Minor and medium-term effects on one or more of protected areas values. Full recovery expected	Moderate effects on aesthetic, economic or recreational values but overall societal benefits outweigh impacts
Minor	Minor and temporary disruption to small portion of population. No effects on critical habitats/ activities	Localised, short term effects. Recovery in the timescale of months to <5 years	Localised, short to medium-term effects. Full recovery expected	Temporary discharge with contamination above background levels. Known biological effect concentrations on medium scale (<10 km²)	Temporary contamination above background. Known biological effect concentrations on medium scale	Minor and temporary exceedance over national or international air quality standards. No harm to the environment or human health expected	Minor and short-term effects on one or more of protected areas values. Full recovery expected	Minor and temporary effects on aesthetic, economic or recreational values
Slight	Possible incidental effects to flora and fauna in a locally affected environmental setting	Localised, temporary effects. Recovery in the timescale of days to weeks	Localised, temporary effects. Slight impact on ecological integrity or species composition	Temporary discharge with contamination above background levels. Known biological effect concentrations on small scale (<1 km²)	Temporary contamination above background. Known biological effect concentrations on small scale	Slight, temporary exceedance over national or international air quality standards. No harm to the environment or human health expected	Slight to negligible effects on any protected area values	Slight to negligible effects on aesthetic, economic or recreational values

Table 2-5: Likelihood Categories

Categories	Likelihood Description		
	Definition	**Probability**	**Experience History of occurrence in Company or industry**
Remote	Once every 10,000-100,000 years at location	1 in 100,000-1,000,000	Unheard of in the industry
Highly Unlikely	Once every 1,000-10,000 years at location	1 in 10,000-100,000	Has occurred once or twice in the industry
Unlikely	Once every 100-1,000 years at location	1 in 1,000-10,000	Has occurred many times in the industry, but not in the company
Possible	Once every 10-100 years at location	1 in 100-1,000	Has occurred once or twice in the company
Likely	Once every 1-10 years at location	1 in 10-100	Has occurred frequently in the company
Highly Likely	More than once a year at location or continuously	>1 in 10	Has occurred frequently at the location

Table 2-6: Environmental Risk Matrix

		LIKELIHOOD LEVEL					
		Remote	**Highly Unlikely**	**Unlikely**	**Possible**	**Likely**	**Highly Likely**
CONSEQUENCE LEVEL	**Catastrophic**	2	2	1	1	1	1
	Massive	3	2	2	1	1	1
	Major	3	3	2	2	1	1
	Moderate	4	3	3	2	2	1
	Minor	4	4	3	3	2	2
	Slight	4	4	4	3	3	2

1 -Very High
2- High
3 – Medium
4 - Low

3. Environmental Requirements

The OPGGS(E) Regulations requires that the EP must:

a) describe the requirements, including legislative requirements, that apply to the activity and are relevant to the environmental management of the activity; and
b) demonstrate how those requirements will be met.

NOPSEMA Guidance Note Environment Plan Content Requirements (September 2020) details that:

- The requirements that apply to the activity include all laws, other approvals and conditions, standards or other environmental requirements that apply to the activity and are relevant to the activity's environmental management.
- Requirements could include relevant laws, codes, standards, agreements, treaties, conventions, or practices (in whole or in part), that apply to the jurisdiction in which the activity takes place.
- The description of requirements should explain how the requirements are relevant to the activity in the EP and specifically how they apply to the activity.

The activity is solely within Commonwealth waters. Commonwealth legislation and other requirements relevant to the activity are summarised in Table 3-1.

Relevant requirements associated with the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) policies, guidelines, management plans, recovery plans, threat abatement plans, and other advice issued by the Department of Agriculture, Water and the Environment (DAWE) are detailed in Section 4 in the applicable subsections, as part of the description of the existing environment.

Table 3-1: Environmental Requirements

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
Australian Maritime Safety Authority Act 1990	This 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 affected by AMSA who administers the National Plan for Maritime Environmental Emergencies (NatPlan).	Under this Act, any hydrocarbon spill to the marine environment, resulting from the activity must be reported. Reporting requirements are detailed in 8.1.5. In Commonwealth waters the Australian Maritime Safety Authority (AMSA) is the Control Agency for oils spills from vessels. These arrangements are detailed in CSEP OPEP.	Australian Maritime Safety Authority (AMSA)
Australian Ballast Water Management Requirements (DAWE 2020b)	The Australian Ballast Water Management Requirements set out the obligations on vessel operators regarding the management of ballast water and ballast tank sediment when operating within Australian seas.	Provides requirements on how vessel operators should manage ballast water when operating within Australian seas to comply with the Biosecurity Act. Section 7.9 details how these requirements will be applied.	DAWE
Australia Biofouling Management Requirements (DAWE 2022)	The Australian biofouling management requirements set out vessel operator obligations for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas.	Provides requirements on how vessel operators should manage biofouling when operating within Australian seas to comply with the Biosecurity Act. Section 7.9 details how these requirements will be applied.	DAWE
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act replaced the Quarantine Act 1908 in 2015 and is the primary legislation for the management of the risk of diseases and pests that may cause harm to human, animal or plant health, the environment, and the economy. The objects of this Act are to provide for:	The Biosecurity Act and regulations apply to 'Australian territory' which is the airspace over and the coastal seas out to 12 nm from the coastline.	DAWE

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
	(a) managing biosecurity risks; human disease; risks related to ballast water; biosecurity emergencies and human biosecurity emergencies. (b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the Sanitary and Phytosanitary Agreement and the Biodiversity Convention.	For the activity, the Act regulates vessels entering Australian territory regarding ballast water and hull fouling. Section 7.9 details how these requirements will be applied.	
Biosecurity Amendment (Biofouling Management) Regulations 2021	The Biosecurity Amendment (Biofouling Management) Regulations 2021 (Biofouling Regulations) enters into force on 15 June 2022. This requires operators of all vessels to provide information on biofouling management practices prior to arriving in Australia. The Australian biofouling management requirements provides details of Australia's pre-arrival reporting requirements and guidance for operators of international vessels that are subject to biosecurity control while in Australian territorial seas.	Vessels from international waters used for the activity will be required to provide information on how biofouling has been managed prior to arriving in Australian territorial seas. Section 7.9 details how these requirements will be applied.	DAWE
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	This Act applies to actions that have, will have or are likely to have a significant impact on matters of national environmental or cultural significance. The Act protects Matters of National Environmental Significance (MNES) and provides for a Commonwealth environmental assessment and approval process for actions. There are eight MNES, these being: • World heritage properties. • Ramsar wetlands. • Listed Threatened species and communities. • Listed Migratory species under international agreements. • Nuclear actions. • Commonwealth marine environment. • Great Barrier Reef Marine Park.	Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f). The activity is not within a World Heritage Area. The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these. Section 5 describes matters protected under Part 3 of the EPBC Act. The EP must assess any actual or potential impacts or risks to MNES from the activity. Section 7 provides an assessment of the impacts and risks from the activity to matters protected under Part 3 of the EPBC Act.	DAWE

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
	• Water trigger for coal seam gas and coal mining developments.		
Environment Protection and Biodiversity Conservation Regulations 2000	Provides additional regulations regarding Matters of National Environmental Significance. Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans.	The interaction requirements are applicable to the activity if a cetacean is sighted. Section 7 details how these requirements will be applied.	DAWE
EPBC Act Policy Statement 2.1 Interaction between offshore seismic exploration and whales	The aim of this Policy Statement is to: • provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations; • provide a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours; and • provide guidance to both proponents of seismic surveys and operators conducting seismic surveys about their legal responsibilities under the EPBC Act.	The policy statement provides guidance on undertaking seismic activities in Australian waters to limit potential impacts to whales. Section 7.1 details how these requirements will be applied.	DAWE
Environment Manual for Worldwide Geophysical Operations (IAGC 2013)	Provides the industry with information for conducting geophysical field operations in an environmentally sensitive manner.	Provides guidelines for best practice operations of seismic surveys to minimise environment impacts. Section 7.1 details how these requirements will be applied.	Energreo Alliance (formerly International Association of Geophysical Contractors (IAGC))
Guidance Statement on Undertaking Seismic Surveys in WA Waters (2013)	Identifies potential issues of concern associated with seismic surveys on fish and fish habitats, as defined under the Fish Resources Management Act 1994. It is aimed at giving proponents direction on general standards and protocols designed to avoid or mitigate the potential impacts of seismic surveys on fish. It is expected that proponents will incorporate these standards and protocols when planning and implementing seismic surveys.	Provides guidance and mitigation strategies to avoid or minimise potential impacts of seismic surveys on fish. Section 7.1 details how these requirements will be applied	WA Department of Primary Industry and Regional Development (DPIRD)

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) 2011	Provide a globally consistent approach to the management of biofouling. They were adopted by the Marine Environment Protection Committee (MEPC) in July 2011 and were the result of three years of consultation between IMO Member States.	Specific requirements are that vessels have a biofouling management plan and biofouling record book. Section 7.9 details how these requirements will be applied.	International Maritime Organisation (IMO)
Marine Pest Plan 2018–2023: the National Strategic Plan for Marine Pest Biosecurity (DAWR 2018)	The visions of the Marine Pest Plan is: Maintaining Australia's healthy and resilient marine environment that is protected from the threat of marine pests, and which supports our economy and social amenity. While the vision sets the broad direction for the future of marine pest biosecurity in Australia, Marine Pest Plan 2018–2023 describes the steps to make this vision a reality, and the outcomes to achieve over the next five years.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. Section 7.9 details how these requirements will be applied.	DAWE
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry 2009 (Marine Pest Sectoral Committee 2018)	The guidance document provides recommendations for the management of biofouling hazards by the petroleum industry.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. Section 7.9 details how these requirements will be applied.	DAWE
National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia 2020)	The guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife. They apply to new projects, lighting upgrades (retrofitting) and where there is evidence of wildlife being affected by existing artificial light.	Applying the recommendations within this document and implementing effective controls can reduce the impact of light on light sensitive species. Section 7.3 details how these requirements will be applied.	DAWE

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia 2017c)	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna.	Applying the recommendations within this document and implementing effective controls can reduce the risk of the vessel collisions with megafauna. Section 7.7 details how these requirements will be applied.	DAWE
Navigation Act 2012	Regulates international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters. It gives effect to the relevant international conventions (MARPOL 73/78, COLREGS 1972) relating to maritime issues to which Australia is a signatory.	Several Marine Orders (MO) are enacted under this Act relating to the activity, including: MO 21: Safety and emergency arrangements MO 27: Safety of navigation and radio equipment MO 30: Prevention of collisions MO 31: SOLAS and non-SOLAS certification MO 58: Safe management of vessels Section 7details how these requirements will be applied.	AMSA
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) OPGGS(E) Regulations	The Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three-nautical mile limit. Part 2 of the OPGGS(E) Regulations specifies that an EP must be prepared for any petroleum activity and that activities are undertaken in an ecologically sustainable manner and in accordance with an accepted EP.	The OPGGS Act provides the regulatory framework for all offshore petroleum exploration and production activities in Commonwealth waters, to ensure that these activities are carried out: Consistent with the principles of ecologically sustainable development as set out in section 3A of the EPBC Act. So that environmental impacts and risks of the activity are reduced to as low as reasonably practicable (ALARP).	NOPSEMA

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
		So that environmental impacts and risks of the activity are of an acceptable level. Demonstration that the activity will be undertaken in line with the principles of ecologically sustainable development, and that impacts and risks resulting from these activities are ALARP and acceptable is provided in Section 7areine.	
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003 Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2004	An Act to impose levies relating to the regulation of offshore petroleum activities and greenhouse gas storage activities.	Requires that EP levies are imposed on EP submissions, including revisions, where the activities to which the EP relates are authorised by one or more Commonwealth titles. This requirement applies once the EP is accepted.	NOPSEMA
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	This Act regulates Australian regulated vessels with respect to ship-related activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc. Provides exemptions for the discharge of materials in response to marine pollution incidents.	Several Marine Orders are enacted under this Act relating to offshore petroleum activities, including: MO 91: Marine Pollution Prevention – Oil. MO 93: Marine Pollution Prevention – Noxious Liquid Substances. MO 94: Marine Pollution Prevention – Packaged Harmful Substances. MO 95: Marine Pollution Prevention – Garbage. MO 96: Marine Pollution Prevention – Sewage.	AMSA

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
		MO 97: Marine Pollution Prevention – Air Pollution. MO 98: Marine pollution prevention – anti-fouling systems. Section 7 detail how these requirements will be applied.	
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Under this Act, it is an offence for a person to engage in negligent conduct that results in a harmful anti-fouling compound being applied to or present on a ship. The Act also provides that Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria.	All ships involved in offshore petroleum activities in Australian waters are required to abide to the requirements under this Act. MO 98: Marine Pollution Prevention – Anti-fouling Systems is enacted under this Act. Section 7.9 details how these requirements will be applied.	AMSA
Recommended monitoring and mitigation measures for cetaceans during marine seismic survey geophysical operations (March 2017)	Provides recommendations on applying mitigation measures for cetaceans during geophysical operations. The measures outlined in this report are recommended for use during all marine seismic surveys that use compressed air source arrays, and are only intended for cetaceans (whales, dolphins and porpoises).	Provides recommended mitigation measures for cetaceans during a marine seismic survey, including exclusion zones, soft starts, seismic testing procedures, and recording Marine Fauna Observer (MFO) observations. Section 7.1 details how these requirements will be applied.	International Association of Oil and Gas Producers (IOGP) Energreo Alliance
Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Ocean (DoEE 2018)	The plan provides national guidance on action to prevent and mitigate the impacts of harmful marine debris on vertebrate marine life.	Section 7.8 details how these requirements will be applied.	DAWE
Underwater Cultural Heritage Act 2018	This Act replaces the Historic Shipwreck Act 1976. The Act provides for the protection of Australia' underwater cultural heritage.	Provisions under the Act are applicable to the activity in the event of removal,	DAWE

Requirement	Scope Relevant to the CSEP	Application to Activity	Administering Authority
	It protects the heritage values of remains of vessels, aircraft and certain associated articles that have been in Commonwealth waters for at least 75 years. Vessels and aircraft that have been underwater less than 75 years, and other types of underwater cultural heritage, can be protected through individual declaration based on an assessment of heritage significance.	damage or interference to items of underwater cultural heritage and/or the activity is proposed within an Underwater Protected Heritage Zone. Section 5.2.7 details that there are no Underwater Protected Heritage Zones within CSEP OA and five within the CSEP EMBA.	

4. Description of the Activity

This section provides a description of the petroleum activity, including the details of the location in which the activities will occur, in accordance with the OPGGS(E) Regulations.

4.1 Activity Location

Individual seismic surveys will be undertaken within the CSEP Operational Area (OA) which is shown in Figure 4-2. The CSEP Operational Area is within Commonwealth waters adjacent to Western Australia and Northern Territory. The CSEP Operational Area consists of the following three areas:

- Bonaparte Operational Area
- Browse Operational Area
- Carnarvon Operational Area

As detailed in Section 7.1 Impact Assessment for Acoustic Emissions and Section 7.12 Environmental Performance Outcomes, Standards and Measurement Criteria, spatial controls will be implemented to avoid impacts to the outstanding universal values of the Ningaloo Coast World Heritage Area and to areas where protected species are undertaking biologically important behaviours.

4.2 Activity Timing

The CSEP is valid for a period of 5 years from NOPSEMA acceptance.

As detailed in Section 7.1 Impact Assessment for Acoustic Emissions and Section 7.12 Environmental Performance Outcomes, Standards and Measurement Criteria, temporal controls will be implemented to avoid periods when protected species are undertaking biologically important behaviours and when commercial fish species are spawning in Reef Fish Protection Areas.

4.3 Temporal and Spatial Exclusion Zones

To manage impacts and risks from CSEP activities to an acceptable level, temporal and spatial controls have been implemented as detailed in the impact and risk evaluation section (Section 7).

Table 4-1 details the months that the exclusion zones will occur for each of the controls measures and where applicable for the different CSEP OAs.

4.4 Seismic Survey Areas

Individual seismic surveys will consist of the following areas as shown in Figure 4-1:

- **Survey Acquisition Area:** the primary target area for a seismic survey and the area in which seismic data will be recorded.

- **Survey Active Source Area:** an area including and around the Acquisition Area in which the seismic source is active. This area is used to:
  - incrementally build the power of the seismic source from non-operation to full capacity, for the purpose of soft starts during line run-ins.
  - complete seismic acquisition and data collection along sail lines in the acquisition area, during which the seismic source will be operated at full capacity.
  - complete line run-outs, during which the seismic source will be operated at full capacity for approximately half a streamer length beyond the end of the acquisition area line to complete the required data collection.
  - occasional source testing at, or below, full capacity.
- **Survey Operational Area (OA)**: an area encompassing the Active Source Area in which survey vessel activities other than actively operating the seismic source will be conducted, such as line turns, equipment maintenance and deployment/recovery, crew change and resupply. Should vessels need to transit through marine parks that are not within the CSEP OA all equipment is to be stowed (i.e., streamers away). This includes where the vessel is turning, repositioning, or exiting the field due to conditions at sea.

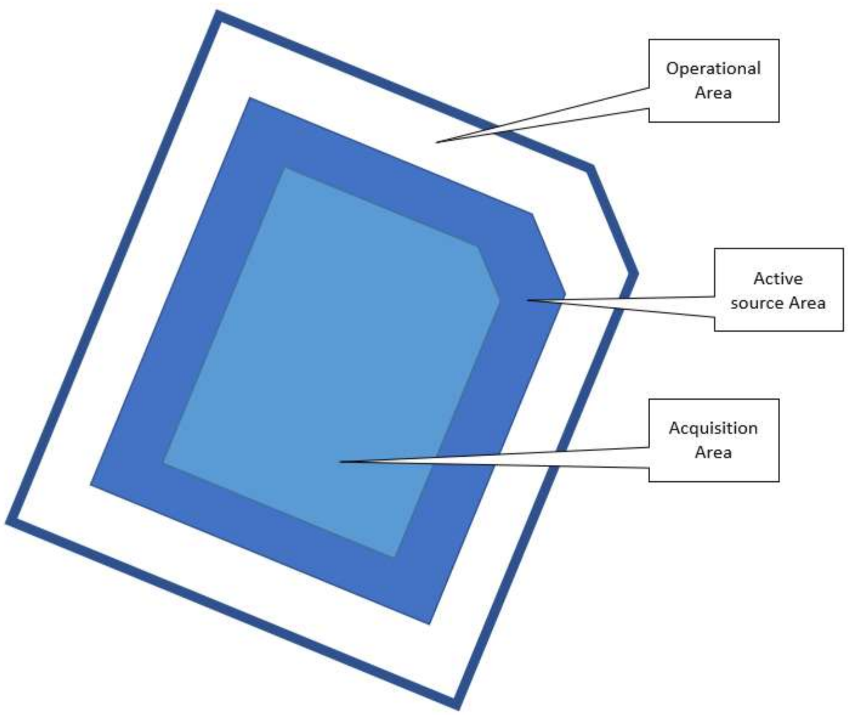


Figure 4-1: CSEP Seismic Survey Areas

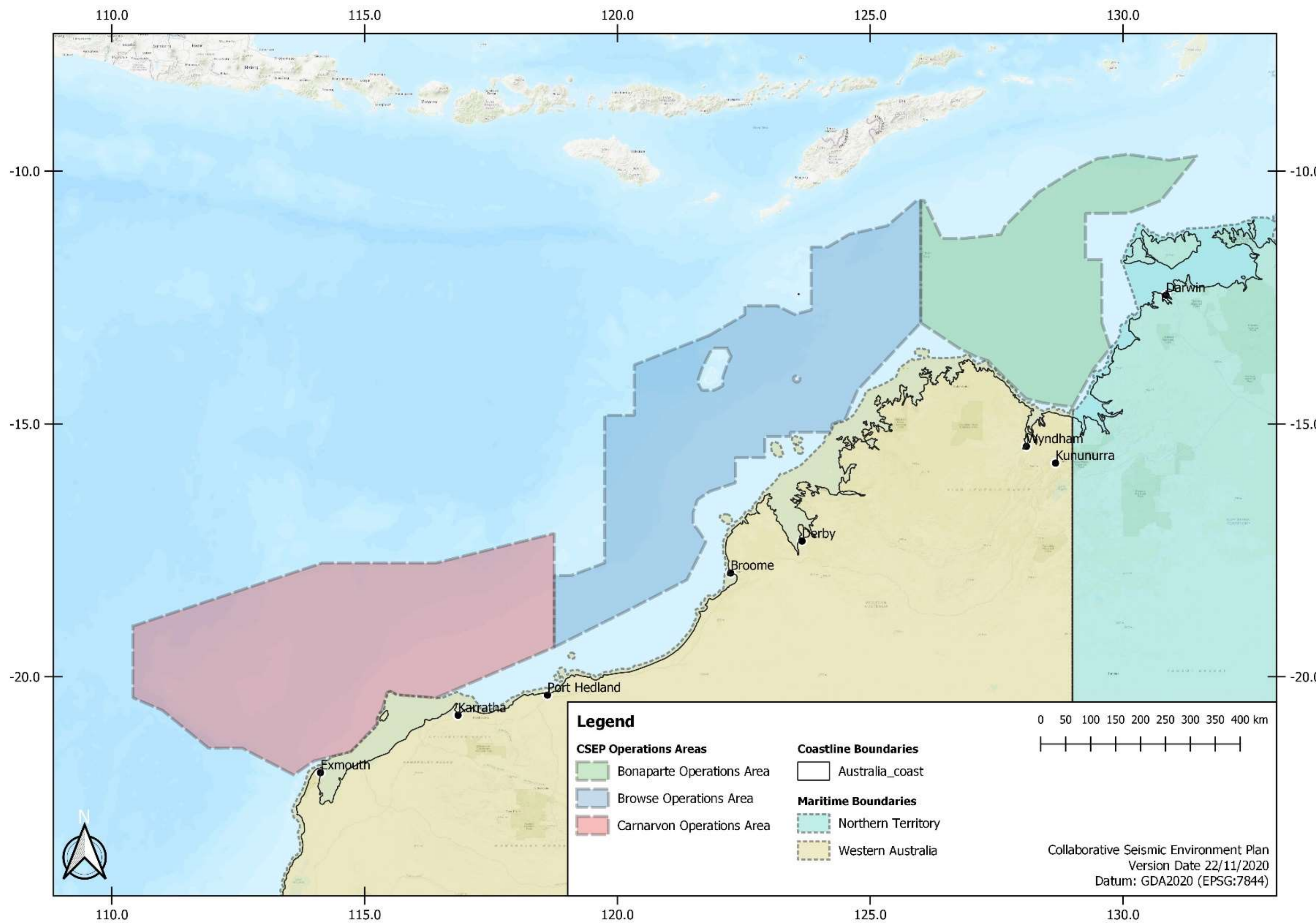


Figure 4-2: CSEP Operational Area

Table 4-1: CSEP Temporal and Spatial Exclusion Zones

Yellow denotes timing when surveys will not be undertaken within the exclusion zone.

Temporal and Spatial Exclusion Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CM#4 Reef Fish Protection Area.												
CM#6 Ningaloo Coast World Heritage Area (NCWHA) Exclusion Zone - 70 km from the NCWHA boundary.												
CM#9 Turtle Exclusion Zone - 3 km from flatback turtle internesting, nesting or mating BIA or habitat critical for the survival of the species in Bonaparte OA.												
CM#9 Turtle Exclusion Zone - 3 km from flatback turtle internesting, nesting or mating BIA or habitat critical for the survival of the species in Browse OA and Carnarvon OA.												
CM#9 Turtle Exclusion Zone - 3 km from green turtle internesting, nesting or mating BIA or habitat critical for the survival of the species Ashmore reef.												
CM#9 Turtle Exclusion Zone - 3 km from green turtle internesting, nesting or mating BIA or habitat critical for the survival of the species all other areas.												
CM#9 Turtle Exclusion Zone - 3 km from loggerhead internesting, nesting or mating BIA or habitat critical for the survival of the species all other areas.												
CM#9 Turtle Exclusion Zone - 3 km from hawksbill internesting, nesting or mating BIA or habitat critical for the survival of the species all areas.												
CM#9 Turtle Exclusion Zone - 3 km from olive ridley internesting, nesting or mating BIA or habitat critical for the survival of the species Bonaparte OA.												
CM#9 Turtle Exclusion Zone - 3 km from olive ridley internesting, nesting or mating BIA or habitat critical for the survival of the species Browse OA.												
CM#9 Turtle Exclusion Zone - 3 km from leatherback internesting, nesting or mating BIA or habitat critical for the survival of the species all areas.												
CM#14 Marine Mammal Exclusion Zone - 100km from Humpback whale Exmouth Gulf BIA.												

Temporal and Spatial Exclusion Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CM#14Marine Mammal Exclusion Zone - 100km from Humpback whale Kimberley BIA.												
CM#14Marine Mammal Exclusion Zone - 100km from Humpback whale migration BIA within the Carnarvon OA.												
CM#14 Marine Mammal Exclusion Zone - 100km from Humpback whale migration BIA Browse OA.												
Marine Mammal Exclusion Zone - 100km from Pygmy blue whale BIA.												
CM#14 Marine Mammal Exclusion Zone - 20km from dugong or dolphin BIA.												
CM#8 Banks and Shoals Exclusion Zone - 350 m horizontal distance of the 60 m contour of any bank and shoal as detailed in maps provided.												

4.5 Seismic Survey Activities

Seismic surveys are the main method that the oil and gas industry maps and gains an understanding of the geological features below the seabed.

The CSEP covers 2D, 3D and 4D seismic surveys the difference being:

- 2D: used for regional surveys during early phases of oil and gas exploration and typically have a sound source, a single streamer and fewer and more widely spaced sail lines that may cross each other.
- 3D: use multiple sound sources with multiple streamers following a 'racetrack' pattern to achieve a higher degree of resolution of the geological features than is achievable by 2D survey.
- 4D: repetition of a 3D survey at a later time interval. 4D surveys are undertaken to map producing oil and gas reservoirs to determine changes over time.

Figure 4-3 and Figure 4-4 details the equipment associated with a seismic survey and Figure 4-5 details the seismic survey acquisition process.

Marine seismic surveys are undertaken using a seismic vessel towing an underwater seismic source and a series of streamers (3D and 4D) or a single streamer (2D).

The seismic source consists of an array of air chambers of varying volumes, distributed in two to three separate sub-arrays that alternately discharge compressed air (Figure 4-4). The release of the compressed air creates a sound wave that is directed downwards into the seabed and into the subsurface. The streamers contain microphones, known as hydrophones, which record the sound waves reflected off the seabed and underlying rock formation. Solid streamers are used that maintain neutral buoyancy.

Each streamer is equipped with depth controllers, positioning and steering units, and recovery units. The recovery unit is a device attached to the streamer at intervals of ~300 m that sense if the streamer sinks below a pre-determined depth, and in such events deploys an automatic pressure-activated airbag to float the streamer back to the surface.

The seismic vessel acquires data along a series of adjacent and parallel sail lines in a 'racetrack' like pattern. At the end of the first line in a racetrack sequence, the vessel turns in a wide arc to position for another parallel line in the opposite direction, offset by several kilometres from the previous line. The vessel will then turn again to position itself to return in the opposite direction along the third parallel line in the sequence, offset up to 500 m from the first line. This pattern is repeated in the Acquisition Area until the required coverage is completed. The seismic vessel travels at an average speed of ~8–9 km/h (4–4.5 knots) while acquiring data.

To obtain a full coverage of the acquisition area the seismic source must remain at full power for at least half a streamer length prior to the vessel turn. This run out makes up the full power zone. The seismic source is then turned off to complete the turn. During the run in, soft-start procedures occur for a minimum of 30 minutes, which begins with the operation of the single smallest air chamber in the array and then the gradual ramp-up to include additional air chambers until the seismic source is at full power for the commencement of acquisition at the acquisition area boundary.

The seismic source may be operated for short durations elsewhere in the Survey OA for maintenance and testing. These activities are infrequent and typically involve intermittent discharge of individual air chambers.

The acquisition data obtained are later processed to provide information about the structure and composition of geological formations below the seabed.

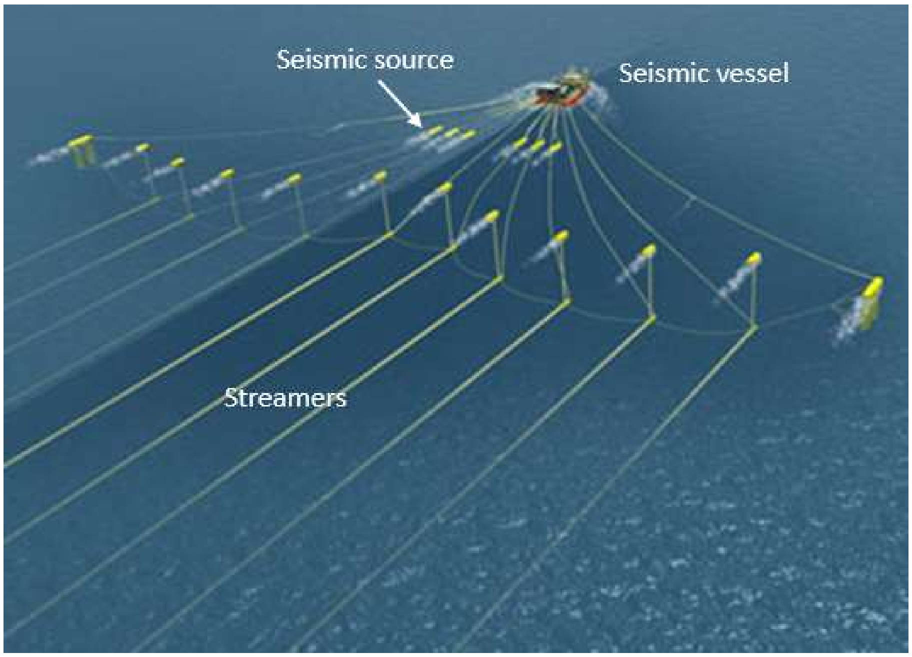


Figure 4-3: Seismic Survey Equipment

Figure 4-4: Individual compressed air chamber and a sub-array

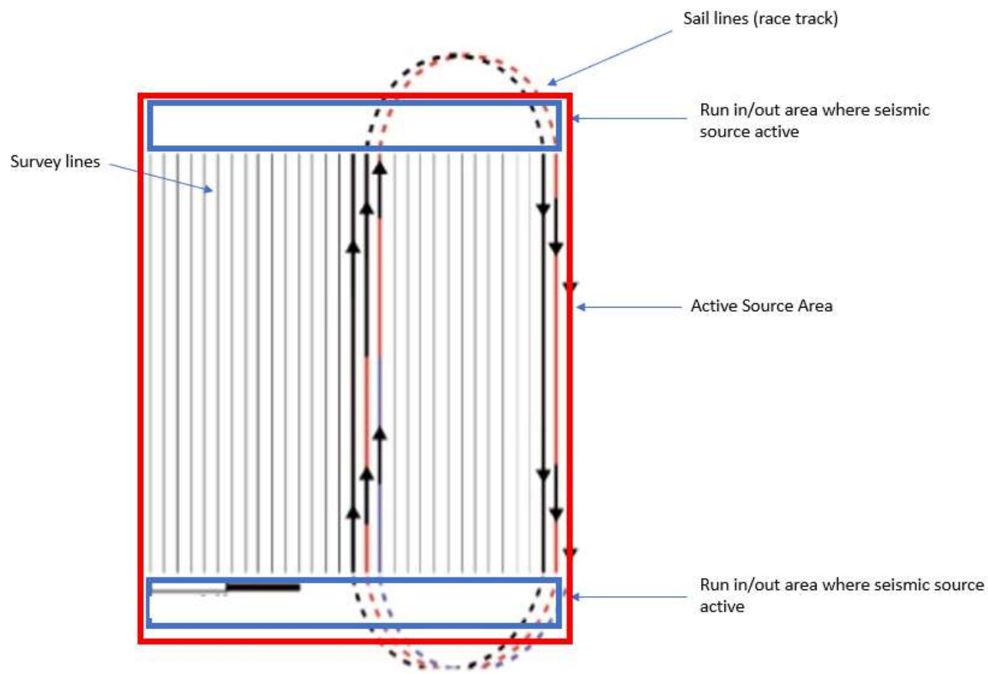


Figure 4-5: Seismic Survey Acquisition Process

4.6 Seismic Survey Parameters

Table 4-2 details the seismic survey parameters relevant to the impact and risk evaluation.

Table 4-2: CSEP Parameters

Parameter	CSEP Parameters
Volume of seismic source	Max 4,130 cubic inches (in^3)
Operating pressure	Max 2000 psi
Seismic vessel sail line speed	Up to 8–9 km/h (4–4.5 knots)
No. streamers	Up to 16 streamers
Streamer length	Up to 10 km
Vessel fuel	Marine diesel oil or Marine diesel gas
Shallowest water depth	25 m
Vessel largest fuel tank	2,000 m^3

4.7 Vessel Operations

Vessel operations consist of a seismic vessel and up to two support vessels. Support vessels are used for refuelling, resupply and crew change for the seismic vessel. Refuelling and resupply are estimated to occur every 2 – 4 weeks during a survey. Crew change is estimated to occur every 4 – 6 weeks during a survey.

One support vessel accompanies the seismic vessel to assist with managing potential interactions with marine vessels. Support vessels typically remain around 1-2 nm off the seismic vessel, usually ahead as a scout, but sometimes they can move around the full towed array, dependent on other vessel activity.

The seismic vessel could have up to 70 persons on board and the support vessels between 5 and 15 persons.

If required vessels will hold station via dynamic positioning or manipulating propulsion and thrusters, thus there will be no anchoring operations.

4.8 Aircraft Operations

Aircraft, typically helicopters, may be used for crew changes, critical equipment supply, surveillance, and emergency response.

Crew change may be undertaken by helicopter and is estimated to occur every 4 – 6 weeks during a survey. Refuelling of helicopters may take place on the seismic or support vessel.

5. Description of the Environment

The OPGGS(E)R define 'environment' as the ecosystems and their constituent parts, natural and physical resources, qualities and characteristics of areas, the heritage value of places and includes the social, economic, and cultural features of those matters. These features of the environment are described herein, addressing the requirements of the following regulations:

- Regulation 13(2): the EP must describe the existing environment that may be affected by the activity and include details of the particular relevant values and sensitivities of the environment.
- Regulation 13(3): particular relevant values and sensitivities may include (but not limited to) matters protected under Part 3 of the EPBC Act, which are:

a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;

b) the national heritage values of a National Heritage place within the meaning of that Act;

c) the ecological character of a declared Ramsar wetland within the meaning of that Act;

d) the presence of a listed Threatened species or listed Threatened Ecological Community within the meaning of that Act;

e) the presence of a listed Migratory species within the meaning of that Act;

f) any values and sensitivities that exist in, or in relation to, part or all of:

a. Commonwealth marine area within the meaning of that Act; or

b. Commonwealth land within the meaning of that Act.

Resources used to gather this information include:

- Marine Bioregional Plans
- Marine Park Management Plans
- Threatened species recovery plans
- Threat abatement plans
- Species conservation advice
- EPBC Protected Matters Search tool
- National Conservation Values Atlas
- Species Profile and Threats Database (SPRAT) database
- Published scientific journal papers
- Unpublished industry reports
- Online megafauna tracking portals
- Protect Matters Search Tool (PMST) reports
- Commercial fishery status reports

This information is summarised in this section and has been compiled into a comprehensive Existing Environment Addendum to the CSEP.

The environment that may be affected (EMBA) is based on hydrocarbon exposure from the unplanned release of marine diesel oil resulting from a vessel collision scenario from within the CSEP Operational Area. Figure 5-1 shows the EMBA and Section 7.10.1.5 details how the EMBA was developed.

For the CSEP Operational Area, EPBC Protected Matters Search Tool (PMST) reports were generated for each of the three Operational Areas (Bonaparte OA, Browse OA, Carnarvon OA) that comprise the CSEP Operational Area. For the EMBA, spatial information is also presented across three regions (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA), combined they comprise the CSEP EMBA. The PMST reports for the three Operational Areas and three EMBAS are available as Appendix A of the CSEP Existing Environment Addendum.

The following sections provide a summary of the existing environment that may be affected by the activity and includes the particular relevant values and sensitivities of the environment within the CSEP EMBA. Detailed information regarding the values and sensitivities of the existing environment are provided in the Existing Environment Addendum which is to be read in conjunction with this section.

5.1 Bioregions

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, the provincial bioregions overlapped by the CSEP OAs and EMBA are shown in Figure 5-2. A description of the geomorphology, benthic habitats, pelagic habitats and regional fauna are provided for each IMCRA provincial bioregion in the Existing Environment Addendum.

The CSEP OA and CSEP EMBA are within the North-west Marine Region and the North Marine Region, with the Carnarvon EMBA extending into the very northern part of the South-west Marine Region. The regions are covered by the North Marine Bioregional Plan (DSEWPaC 2012a), North-west Bioregional Plan (DSEWPaC 2012b) and South-west Bioregional plan (DSEWPaC 2012c) which have been prepared under section 176 of the EPBC Act 1999 and describe the marine environment and conservation values bounded by them under the categories of biodiversity, key ecological features, protected species, and protected places. This information is included in the EE Addendum.

The international waters of south west Indonesia and Timor-Leste are also included within the boundary of the CSEP EMBA and are described in the Existing Environment Addendum.

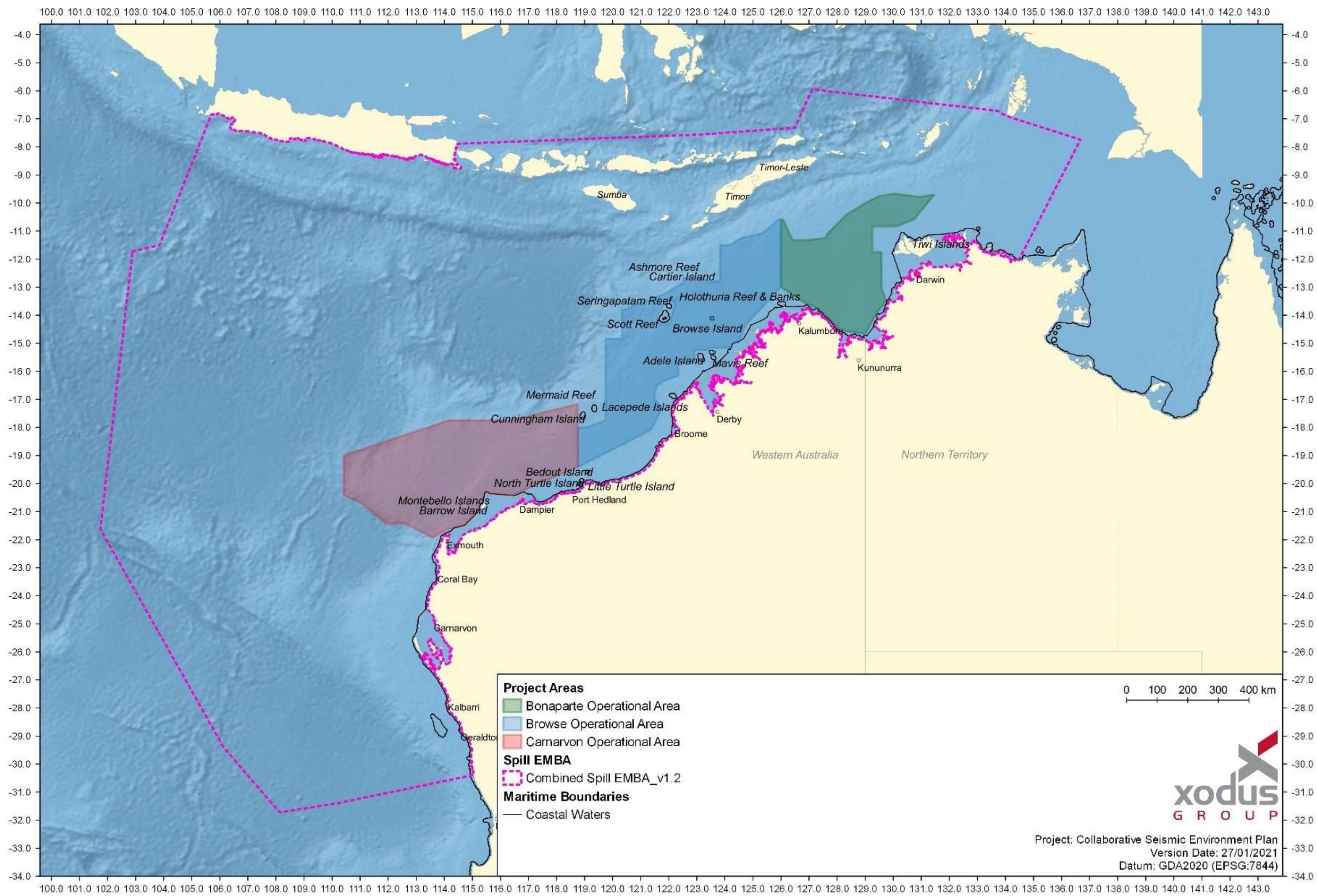


Figure 5-1: CSEP OAs and EMBA

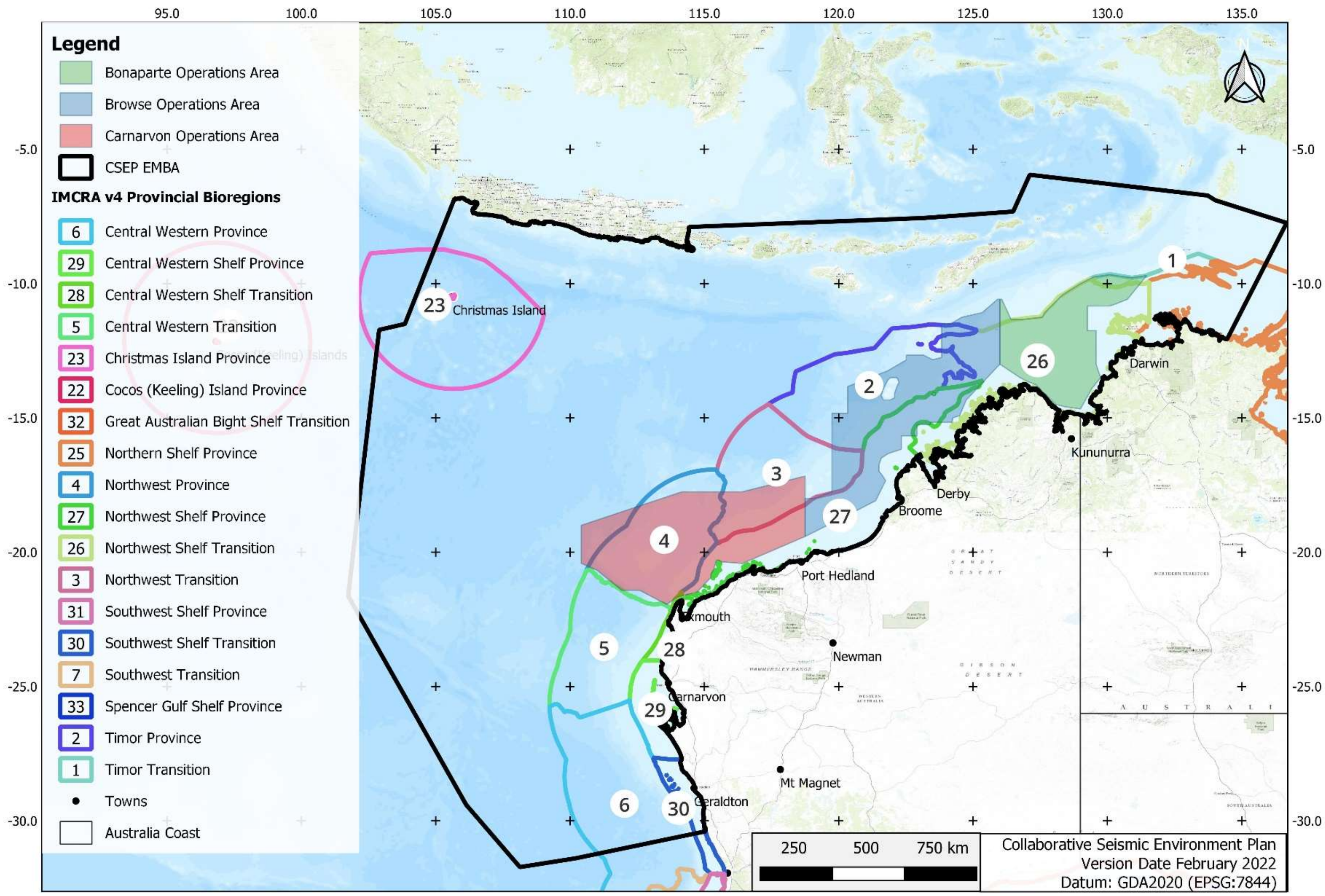


Figure 5-2: CSEP OA and EMBA and IMCRA provincial bioregions

5.2 Protected Areas

Protected areas under state and federal legislation within the CSEP EMBA include World Heritage Areas, Australian Marine Parks, Wetlands of International Importance (Ramsar), Wetlands of National Importance, Commonwealth and National Heritage Places, Shipwrecks, Indigenous Protected Areas, State marine conservation reserves and terrestrial conservation reserves (National Parks, Nature Reserves and Conservation Parks) that bound marine waters.

5.2.1 World Heritage Areas

The CSEP OA does not overlap any World Heritage Areas (WHA).

There are three World Heritage Areas within the CSEP EMBA (Table 5-1), being the coastal boundary of the Kakadu WHA in the Bonaparte EMBA (Figure 5-3), the Ningaloo Coast WHA in the Browse and Carnarvon EMBAs (Figure 5-4 and Figure 5-5) and the Shark Bay WHA in the Carnarvon EMBA (Figure 5-6). Properties of these WHAs are provided in Existing Environment Addendum.

Table 5-1: Heritage Places (World Heritage Areas, Commonwealth Heritage Places and National Heritage Places) within the CSEP EMBA.

Heritage Places	Bonaparte EMBA	Browse EMBA	Carnarvon EMBA
World Heritage Areas			
Kakadu	X		
Ningaloo Coast		X	X
Shark Bay			X
Commonwealth Heritage Places			
Scott Reef and Surrounds – Commonwealth Area	X	X	X
Mermaid Reef – Rowley Shoals	X	X	X
Ningaloo Marine Area – Commonwealth Waters		X	X
Ashmore Reef National Nature Reserve	X	X	
Christmas Island Natural Areas		X	
Yampi Defence Area	X	X	
Bradshaw Defence Area	X	X	
National Heritage Places			
HMAS Sydney II and HSK Kormoran Shipwreck Sites			X
Batavia shipwreck site and survivor camps area 1629 – Houtman Abrolhos			X
The West Kimberley	X	X	X
The Ningaloo Coast		X	X
Shark Bay			X

Heritage Places	Bonaparte EMBA	Browse EMBA	Carnarvon EMBA
Dirk Hartog Landing Site 1616 – Cape Inscription Area			X
Dampier Archipelago (including Burrup Peninsula)		X	X
Kakadu National Park	X		

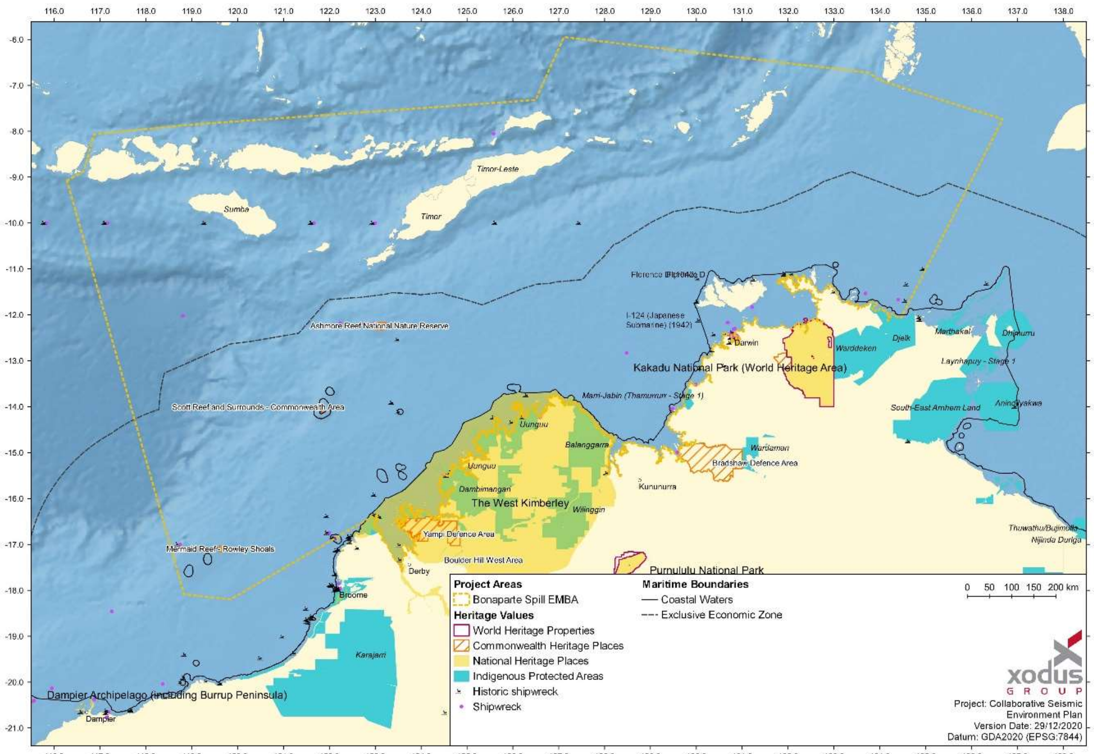


Figure 5-3: WHAs, Indigenous Protected Areas and Shipwrecks within the Bonaparte EMBA

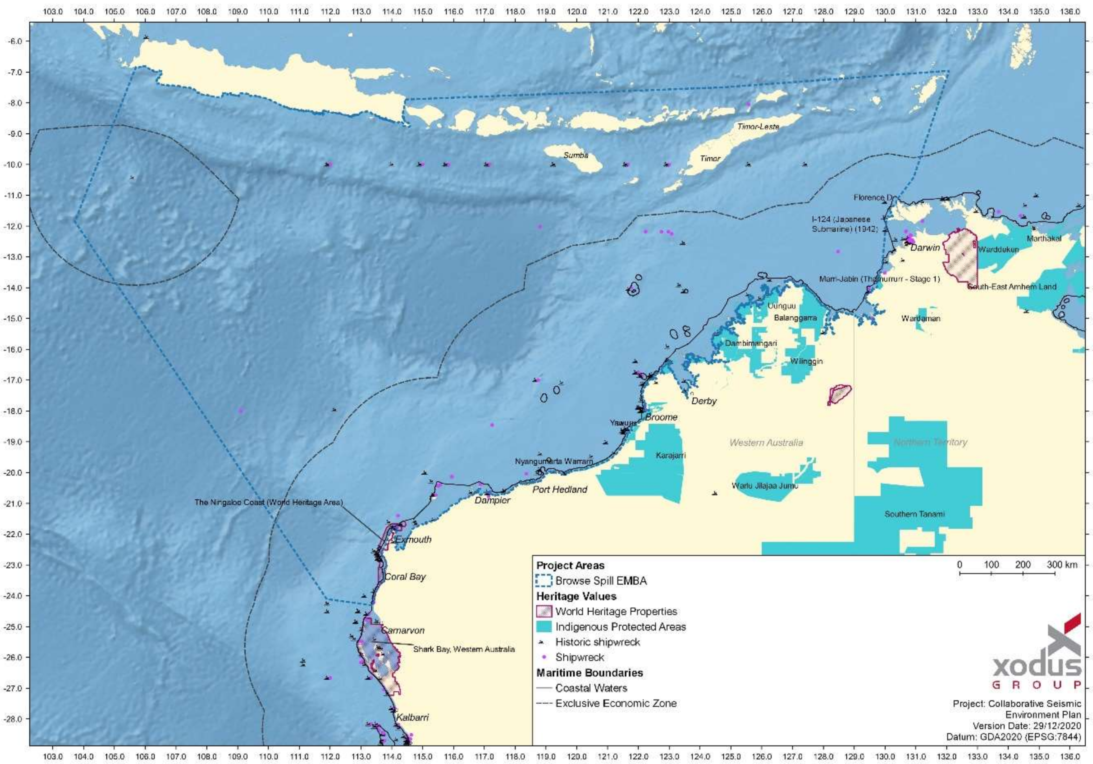


Figure 5-4: WHAs, Indigenous Protected Areas and Shipwrecks within the Browse EMBA

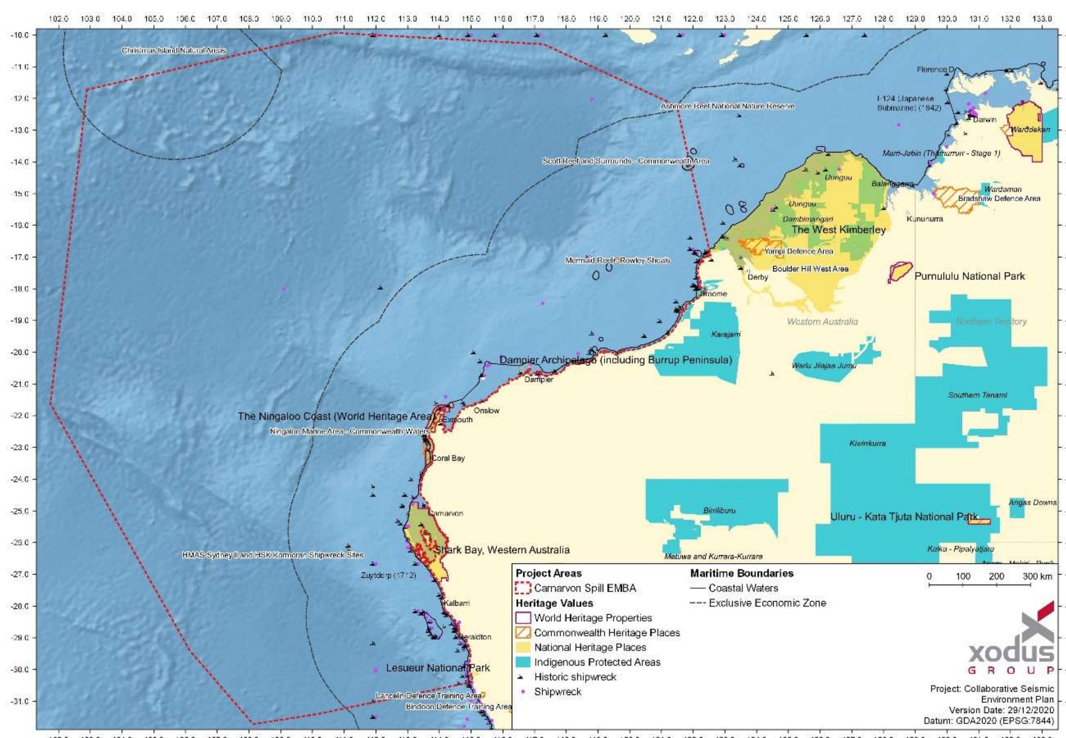


Figure 5-5: WHAs, Indigenous Protected Areas and Shipwrecks within the Carnarvon EMBA

5.2.2 Commonwealth and National Heritage Places

The heritage value of places is part of the definition of environment in the OPGGS(E) Regulations. World Heritage Properties and National Heritage Places are both matters of national environment significance under the EPBC Act. In addition, the Commonwealth Heritage Places List comprises natural, indigenous and historic heritage places which are either entirely within a Commonwealth area, or outside the Australian jurisdiction and owned or leased by the Commonwealth or a Commonwealth Authority.

The CSEP OA does not overlap any Commonwealth or National Heritage Places.

Table 5-1 provides a list of Commonwealth or National Heritage Places within the CSEP EMBA with the locations shown in Figure 5-6 (Bonaparte EMBA), Figure 5-7 (Browse EMBA) and Figure 5-8 (Carnarvon EMBA).

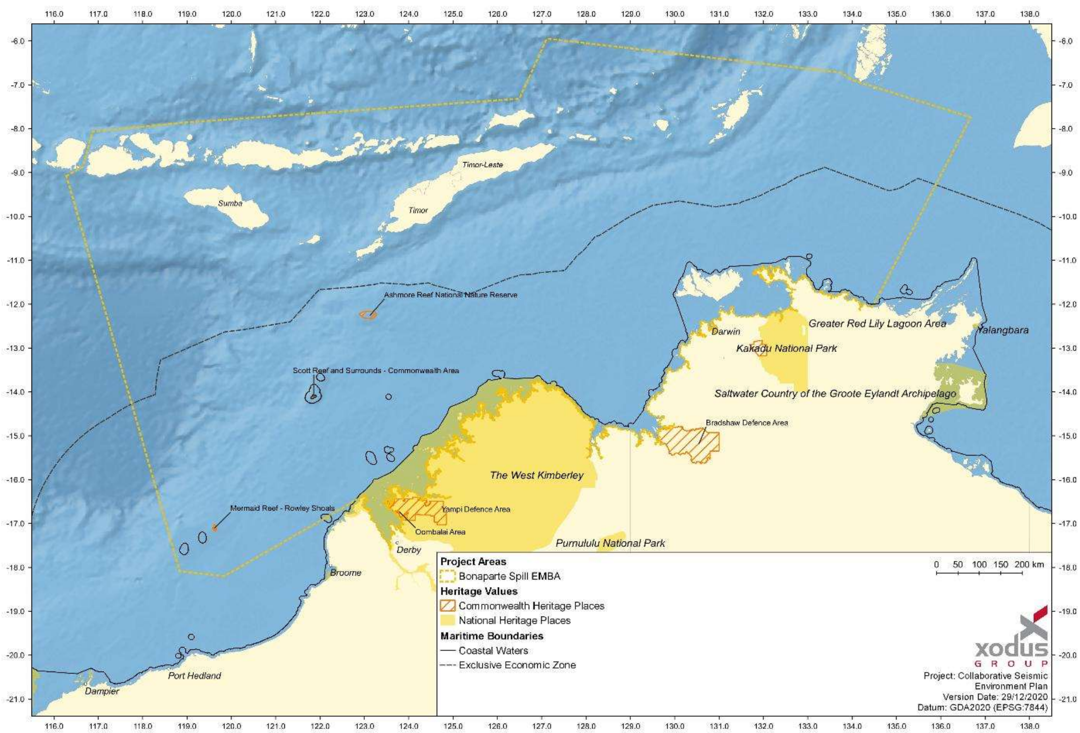


Figure 5-6: Commonwealth and National Heritage Places within the Bonaparte EMBA

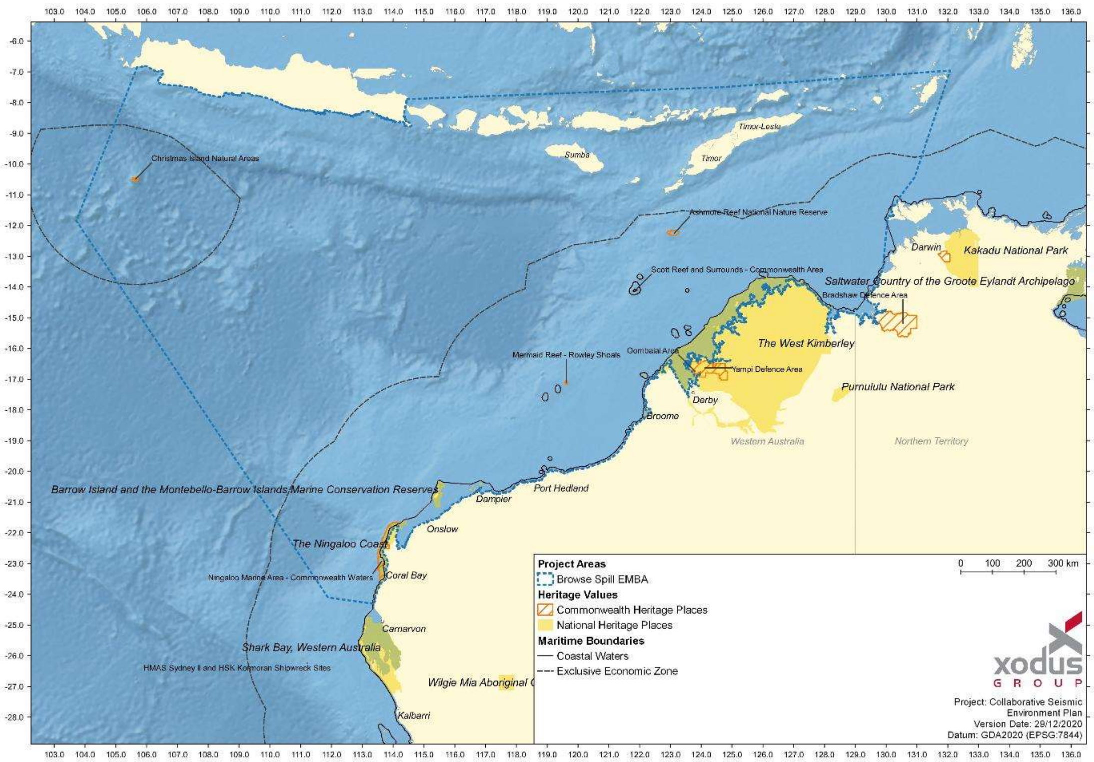


Figure 5-7: Commonwealth and National Heritage Places within the Browse EMBA

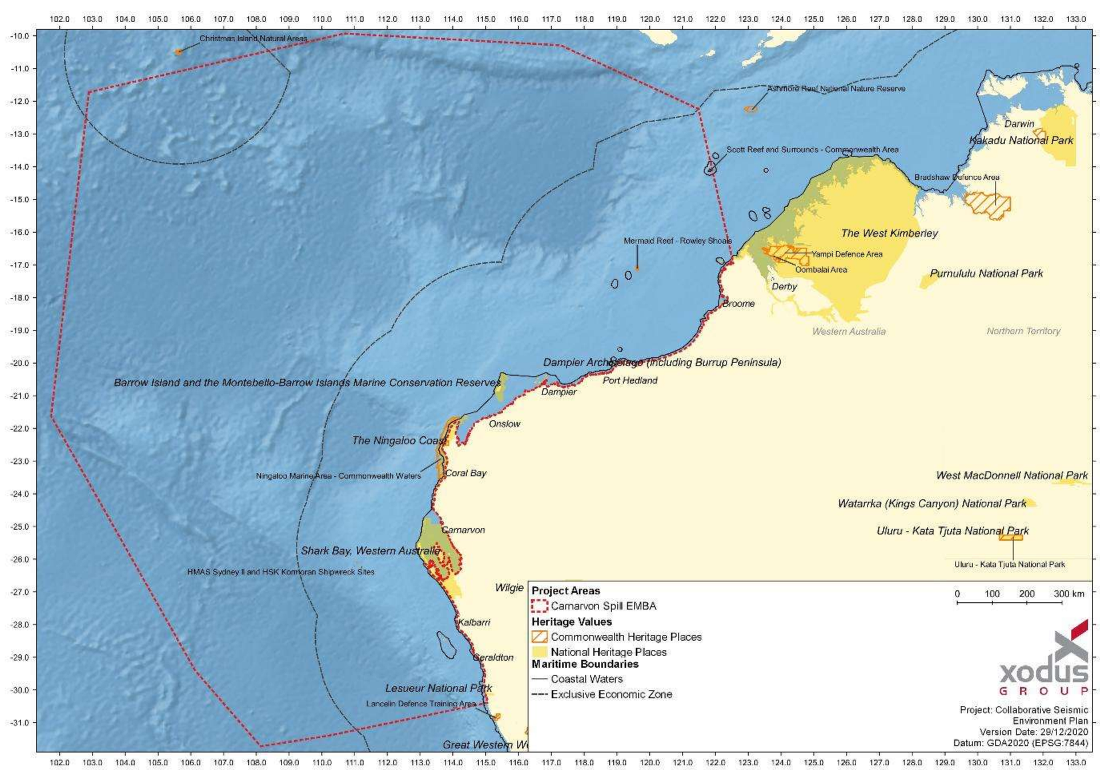


Figure 5-8: Commonwealth and National Heritage Places within the Carnarvon EMBA

5.2.3 *Indigenous Protected Areas*

Aboriginal sites are of immense cultural, scientific, educational, and historic interest and provide Aboriginal people with an important link to their present and past culture. Laws to protect Indigenous heritage, including the EPBC Act, the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* and the *Protection of Movable Cultural Heritage Act 1986*. Sites of significance are included within the National Heritage List and Commonwealth Heritage List. Indigenous Protected Areas are a component of Australia's National Reserve System, which is the network of formally recognised parks, reserves, and protected areas across Australia. Indigenous Protected Areas are areas of land and sea managed by Indigenous groups as protected areas for biodiversity conservation through voluntary agreements with the Australian Government.

The CSEP OA does not overlap any Indigenous Protected Areas.

Indigenous Protected Areas that have coastal interfaces along both the Western Australian and Northern Territory coasts within the CSEP EMBA are shown in Figure 5-3 (Bonaparte EMBA), Figure 5-4 (Browse EMBA) and Figure 5-5 (Carnarvon EMBA).

Registered Aboriginal Heritage Places within the CSEP EMBAs are of various types including ceremonial, engraving, midden/scatters, mythological; present along coast and/or in coastal waters.

5.2.4 *Australian Marine Parks*

The Commonwealth marine environment is a matter of national environment significance under the EPBC Act. Australian Marine Parks (AMPs) occur within Commonwealth waters and have been proclaimed as Commonwealth reserves under the EPBC Act in 2007 and 2013. AMPs (formerly Commonwealth Marine Reserves) are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas. Under the relevant management plans, AMPs are allocated conservation objectives (International Union for Conservation of Nature (IUCN) Protected Area Category) based on the Australian IUCN reserve management principles in Schedule 8 of the EPBC Regulations 2000.

AMP management plans allow for mining operations, which includes seismic activities, in multiple use zones and special purpose zones (IUCN category VI) in accordance with an authorisation issued by the Director of National Parks through class approvals. These class approvals authorise activities undertaken in accordance with an EP accepted under the OPGGS(E) Regulations by NOPSEMA.

Six AMPs occur (wholly, or in part) within the CSEP OAs:

- Argo-Rowley Terrace
    - Multiple Use Zone (IUCN VI)
- Gascoyne
    - Multiple Use Zone (IUCN VI)
- Joseph Bonaparte Gulf
    - Multiple Use Zone (IUCN VI)
    - Special Purpose Zone (IUCN VI)
- Kimberley

  - Multiple Use Zone (IUCN VI)
- Montebello
  - Multiple Use Zone (IUCN VI)
- Oceanic Shoals
  - Multiple Use Zone (IUCN VI)
  - Special Purpose Zone Trawl (IUCN VI)

Table 5-2 provides a summary of the values for the AMPs within the CSEP OA with a description of the values in the Existing Environment Addendum. Figure 5-9 details the AMPs within the CSEP OA.

An additional 14 AMPs occur within the CSEP EMBA:

- Abrolhos
  - Multiple Use Zone (IUCN VI)
  - Special Purpose Zone Trawl (IUCN VI)
- Arafura
  - Multiple Use Zone (IUCN VI)
  - Special Purpose Zone Trawl (IUCN VI)
- Arnhem
  - Special Purpose Zone (IUCN VI)
- Ashmore Reef
- Carnarvon Canyon
- Cartier Island
- Christmas Island
- Dampier
  - Multiple Use Zone (IUCN VI)
- Eighty Mile Beach
  - Multiple Use Zone (IUCN VI)
- Jurien
- Mermaid Reef
- Ningaloo
- Roebuck
  - Multiple Use Zone (IUCN VI)
- Shark Bay
  - Multiple Use Zone (IUCN VI)

Table 5-3 provides a summary of the values for the AMPs within the CSEP EMBA with a description of the values in the Existing Environment Addendum. Figure 5-9 details the AMPs within the CSEP EMBA.

Note Table 5-3 and Figure 5-9 do not detail the Christmas Island Marine Park. A management plan is not in place for this marine park but general information in relation to the park is available in the Existing Environment Addendum.

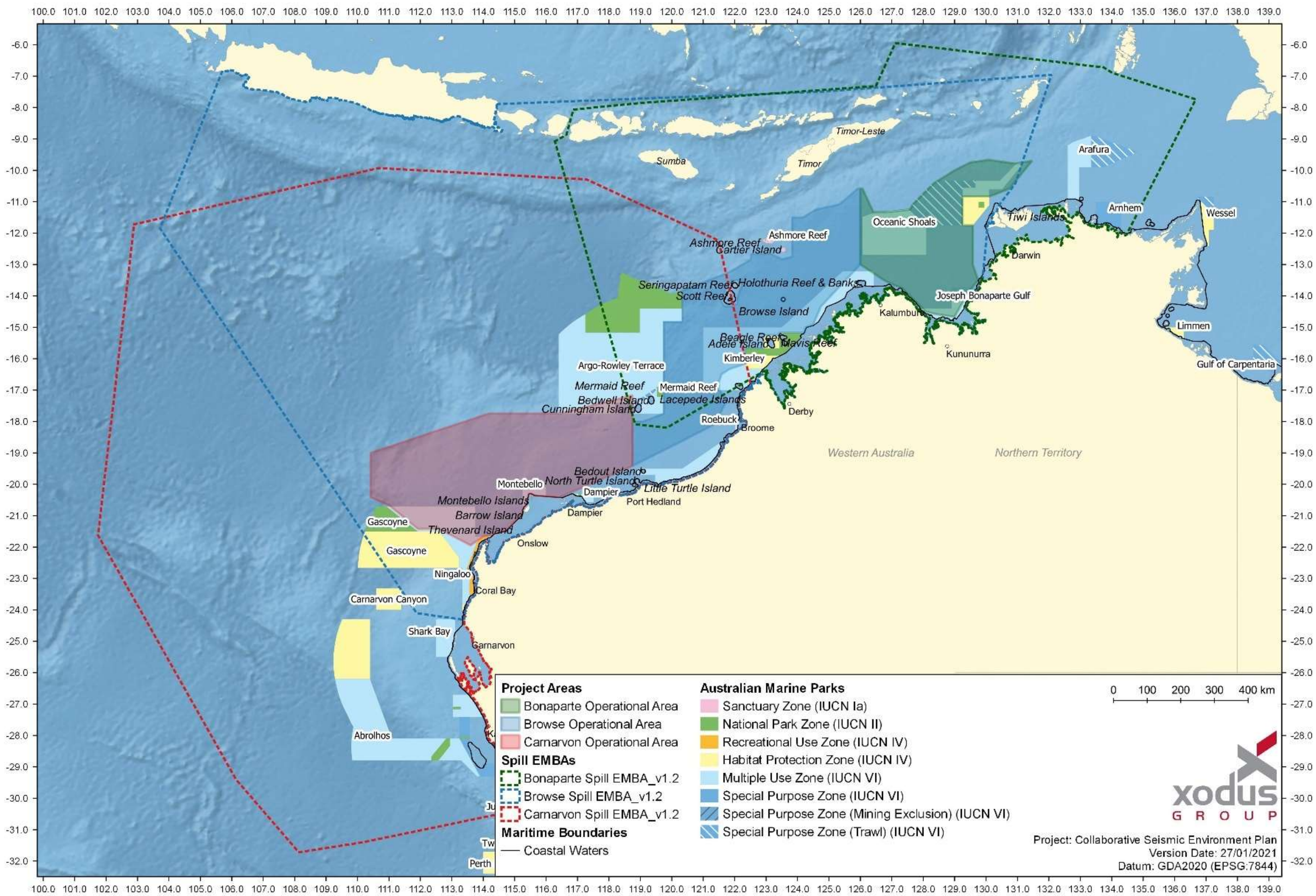


Figure 5-9: Australian Marine Parks within the CSEP OAs and EMBA

Table 5-2: Summary of Values for AMPs within the CSEP OA

AMP	Argo-Rowley Terrace	Gascoyne	Joseph Bonaparte Gulf	Kimberley	Montebello	Oceanic Shoals
Bonaparte OA			X	X		X
Browse OA				X		
Carnarvon OA	X	X			X	
Values						
Benthic habitat		X	X	X		X
Plankton (productivity)						
Marine invertebrates			X			X
Fish	X	X		X	X	X
Birds	X	X		X	X	X
Marine reptiles	X	X	X	X	X	X
Marine mammals	X	X	X	X	X	
KEFs	X	X	X	X	X	X
Heritage values of places	X	X		X	X	
Tourism, recreation, and research		X	X	X	X	
Commercial fisheries	X	X	X	X	X	X
Petroleum activity	X	X	X	X	X	X

Table 5-3: Summary of Values for AMPs within the CSEP EMBA in addition to those in the CSEP OA

AMP	Abrolhos	Arafura	Arnhem	Ashmore Reef	Carnarvon Canyon	Cartier Island	Dampier	Eighty Mile Beach	Jurien	Mermaid Reef	Ningaloo	Roebuck	Shark Bay
Bonaparte EMBA		X	X	X		X							
Browse EMBA				X		X	X	X		X	X	X	
Carnarvon EMBA	X				X	X	X	X	X	X	X	X	X
Values													
Benthic habitat				X	X	X		X	X	X	X	X	
Plankton (productivity)	X		X										X
Marine invertebrates	X	X		X	X	X	X						
Fish	X	X		X		X	X	X	X	X	X	X	X
Birds	X	X	X	X		X	X	X	X		X	X	X
Marine reptiles		X		X		X	X	X			X	X	X
Marine mammals	X			X			X	X	X	X	X	X	X
KEFs	X	X		X		X			X	X	X		
Heritage values of places		X	X	X			X	X		X	X	X	
Tourism, recreation, and research	X	X	X	X		X		X	X	X	X	X	X
Commercial fisheries	X	X	X		X	X	X	X	X			X	X
Petroleum activity	X						X						X

5.2.5 Wetlands of International Importance (Ramsar)

The CSEP OA does not overlap any Wetlands of International Importance.

There are eight Wetlands of International Importance within the CSEP EMBA (Table 5-4). These are included on the List of Wetlands of International Importance developed under the Ramsar Convention in 1971, a treaty between nations aimed at conserving natural wetland resources. Properties of these wetlands are provided in the Existing Environment Addendum.

Table 5-4: Wetlands of International Importance within the CSEP EMBA

Wetlands of International importance (Ramsar)	Bonaparte	Browse	Carnarvon
Ashmore Reef National Nature Reserve		X	
Cobourg Peninsula	X		
Eighty Mile Beach		X	X
Hosnies Spring, Christmas Island		X	
Kakadu National Park	X		
Ord River Flood Plains	X	X	
Roebuck Bay		X	X
The Dales, Christmas Island		X	

5.2.6 Wetlands of National Importance

The CSEP OA does not overlap any Wetlands of National Importance.

There are 22 Wetlands of National Importance within the CSEP EMBA (Table 5-5). Properties of these wetlands are provided in the Existing Environment Addendum.

Table 5-5: Wetlands of National Importance within the CSEP EMBA

Wetlands of National Importance (Ramsar)	Bonaparte	Browse	Carnarvon
Adelaide River Floodplain System	X		
Ashmore Reef		X	
Cape Range Subterranean Waterways		X	X
Coburg Peninsula System	X		
Daly-Reynolds Floodplain-Estuary System	X		
Eighty Mile Beach System		X	X
Exmouth Gulf East		X	X
Finniss Floodplain and Fog Bay Systems	X		
Hosnies Spring, Christmas Island		X	
Kakadu National Park	X		

Wetlands of National Importance (Ramsar)	Bonaparte	Browse	Carnarvon
Leslie (Port Hedland) Saltfields System		X	X
Mary Floodplain System	X		
Mermaid Reef		X	X
Moyle Floodplain and Hyland Bay System	X		
Murgenella-Cooper Floodplain System	X		
Ord Estuary System	X		
Prince Regent River System	X	X	
Port Darwin	X		
Roebuck Bay		X	X
Shark Bay East		X	
Shoal Bay – Micket Creek	X		
The Dales, Christmas Island		X	

5.2.7 Shipwrecks

Australia protects its shipwrecks, sunken aircraft and their associated artefacts that are older than 75 years through the *Underwater Cultural Heritage Act* 2018, administered in collaboration between the Commonwealth and the States, Northern Territory and Norfolk Island. Some underwater heritage sites also have a protected zone around them.

Shipwrecks within the CSEP EMBAs are shown in Figure 5-3, Figure 5-4 and Figure 5-5. Five protected no-entry zones, for Florence D (1942), I-124 (1942), HSK Kormoran (1941), HMAS Sydney II (1941) and Zutydorp (1712) exist within the CSEP EMBAs (Figure 5-10). There are no protected no-entry zones within the CSEP OA.

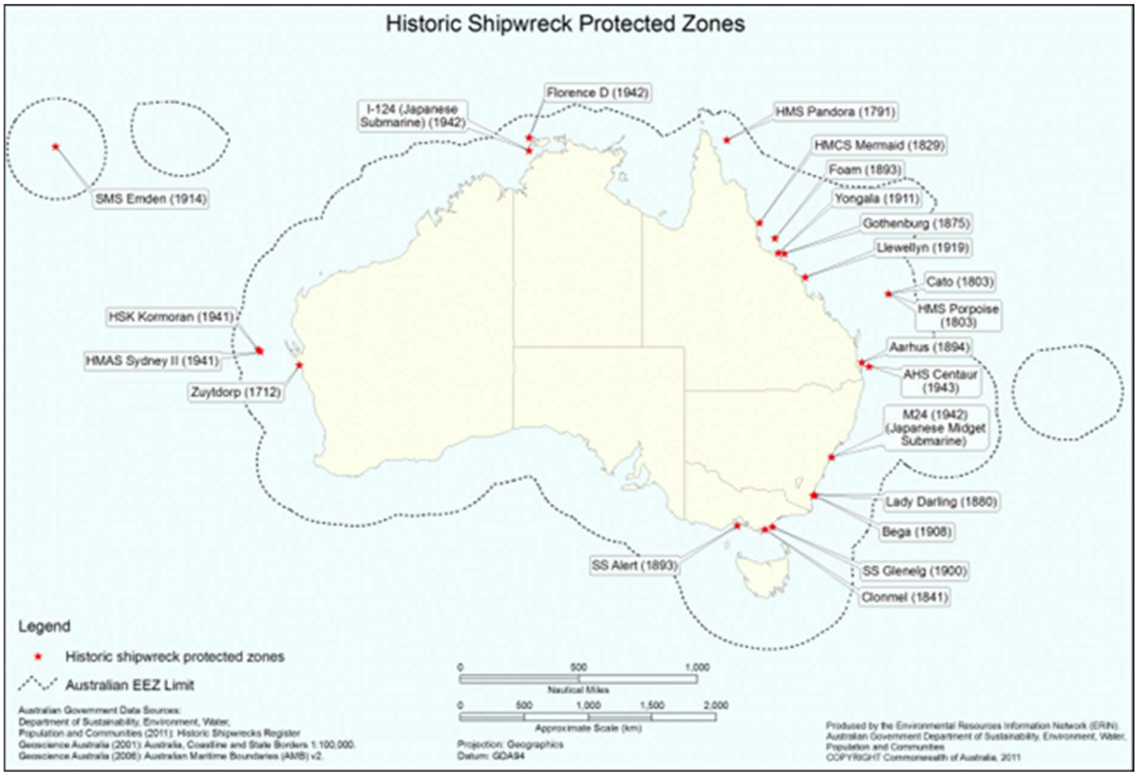


Figure 5-10: Historical Shipwrecks with Protected No-entry Zones

5.2.8 State and Territory Marine Conservation Reserves

The CSEP OA does not overlap any State or Territory Marine Conservation Reserves.

There are 15 State and Territory Marine Conservation Reserves within the CSEP EMBA (Table 5-6). These are shown in Figure 5-11 (Bonaparte EMBA), Figure 5-12 (Browse EMBA) and Figure 5-13 (Carnarvon EMBA).

Properties of these marine conservation reserves are provided in the Existing Environment Addendum.

Table 5-6: State and Territory Marine Conservation Reserves within the CSEP EMBA

State/NT Marine Conservation Reserves	Bonaparte	Browse	Carnarvon
Barrow Island Marine Management Area		X	X
Barrow Island Marine Park		X	X
Eighty Mile Beach Marine Park		X	X
Garig Gunak Barlu National Park	X		
Jurien Bay Marine Park			X
Lalang-garram Camden Sound Marine Park	X	X	
Lalang-garram Horizontal Falls	X	X	
Montebello Islands Marine Park		X	X

State/NT Marine Conservation Reserves	Bonaparte	Browse	Carnarvon
Muiron Islands Marine Management Area		X	X
Ningaloo Marine Park		X	X
North Lalang-garram Marine Park	X	X	
North Kimberley Marine Park	X	X	
Rowley Shoals Marine Park		X	X
Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve			X
Yawuru Nagulagun/Roebuck Bay Marine Park		X	

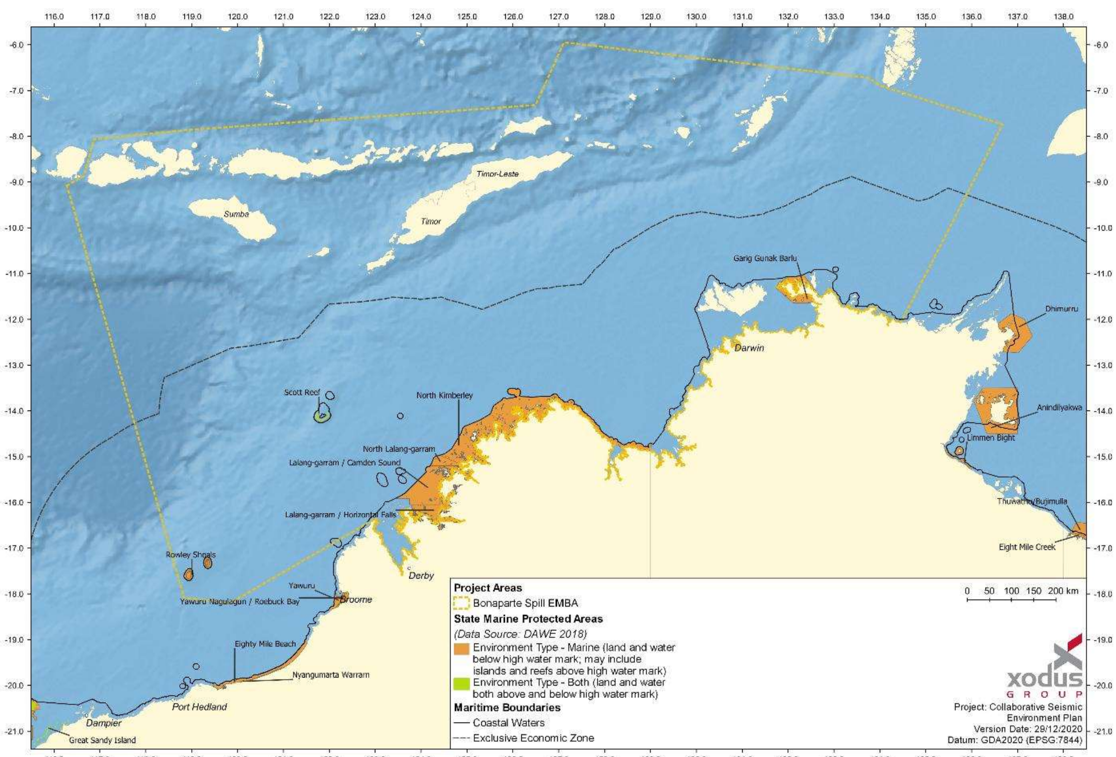


Figure 5-11: State and Territory Protected Marine Areas within the Bonaparte EMBA

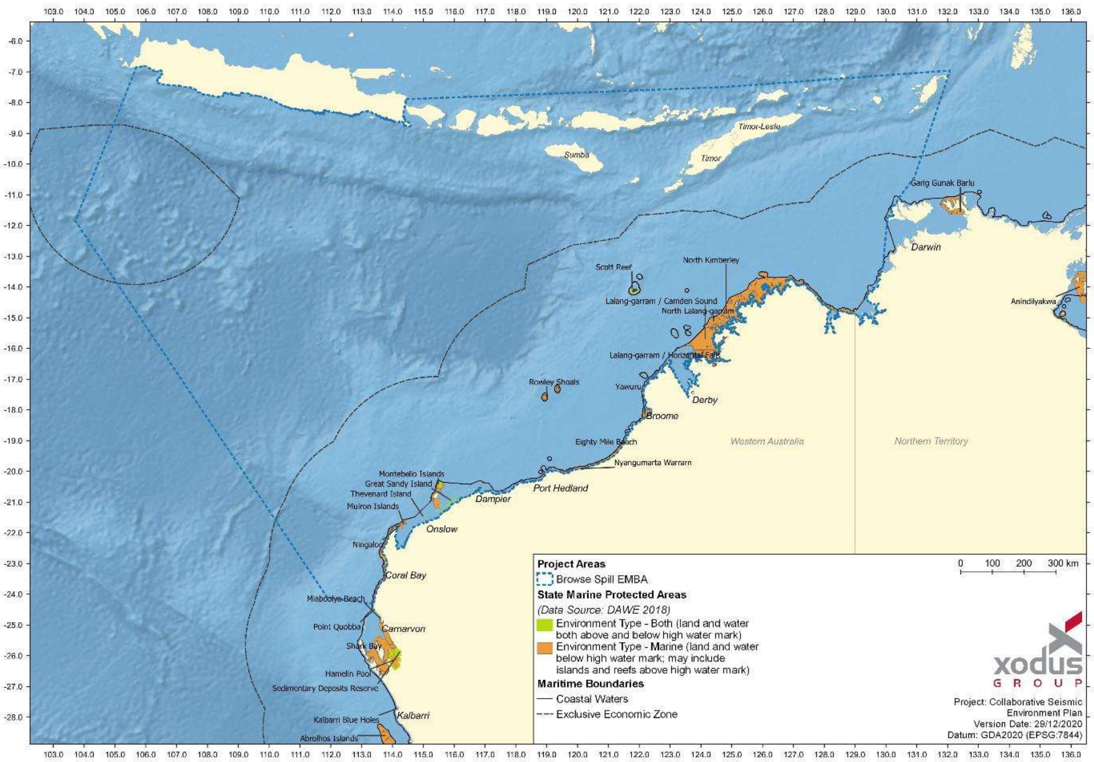


Figure 5-12: State and Territory Protected Marine Areas within the Browse EMBA

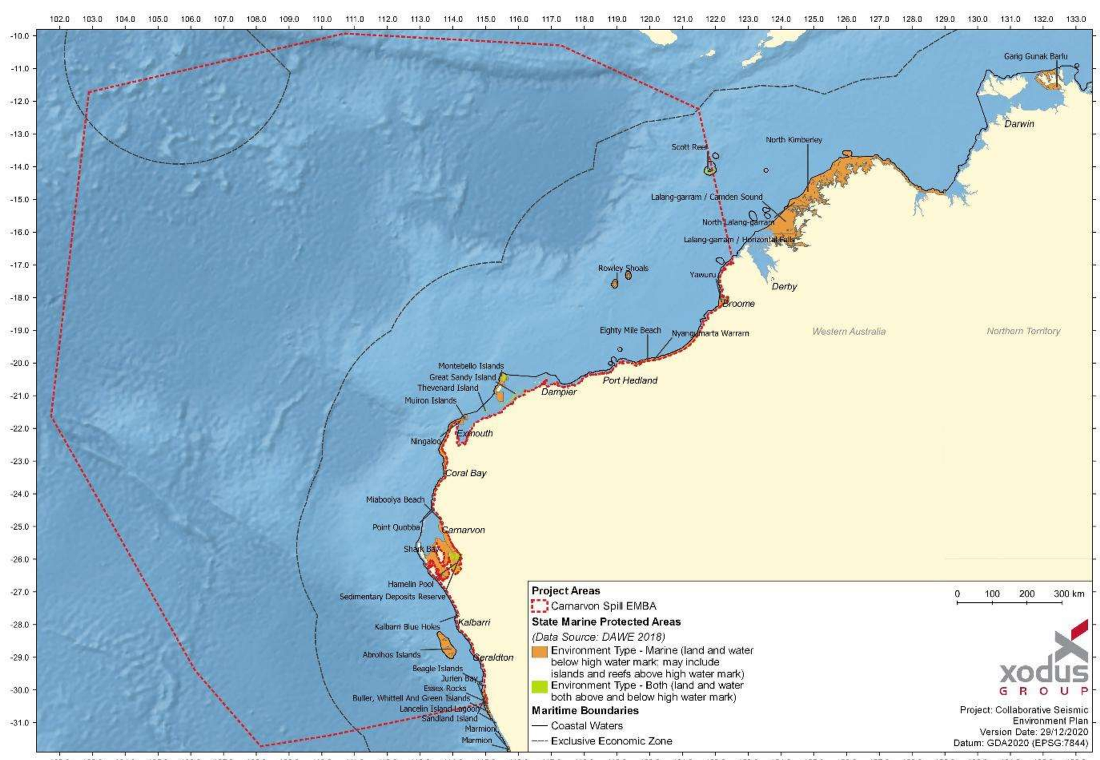


Figure 5-13: State and Territory Protected Marine Areas within the Carnarvon EMBA

5.2.9 Coastal Terrestrial Conservation Reserves with Marine Boundaries

There are no terrestrial conservation reserves within the CSEP OA.

There are numerous terrestrial conservation reserves located adjacent to the coast in the CSEP EMBA, listed under the *Land Administration Act 1997* in WA and the *Territory Parks and Wildlife Conservation Act 1976* in NT. The marine boundary of the reserves can be at low water mark, high water mark or undefined. Many of these coastal terrestrial conservation reserves are islands off the coast of WA. Within the CSEP EMBA there are:

- 14 coastal national parks (3 in Northern WA, 2 in North-West WA, 4 in Southern WA and 5 in the NT).
- 59 coastal nature reserves (16 in Northern WA, 26 in North-West WA and 17 in Southern WA).
- 4 coastal conservation parks (2 in Northern WA, 1 in North-West WA and 1 in Southern WA).

The names, marine boundary and management plans of these reserves are provided in the Existing Environment Addendum.

5.2.10 International Protected Areas

There are no international protected areas within the CSEP OA.

The international protected areas within the CSEP EMBA are:

- Komodo World Heritage Area – located within the lesser Sunda Islands, Indonesia.
- Junung Kulon World Heritage Area – located at the south-western tip of java, Indonesia.
- Laut Sawu Marine National Park - located in the Savu Sea between Sumba, Indonesia, and Timor.
- Meru Betiri National Park – located in East Java, Indonesia with coastal boundary.
- Savu Sea National Marine Conservation Area - located in the Savu sea between Sumba, Indonesia, and Timor.

Information on the values and sensitivities of these protected areas is provided in the Existing Environment Addendum.

5.3 Key Ecological Features

Key Ecological Features (KEFs) are elements of the marine environment that, based on current scientific understanding, are considered to be of regional importance for either a region's biodiversity or the ecosystem function and integrity of a Commonwealth Marine Area.

KEFs that overlap with the CSEP OA are detailed in Table 5-7 with Figure 5-14, Figure 5-15 and Figure 5-17 showing their locations within the Bonaparte OA, Browse OA and Carnarvon OA.

In addition to those KEFs in CSEP OA, Table 5-8 detail those that overlap with the CSEP EMBA (Figure 5-17).

Description of the values of the KEFs are provided in the Existing Environment Addendum.

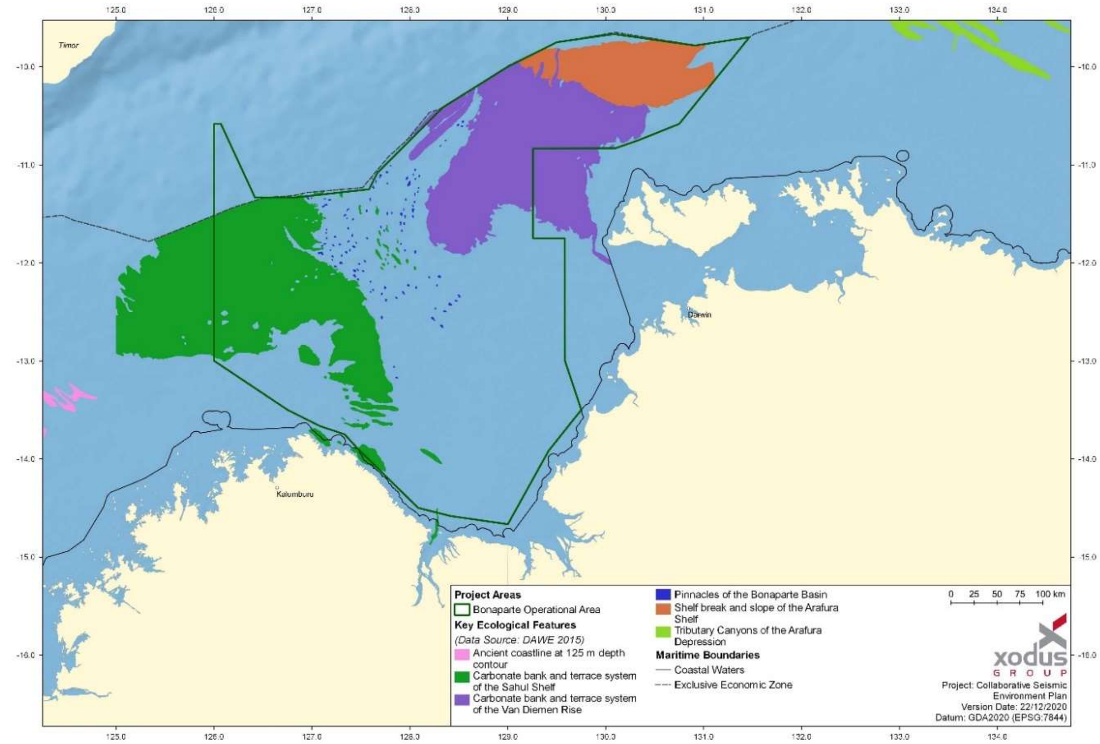


Figure 5-14: KEFs within the Bonaparte OA

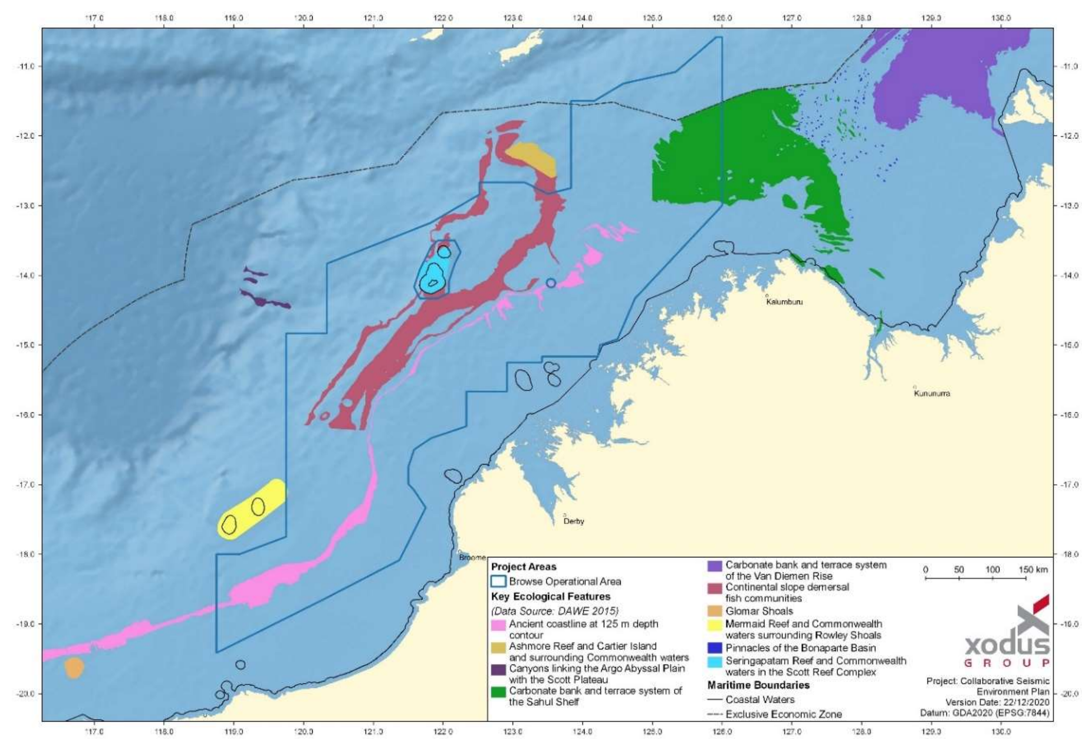


Figure 5-15: KEFs within the Browse OA

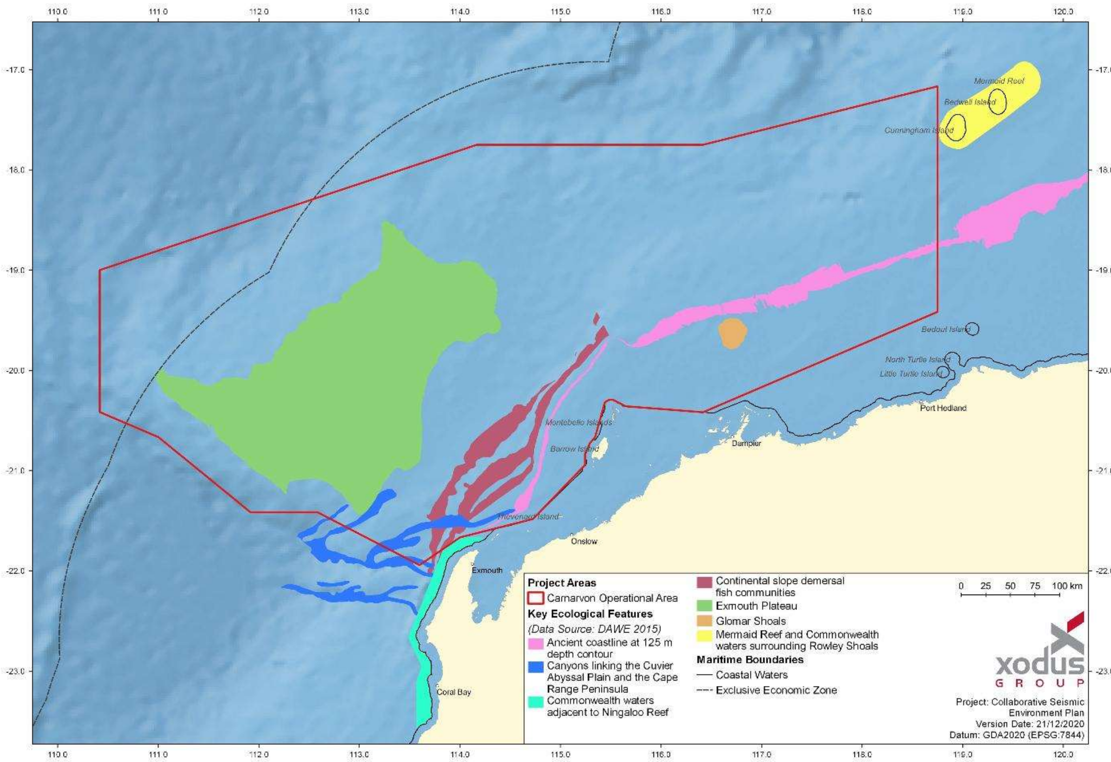


Figure 5-16: KEFs within the Carnarvon OA

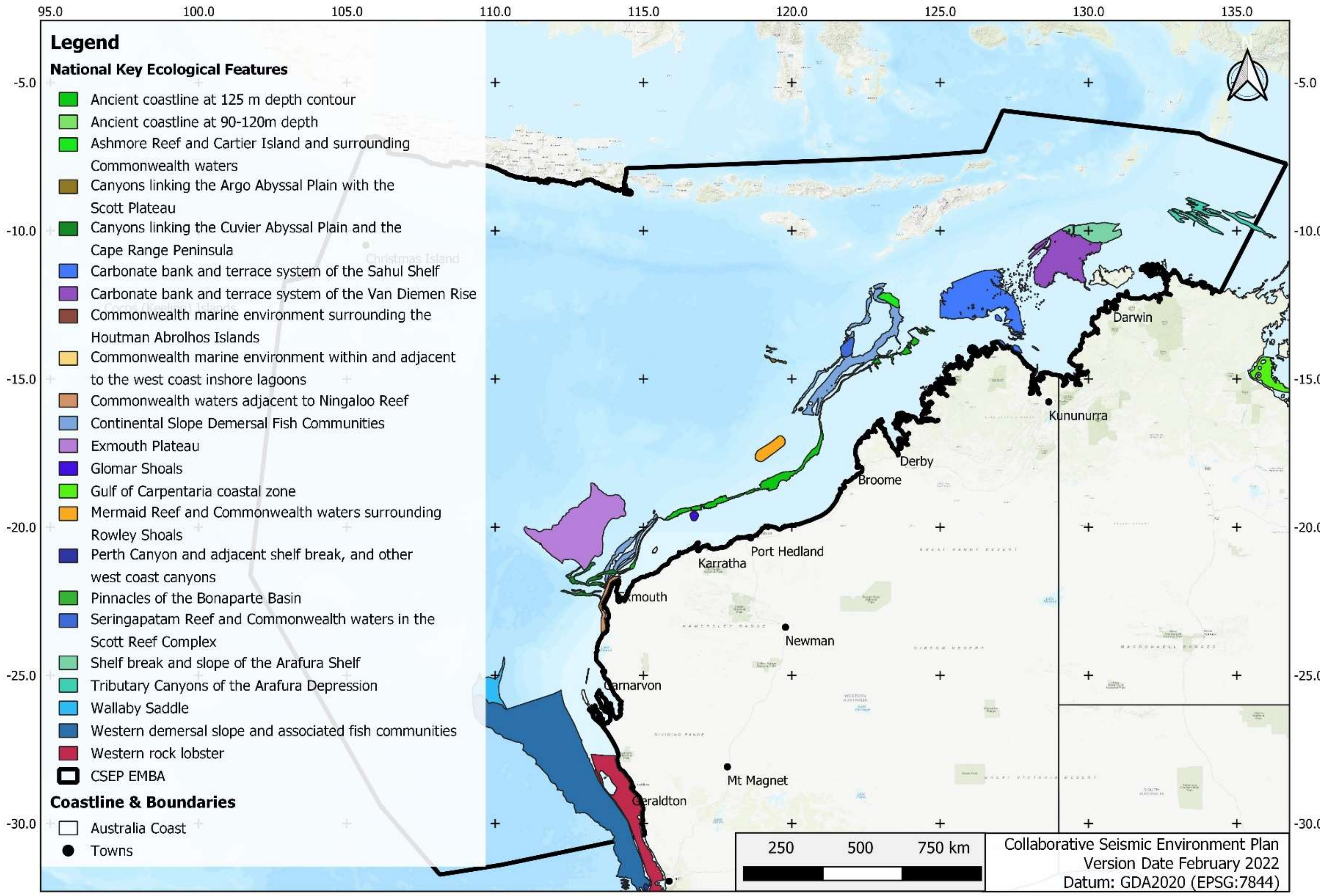


Figure 5-17: KEFs within the CSEP EMBA

Table 5-7: Summary of Values and Sensitivities and Related Receptors for KEFs within the CSEP OA

KEF	Ancient coastline at 125m depth contour	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Carbonate bank and terrace system of the Sahul Shelf	Carbonate bank and terrace system of the Van Diemen Rise	Commonwealth waters adjacent to Ningaloo Reef	Continental slope demersal fish communities	Exmouth Plateau	Glomar Shoals	Pinnacles of the Bonaparte Basin	Shelf break and slope of the Arafura Shelf
Bonaparte OA			X	X					X	X
Browse OA	X									
Carnarvon OA	X	X			X	X	X	X		
<u>Values</u>										
Benthic habitat	X		X	X			X		X	X
Plankton (productivity)			X		X	X	X		X	X
Marine invertebrates	X		X	X	X	X	X		X	
Fish	X	X	X	X	X	X		X	X	X
Birds		X			X					
Marine reptiles		X	X	X	X				X	X
Marine mammals	X	X	X		X	X	X			
Commercial fisheries			-	X		X		X		X

Table 5-8: Summary of Values and Sensitivities and Related Receptors for KEFs within the CSEP EMBA in addition to those in the CSEP OA

KEF	Ashmore Reef and Cartier Island and surrounding Commonwealth waters	Canyons linking the Argo Abyssal Plain and Scott Plateau	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	Seringapatam Reef and Commonwealth waters in the Scott Reef complex	Tributary Canyons of the Arafura Depression
Bonaparte EMBA	X	X	X	X	X
Browse EMBA	X	X	X	X	
Carnarvon EMBA		X	X		
<u>Values</u>					
Benthic habitat	X	X	-	X	X
Plankton (productivity)	-	-	-	-	-
Marine invertebrates	X	-	X	X	X
Fish	X	X	X	X	-
Birds	X	-	-	X	-
Marine reptiles	X	-	-	X	
Marine mammals	X	X	=	X	-
Commercial fisheries	-	-	-	-	-

5.4 Habitats and Faunal Communities

5.4.1 Plankton

Plankton communities comprise phytoplankton and zooplankton, including fish and invertebrate eggs and larvae that float passively in the water or possess such limited swimming ability, that they exist in a drifting state and are moved by currents. Phytoplankton and zooplankton are a source of primary and secondary productivity, and key food sources for other organisms in the oceans (Brewer et al. 2007). Eggs and larvae may be dispersed throughout the water column and throughout the CSEP OAs and beyond, playing an important role in species recruitment.

Plankton abundance and distribution is patchy, dynamic and strongly linked to localised and seasonal productivity (Evans et al. 2016). The mixing of warm surface waters with deeper, more nutrient-rich waters (i.e., areas of upwelling) generates phytoplankton production and zooplankton blooms. In the offshore waters of north-western and northern Australia, productivity typically follows a 'boom and bust' cycle. Productivity booms are thought to be triggered by seasonal changes to physical drivers or episodic events, which result in rapid increases in primary production over short periods, followed by extended periods of lower productivity.

The Indonesian Throughflow has an important effect on biological productivity in the northern areas of Australia and Indonesia. Generally, its deep, warm and low nutrient waters suppress upwelling of deeper, comparatively nutrient-rich waters, thereby forcing the highest rates of primary productivity to occur at depths associated with the thermocline (generally 70 – 100 m depth). When the Indonesian Throughflow is weaker, the thermocline lifts, and brings deeper, more nutrient-rich waters into the photic zone, which results in conditions favourable to increased productivity. Consequently, plankton populations have a high degree of temporal and spatial variability. In tropical regions, higher plankton concentrations generally occur during the winter months (June to August). In waters surrounding Indonesia, seasonal peaks in phytoplankton biomass are linked to monsoon related changes in wind. When the winds reverse direction (offshore vs. onshore), nutrient concentrations decrease/increase because of the suppression/enhancement of upwelling (NASA 2019). Annual variability of phytoplankton productivity in waters surrounding Indonesia is heavily influenced by the El Niño-Southern Oscillation climate pattern (NASA 2019). For example, phytoplankton productivity around Indonesia increases during El Niño events

The waters of north-western Australia are generally considered to be of low productivity in comparison with other global oceanic systems. This is largely due to the relatively low-nutrient, shallow water environment. Peaks in zooplankton such as mass coral spawning events (typically in March and April) (Rosser & Gilmour, 2008) and fish larvae abundance can occur throughout the year.

5.4.2 Benthic Habitats

Benthic habitats are the subtidal seabed substrates that benthic communities grow on or in; these can range from unconsolidated sand to hard and support four biological communities; coral, seagrasses, macroalgae and non-coral benthic invertebrates. The benthic habitats within waters in the CSEP EMBA lie at depths ranging from LAT down to more than 6,000 m at Argo and Cuvier abyssal plains (DEWHA 2008a, 2008b, 2008c).

Benthic habitats are partially driven by light availability. Primary producers (photosynthetic corals, seagrasses and macroalgae) are limited to the photic zone, whereas benthic invertebrates including filter feeding communities may be found in deeper waters. The depth of the photic zone varies spatially and temporally and is predominantly dependent on the volumes of suspended material in the water column. The photic zone in the offshore Pilbara is approximately 70 m whereas in oceanic waters in the northwest and coastal waters of the southwest the photic zone may extend to 120 m (DEWHA 2008b). The photic zone in the offshore north extends to 100 m (DEWHA 2008c).

Further information, if available, on benthic habitats is provided in the Existing Environment Addendum.

5.4.3 Banks and Shoals

Banks and shoals are characterised by abrupt bathymetry, rising steeply from the surrounding shelf to shallower horizontal plateau areas. Substrate types tend to differ from patches of coarse sand to extensive fields of rubble and rocks, limited areas of consolidated reef and occasional isolated rock or live coral outcrops. Knowledge regarding the banks and shoals in northern Australia has been built around several key studies including the Big Bank Shoals study (Heyward et al. 1997) and studies in response to the Montara incident (Heyward et al. 2012, 2010). More recently survey work was undertaken by AIMS as part of the Barossa Development marine studies programme (Heyward et al. 2016, 2017). To date, many banks and shoals have not been described.

The submerged shoals within the CSEP OA can support diverse tropical ecosystems, including phototrophic benthos typical of tropical coral reefs. The shoals support a diverse biota, including algae, reef-building corals, hard corals and filter-feeders. The shoals and banks within the Northern Marine Region, being 5 to 20 km apart, may act as ‘stepping stones’ for enhanced biological connectivity between the reef systems of the region. Shoal and bank habitats are thought to provide additional regional habitat for marine fauna, including sharks and sea snakes (Heyward et al., 2012).

Table 5-9 provides a list of the key banks and shoals within the CSEP OA with locations shown in Figure 5-18, Figure 5-19 and Figure 5-20. Further information, if available, on these banks and shoals within the CSEP OA and EMBA is provided in the Existing Environment Addendum.

Table 5-9: Banks and Shoals within the CSEP OA

Bank/Shoal	Bonaparte OA	Browse OA	Carnarvon OA	Depth (m)	Within Protected Area or KEF?	IMCRA Bioregion
Barracouta Shoal		X		10.3	-	North West Shelf Transition
Barton Shoal		X		13.7	-	North West Shelf Transition
Big Bank Shoals (Bashful, Big, Doc, Grumpy, Happy, Sleepy, Sneezy, Snow White, Wicked)	X	X		15 – 50	-	Timor Province
Blackwood Shoal	X			15 - 50	-	North West Shelf Transition
Dillon Shoal		X		13.1	-	North West Shelf Transition
Echuca Shoal		X		15 - 30	-	North West Shelf Transition
Eugene McDermott Shoal		X		15.5	-	North West Shelf Transition
Evans Shoal	X			13.2 -50	-	North West Shelf Transition
Favell Bank	X			No data	-	North West Shelf Transition
Franklin Shoal	X			10.5 - 30	-	North West Shelf Transition
Flinders Shoal	X			6.8 - 30	-	North West Shelf Transition
Gale Bank	X			22	Carbonate bank and terrace system of the Sahul Shelf KEF	North West Shelf Transition
Glomar Shoals			X	33	Glomar Shoals KEF	North West Shelf Province

Bank/Shoal	Bonaparte OA	Browse OA	Carnarvon OA	Depth (m)	Within Protected Area or KEF?	IMCRA Bioregion
Goeree Shoal		X		19.6	-	North West Shelf Transition
Goodrich Bank	X			15 - 50	-	North West Shelf Transition
Heywood Shoal		X		15 - 30	-	North West Shelf Transition
Hibernia Reef		X		0	-	Timor Province
Jabiru Shoal		X		9.9	-	North West Shelf Transition
Lynedoch Shoal	X			9.8 - 30	Oceanic Shoals AMP	North West Shelf Transition
Lynher Bank		X		10	-	North West Shelf Transition
Karmt Shoal		X		13	-	
Mangola Shoal		X		9	-	Timor Province
Oceanic Shoals	X			10 - 50	Oceanic Shoals AMP	North West Shelf Transition
Pee Shoal		X		21	-	
Rankin Bank			X	19	-	North West Shelf Province
Sahul Banks and Shoals		X		150	Carbonate Banks and terrace system of the Sahul Shelf KEF	Timor Province
Tassie Shoal	X			11.5 - 20	-	North West Shelf Transition
Van Cloon Shoals	X			10	-	North West Shelf Transition

Bank/Shoal	Bonaparte OA	Browse OA	Carnarvon OA	Depth (m)	Within Protected Area or KEF?	IMCRA Bioregion
Vulcan Shoal		X		9.5	-	North West Shelf Transition
Woodbine Bank		X		11.5	-	North West Shelf Transition

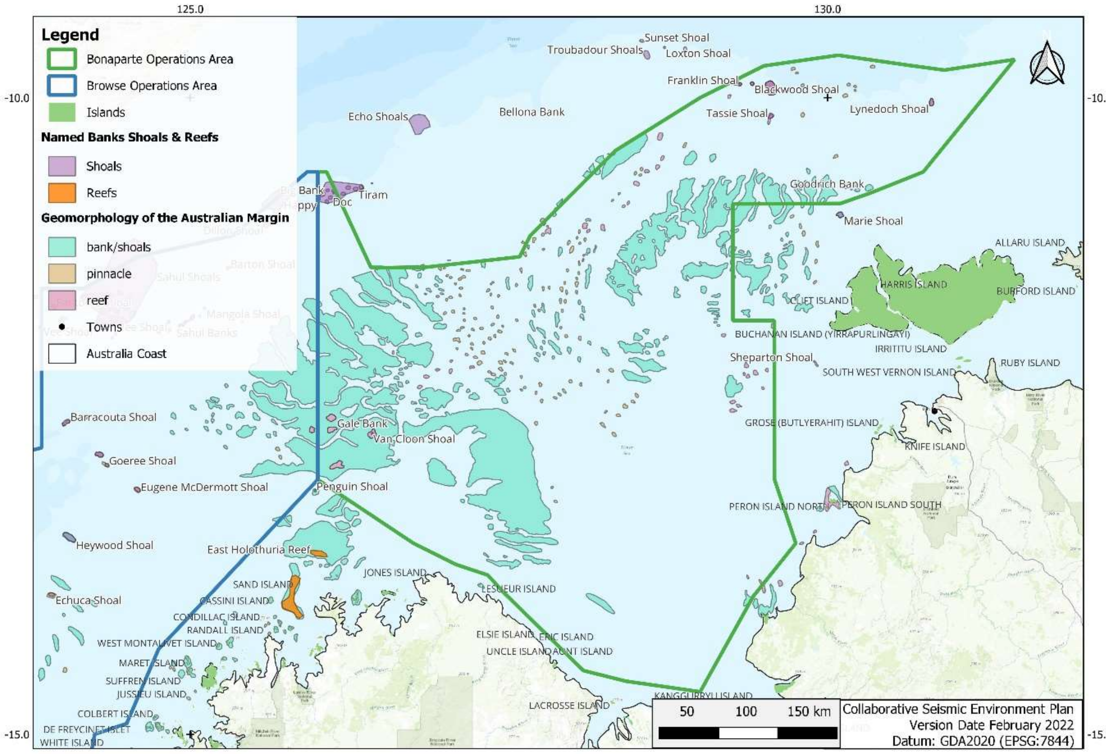


Figure 5-18: Banks and Shoals within the Bonaparte CSEP

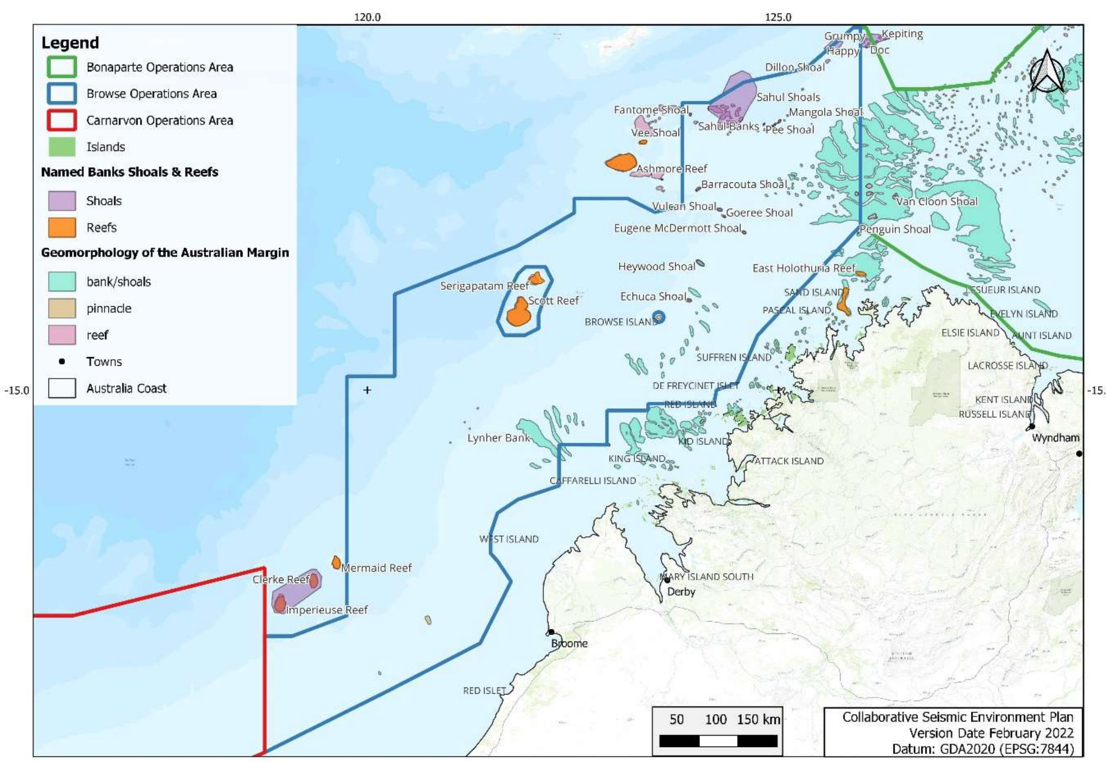


Figure 5-19: Banks and Shoals within the Browse CSEP

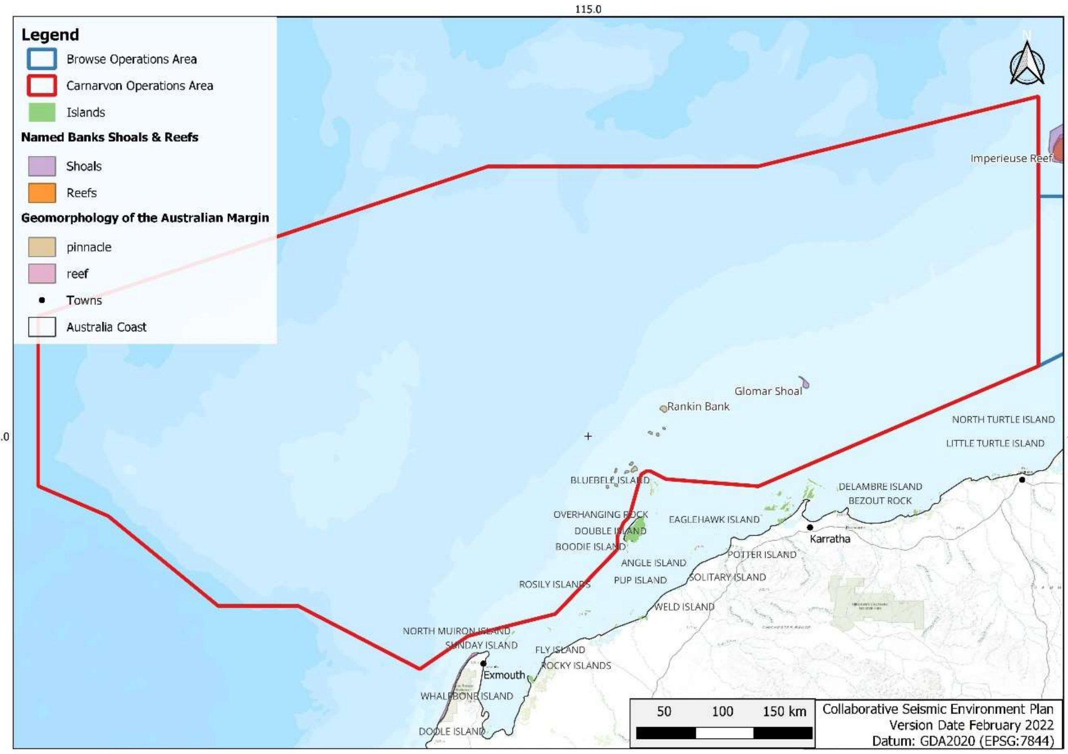


Figure 5-20: Banks and Shoals within the Carnarvon CSEP

5.5 Protected Species

5.5.1 Fish

Fish species listed as threatened and/or migratory under the EPBC Act and derived from a PMST search that may occur within the CSEP OA and EMBA are described in Table 5-10.

BIAs that overlap the CSEP OA are:

- Whale shark (*Rhincodon typus*) – foraging BIA: Browse OA and Carnarvon OA (Figure 5-21).

BIAs that overlap the CSEP EMBA are:

- Whale shark (*Rhincodon typus*) – foraging BIA foraging (high density) BIA (Figure 5-22)
- Dwarf sawfish (*Pristis clavate*) – nursing, foraging, juvenile and pupping BIA (Figure 5-23 Note there are no BIAs within the EMBA than the on the coastal areas adjacent to the CSEP OA)
- Large tooth sawfish or freshwater sawfish (*Pristis pristis*) – foraging and nursing BIA Figure 5-23 Note there are no BIAs within the EMBA than the on the coastal areas adjacent to the CSEP OA)
- Green sawfish (*Pristis zijsron*) – foraging and pupping BIA Figure 5-23 Note there are no BIAs within the EMBA than the on the coastal areas adjacent to the CSEP OA)

- White shark (*Carcharodon carcharias)* – foraging BIA (Figure 5-24 Carnarvon EMBA)

In addition, there are 67 species of syngnathids (pipefishes, ghost pipefishes, seahorses, seadragons) protected under the EPBC Act as listed marine species that may occur within the CSEP EMBA (Table 5-11).

Relevant information on these species is provided in the Existing Environment Addendum.

Fish species of commercial and recreational importance are described in Section 5.8.

Table 5-10: Shark, ray and sawfish species or species habitat presence listed as threatened and/or migratory within CSEP OA and EMBA

Relevant commonwealth conservation management plans are referenced for those species that have them.

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
River sharks									
Glyphis garricki	Northern river shark	Endangered	-	KO	BKO	MO	BKO	-	MO
		CoA (2015a) Recovery Plan for Sawfish and River Sharks Multispecies (2015). Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan). DoE (2014a). Approved Conservation Advice for *Glyphis garricki (*northern river shark*).* Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/82454-conservation-advice.pdf). TSSC (2001a). Commonwealth Listing Advice on *Glyphis sp. C (*Northern River Shark). Threatened Species Scientific Committee (http://www.environment.gov.au/biodiversity/threatened/species/nth-river-shark.html). ***Listed threat of marine debris relevant to seismic surveys.***							
Glyphis glyphis	Speartooth shark	Critically Endangered	-	MO	KO	-	MO	-	-
		CoA (2015a) Recovery Plan for Sawfish and River Sharks Multispecies (2015). Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan). DoE (2014b). Approved Conservation Advice for *Glyphis glyphis* (speartooth shark). Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/82453-conservation-advice.pdf). TSSC (2001b). Commonwealth Listing Advice on *Glyphis sp. A* (Speartooth Shark). Threatened Species Scientific Committee (http://www.environment.gov.au/biodiversity/threatened/species/speartooth-shark.html). ***Listed threat of marine debris relevant to seismic surveys.***							

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Sawfish									
Anoxypristis cuspidata	Narrow sawfish	-	Marine	LO	KO	LO	KO	KO	KO
Pristis clavate	Dwarf sawfish	Vulnerable	Marine	KO	BKO	KO	BKO	KO	BKO
		CoA (2015a) Recovery Plan for Sawfish and River Sharks Multispecies (2015). Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan). ***No listed threats relevant to seismic surveys identified.***							
Pristis pristis	Largetooth (freshwater) sawfish	Vulnerable	Marine	KO	KO	KO	KO	-	KO
		CoA (2015a) Recovery Plan for Sawfish and River Sharks Multispecies (2015). Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan). DoE (2014c). Approved Conservation Advice for *Pristis pristis* (largetooth sawfish). Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/60756-conservation-advice.pdf). ***Listed threat of marine debris relevant to seismic surveys.***							
Pristis zijsron	Green sawfish	Vulnerable	Marine	KO	BKO	KO	BKO	KO	BKO
		CoA (2015a) Recovery Plan for Sawfish and River Sharks Multispecies (2015). Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/recovery/sawfish-river-sharks-multispecies-recovery-plan). DEWHA (2008d). Approved Conservation Advice for Green Sawfish. Canberra: Department of the Environment, Water, Heritage and the Arts. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/68442-conservation-advice.pdf).							

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		TSSC (2008). Listing Advice for *Pristis zijsron* (green sawfish). Threatened Species Scientific Committee (http://www.environment.gov.au/biodiversity/threatened/species/pubs/68442-listing-advice.pdf). ***Listed threat of marine debris relevant to seismic surveys.***							
Sharks									
Carcharodon carcharias	White shark	Vulnerable	-	MO	MO	MO	KO	KO	FKO
		DSEWPaC (2013). Recovery Plan for the White Shark *(Carcharodon carcharias).* Department of Sustainability, Environment, Water, Population and Communities. (http://www.environment.gov.au/biodiversity/threatened/recovery-plans/recovery-plan-white-shark-carcharodon-carcharias). ***No listed threats relevant to seismic surveys.***							
Carcharhinus longimanus	Oceanic whitetip shark	-	Marine	-	MO	-	LO	-	LO
Carcharias taurus	Grey nurse shark (west coast population)	Vulnerable	-	-	MO	-	KO	KO	KO
		DoEE (2018). Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018). Department of the Environment and Energy Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/tap/marine-debris-2018). ***Listed threat of marine debris relevant to seismic surveys.***							
Isurus oxyrinchus	Shortfin mako shark	-	Marine	LO	LO	LO	LO	LO	LO
Isurus paucus	Longfin mako shark	-	Marine	LO	LO	LO	LO	LO	LO
Lamna nasus	Porbeagle mackerel shark		Marine	-	-	-	MO	-	MO

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Rays									
Manta alfredi	Reef manta ray	-	Marine	LO	KO	KO	KO	KO	KO
Manta birostris	Giant manta ray	-	Marine	LO	LO	LO	KO	KO	KO
Whale shark									
Rhincodon typus	Whale shark	Vulnerable	Marine	MO	FKO	FKO	FKO	FKO	FKO
		TSSC (2015a). Conservation Advice *Rhincodon typus* whale shark. Threatened Species Scientific Committee . Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/66680-conservation-advice-01102015.pdf). ***Listed threats of vessel strike and marine debris relevant to seismic surveys.***							

Type of Presence: BKO – Breeding known to occur within area FKO - Foraging, feeding or related behaviour known to occur within area KO - Species or species habitat known to occur within area LO - Species or species habitat likely to occur within area MO - Species or species habitat may occur within area	

Table 5-11: Syngnathid species or species habitat presence within CSEP EMBA.

*Syngnathid species that were identified within the PMST search and have recorded occurrences within the CSEP OA or EMBA (Source: ALA 2021).

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Acentronura australe**	Southern pygmy pipehorse	-	-	-	-	-	MO	No data, occurrences recorded largely within the southern Australia.	No data
*Acentronura larsonae**	Helen's pygmy pipehorse	-	-	MO	MO*	MO	MO*	Found clinging to *Sargassum* algae at the Montebello Islands attached to isolated coral rock on a sandy coral rubble bottom in a sheltered coral reef in 3 m.	<3
*Bhanotia fasciolata**	Corrugated pipefish	MO	MO*	MO	MO*	MO	MO*	Collected in depths of 5-7 m. Demersal individuals are most common in reef and tidepool habitats, but they occur to depths of at least 14-17 m. Lives openly on muddy or silty substrates in depths of 3-25 m.	3-25
*Bulbonaricus brauni**	Braun's pughead pipefish	-	-	MO	MO*	MO	MO*	Found in the Eastern Indian Ocean, from Indonesia to WA, and off the Ryukyu Islands of Japan among coral reefs.	1-10
*Campichthys galei**	Gale's pipefish	-	-	-	MO*	-	MO	Endemic to Australia, found from Shark Bay (WA) to the Spencer Gulf (SA) on the rubble bottom of inshore waters to depths of 18 m.	0-18

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Campichthys tricarinatus**	Three-keel pipefish	MO	MO*	MO	MO*	MO	MO*	Sand, coral rubble, algae (including Sargassum), isolated coral knolls, soft corals, small sponges, low coral outcrops, sheltered reef and rocky islets in depths of 3-11 m.	3-11
*Choeroichthys brachysoma**	Pacific short-bodied pipefish	MO	MO*	MO	MO*	MO*	MO*	Recorded in depths of up to 27.4 m. Most commonly occurs in seagrass, reef and coral habitats in depths of less than 5 m. Reefs (fringing, exposed, sheltered and limestone), live corals (including *Porites, Acropora, Millepora and Synarea*), soft corals, dead corals, algae (including *Sargassum* and filamentous algae), seagrass, sponges, hydroids, coral and shell rubble, coral rock, beach rock, sandstone terraces, isolated rock pools, caves, lagoons, mud, sand, and silt.	1-27
*Choeroichthys latispinosus**	Muiron Island pipefish	-	-	MO	MO*	MO	MO*	Endemic to the coastal waters of WA from Port Denison to Brecknock Island in the east Kimberley.	No data
*Choeroichthys suillus**	Pig-snouted pipefish	-	MO*	MO	MO*	MO	MO*	Occurs in inshore reef habitats. Coral knolls, live corals, coral rubble, shell rubble, coral rock, ledges, sand, seagrass and algae in depths of 1-14 m.	1-14

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Corythoichthys amplexus**	Fijian banded pipefish	MO	MO*	MO	MO*	MO	MO*	Occurs in coral reefs, lagoons, harbours, and open sandy-flats; as well as in rubble along edges of reefs and in small patches of reef which are surrounded by sandy flats.	1-10
*Corythoichthys flavofasciatus**	Reticulate pipefish	MO	MO*	MO	MO*	MO	MO*	Occurs in fringing coral reefs, coral reef crests, reef flats, live corals (including Acropora), gorgonians, limestone rock platforms, soft corals, dead corals, algae, encrusting organisms, rubble, rocky shores, gutters, drop-offs, bomboras, pools, caves and sand, in depths of 0.1-30 m	<1-30
*Corythoichthys haematopterus**	Reef-top pipefish	MO	MO*	-	MO*	-	-	Generally, inhabits protected rubble and sandy areas in shallow reef lagoons, reef flats and fore-reef slopes at 1-21 m, mostly above 5 m.	1-2
*Corythoichthys intestinalis**	Scribbled pipefish	MO	MO*	MO	MO*	MO	MO*	Typically found in sheltered sponge reeds in shallow lagoons and harbours usually in 5-10 m depth. Specimens in Australia. fish collections were collected in association with coral slopes, reef flats, reef edges, bomboras, live corals (including Acropora), soft corals, dead corals, rocky shore, mangroves, seagrass, sand rubble,	0-38

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								rock rubble, caves, lagoons, mud, sand and silt within depths range of 0-38 m.	
*Corythoichthys schultzi**	Schultz's pipefish	MO	MO	MO	MO*	MO	MO*	Found among corals or sea fans in lagoon and seaward reefs. Adults in pairs or small aggregations when in the open or in safe places at night.	2-30
*Cosmocampus banneri**	Roughridge pipefish	MO	MO*	MO	MO*	MO	MO*	Occurs in coral reefs (including outer reefs), ledges, lagoons, live corals, rock, sponges, sand and rubble in depths of 2-30 m.	2-30
*Cosmocampus maxweberi**	Maxweber's pipefish	-	-	-	MO*	-	-	Found in the Red Sea from Sumatra to Tonga and Samoa, and from the Marshall Islands to the Great Barrier Reef. Adults live in reefs and reef-rubble to depths of 36 m, while planktonic juveniles have been found in the top 85m of 1500–2000 m water columns.	1-2000
*Doryrhamphus baldwini**	Redstripe pipefish	-	-	-	MO*	-	-	Adults usually occur in caves, rocky crevices, and the seaward slopes of coral reefs at depths from 6.1 to 48.8 m. It is an active cleaner which has been recorded cleaning small parasitic crustaceans on cave cardinal fish (*Zapogon evermanni*) and a moray eel (*Gymnothorax sp.*).	6-48

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Doryrhamphus dactyliophorus**	Banded pipefish	MO	MO*	MO	MO*	MO	MO*	Inhabits protected reefs and lagoons, usually in caves and crevices to 10 m. This species is rarely found in depths over 20 m. Shallow water species, commonly found inshore and outer reef lagoons. Adults to about 10 m depth. Reports from deep water are based on other banded species. They are often seen in large caves (Kuiter 2009).	5-56
*Doryrhamphus excisus**	Bluestripe pipefish	MO	MO*	MO	MO*	MO	MO*	Inhabits coastal to outer reefs, in a variety of habitats including lagoons, reef flats, reef slopes and walls, channels, coral gutters, usually in or near crevices and caves, in depths between 5 and about 45 m.	5-45
*Doryrhamphus janssi**	Cleaner pipefish	MO	MO*	MO	MO*	MO	MO*	Inhabits sheltered inshore coral reefs where pairs usually maintain cleaning stations in caves and crevices with sponges, and below large plate corals (Kuiter 2009).	14-44
*Doryrhamphus multiannulatus**	Many-banded pipefish	-	-	MO	MO*	MO	MO*	Coastal species, inhabiting waters around the Coral Triangle, including the Philippines, Indonesia, and NW Australia (Austin and Pollom 2016). It lives in coral patches on sandy	15-44

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								and muddy slopes at depths of 15–44 m.	
*Doryrhamphus negrosensis**	Flagtail pipefish	-	-	MO	MO*	MO	MO*	Occurs in mud flats and reefs, both coral and rocky, where it is often associated with sea urchins.	<9
Festucalex cinctus	Girdled pipefish	MO	MO*	-	MO	-	-	Usually inhabits sheltered coastal bays and estuaries, on patches of rubble, sand or in areas of sparse seagrass, algal and sponge growth.	1-31
*Festucalex scalaris**	Ladder pipefish	-	-	MO*	MO	MO	MO*	Endemic to WA, occurring from Shark Bay to the Monte Bello Islands. Habitat generalist, with species samples being taken from trawls, from among weeds and algae and one sample from a pond Austin and Pollom (2016). It is reported to occur on rocky-reefs in inlets, bays and lagoons, as well as shallow seagrass beds.	No Data
*Filicampus tigris**	Tiger pipefish	MO	MO	MO	MO*	MO	MO*	Inhabits areas near channels in inshore sheltered bays and estuaries with sandy or muddy bottoms, or along seagrass bed edges at 2-30 m.	2-30
*Halicampus brocki**	Brock's pipefish	MO	MO*	MO	MO*	MO	MO*	Occurs on coral and rocky reefs with algae. Inhabits patches of coral and macro-algae on coastal reefs at 3-45 m (Kuiter 2009).	3-45

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Halicampus dunckeri**	Red-hair pipefish	MO	MO*	MO	MO*	MO	MO*	Widespread throughout the tropical and subtropical waters of the Indo-West Pacific from the eastern coast of Africa, Red Sea included, until Salomon Islands and from South Japan to the Great Barrier Reef. Typically found in coastal algal-rubble slopes between the surface and 25 metres.	0-25
*Halicampus grayi**	Mud pipefish	MO	MO*	MO	MO*	MO*	MO*	Inhabits silty and muddy soft bottoms on the continental shelf from inshore bays to deep offshore areas to 100 m. Mainly lives in muddy habitats and shallow inshore muddy bays to deep offshore, reported to 100 m depth (Kuiter 2009).	0-100
*Halicampus macrorhynchus**	Whiskered pipefish	-	-	-	MO*	-	-	Widespread throughout the tropical and subtropical waters of the Indo-West Pacific from the eastern coast of Africa, Red Sea included, until Salomon Islands and from South Japan to the Queensland's area in Australia. Adults inhabit reef flats where it is found in seagrass areas, among coral rubble and algae-covered rocks. Juveniles occur with round-leafed seagrasses on sand slopes, usually settling from pelagic	0-25

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								state at about 8 cm long. Adults on sand or algae covered reefs to about 25 m depth.	
Halicampus mataafae	Samoan pipefish	-	-	-	MO*	-	-	It is found in the Indo-Pacific, from the Red Sea to Sodwana Bay, to Taiwan, the Marshall Islands, and Samoa, where it inhabits tidepools and coral and rocky reefs to depths of 15 m. Solitary species with cryptic habits and is rarely observed.	<15
*Halicampus nitidus**	Glittering pipefish	-	MO	MO	MO*	MO	MO*	Found in the Western Pacific, from Vietnam to Fiji and from the Ryukyu Islands to New Caledonia, where it inhabits corals, sand and reef flats to depths of 20 m.	0-20
*Halicampus spinirostris**	Spiny-snout pipefish	MO	MO*	MO	MO*	MO	MO*	Inhabits shallow coral rubble areas in lagoons and intertidal zones of inshore coral reefs in 5- 10 m.	5-10
*Haliichthys taeniophorus**	Ribboned pipehorse	MO	MO*	MO	MO*	MO*	MO*	Inhabits a variety of inshore shallow water areas including weedy regions bordering open substrates, coral reefs, rocky, gravel, sandy and muddy substrates; also associated with sponges, algae, hydroids, shells and seagrass usually from 1-18 m.	0-18
*Hippichthys cyanospilos**	Blue-speckled pipefish	MO	MO*	-	MO*	-	-	Brackish shallow-water environments in estuaries and lower reaches of coastal rivers and	0-4

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								streams, often amongst mangroves to 4 m.	
*Hippichthys heptagonus**	Madura Pipefish	-	-	-	MO*	-	-	A species of freshwater pipefish of the family Syngnathidae. It is found from Kenya and South Africa to the Solomon Islands, and from southern Japan to NSW. Demersal species, living in the lower parts of rivers and streams, estuary habitats such as mangroves and tidal creeks, and occasionally in large lakes.	No Data
Hippichthys parvicarinatus	Short-keel pipefish	-	MO*	-	MO	-	-	An endemic species restricted to estuarine and freshwater habitats in the NT.	0-5
*Hippichthys penicillus**	Beady pipefish	MO	MO*	MO	MO*	MO	MO*	Found in lower reaches of streams and rivers, seagrass beds in estuaries and other shallow inshore habitats	0-5
*Hippichthys spicifer**	Belly-barred pipefish	-	-	-	MO*	-	-	Found in the Indo-Pacific, from the Red Sea and East Africa to Sri Lanka and Samoa. Lives in shallow coastal and estuarine habitats such as mangroves and tidal creeks. Also regularly lives in freshwater in the lower reaches of rivers.	0-3
*Hippocampus angustus**	Western spiny seahorse	-	MO*	MO	MO*	MO*	MO*	Lives over soft-bottom substrates, adjacent to coral reefs, and on soft corals at depths of 3–63 m.	3-63

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
Hipppocampus breviceps	Short-head seahorse	-	-		-	-	MO*	Inhabits coastal waters in South-western and South-eastern Australia, from Gregory to Bremer Bay (WA), and from Denial Bay (SA) to Newcastle (NSW). Lives in sheltered coastal reefs associated with macroalgal beds and seagrasses. Individuals have also been found on floating macroalgae, rock reefs, jetty habitats, and sponge reefs below depths of 15 m. More commonly, this species occurs at depths near 5 m.	0-15
*Hippocampus histrix**	Spiny seahorse	MO	MO*	MO	MO*	MO*	MO*	Inhabits areas with both hard and soft bottoms, often attached to soft corals or sponges at 10-95 m, usually 15-40 m. Also found on shallower algae-rubble or rocky reef areas in about 10 m depth. Typically, at moderate depths of about 15 m or deeper, on soft bottom with soft corals and sponges, but occasionally found in algae-rubble reef zones at about 10 m depth. (Kuiter 2009). Typically found >6 m depth; maximum reported depth 20 m; seagrass bed, weedy rocky reefs, sponges; soft	5-95

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								bottom with soft corals and sponges (Lourie et al. 2004).	
*Hippocampus kuda**	Spotted seahorse	MO	MO*	MO	MO*	MO	MO*	Found in shallow inshore waters normally between 0-8 m depth with a maximum recorded depth of up to 55 m. Inhabits coastal bays, harbours and lagoons, sandy sediments in rocky littoral zones, macroalgae and seagrass beds, mangroves, muddy bottoms, and shallow reef flats (Kuiter 2009).	0-55
*Hippocampus planifrons**	Flat-face seahorse	MO	MO	MO	MO*	MO	MO*	Inhabits algal and rubble reefs in shallow bays from the intertidal to depths of 20 m.	0-20
*Hippocampus spinosissimus**	Hedgehog seahorses	MO	MO*	MO*	MO*	MO*	MO*	Benthic in inner reef waters on rubble substrates and in sponge and seagrass habitats near coral reefs at 20-63 m; often attached to corals in deep current-prone channels between reefs or islands. Known only from the 2 types trawled at 70 m depth. Its habitat was described as sand and scallops. It seems that it may be a small, deep water species that is occasionally brought up by strong upwellings to the shallower depths (Kuiter 2009).	20-70

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								Typically found at >8 m depth; maximum reported depth 70 m; octocorals, macro algae, not hard corals, sand but not mud; near coral reefs on sandy bottoms (Lourie et al. 2004).	
Hippocampus subelongatus	West Australian seahorse	-	-	-	-	-	MO	Endemic to SW Australia, where it occurs from the Abrolhos Islands to Rockingham. Natural habitats are the edges of rocky areas, muddy bottoms and areas with murky water caused by high sediment load, around jetty pilings and moorings; it is often associated with sponges or sea squirts and frequently attaches itself to man-made objects. In the winter they move to deeper water.	No Data
Hippocampus trimaculatus	Three-spot seahorse	-	MO	MO	MO	MO	MO	Inhabits gravel or sand bottoms around shallow reefs, muddy estuaries and near mangroves, tolerating brackish waters	No Data
*Lissocampus fatiloquus**	Prophet's pipefish	-	-	-	MO*	-	MO*	The species has been noted in a variety of habitats including sargassum, seagrass beds and sandy substrates along the coast of WA from Shark Bay to Rottnest Island.	No Data

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
Maroubra perserrata	Sawtooth pipefish	-	-	-	-	-	MO	Found at depths up to 20 m along the coast of Australia from southern QLD to southern WA. While they can live in many different habitats, they are often found inhabiting openings in reefs and rocks that contain algae and invertebrates, which they likely rely on for camouflage.	0-20
*Micrognathus brevirostris**	Thorntail pipefish	-	-	-	MO*	-	-	Inhabits lagoon and seaward reefs from tide pools to a depth of at least 8 m.	2-12
*Micrognathus micronotopterus**	Tidepool pipefish	MO	MO*	MO	MO*	MO	MO*	Usually inhabits shallow inshore reefs and tidepools, amongst sparse seagrasses and algae rubble, in depths from 1-5 m, although individuals have been collected from depths to 10 m.	1-10
Mitotichthys meraculus	Western crested pipefish	-	-	-	-	-	MO	Typically occurs inshore within South Western Australia.	No Data
Nannocampus subosseus	Bonyhead pipefish	-	-	-	MO	-	MO*	Found inhabiting reefs and tide pools only in the region of Shark Bay to Esperance, WA.	3-8
*Phoxocampus belcheri**	Black rock pipefish	-	-	MO	MO*	MO	MO	Found in shallow rocky or coral reefs and tide pools	0.3-15
Phycodurus eques	Leafy seadragon	-	-	-	-	-	MO	Lives in temperate waters exclusively off the southern coast of	5-15

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
								Australia in depths of 5 to 15 meters, Resides in areas with clear water, lower light conditions, and prominent vegetation. Such areas include seagrass meadows, seaweed beds, and rocky reefs (Seadragon Search 2001; Groves 1998).	
Phyllopteryx taeniolatus	Common seadragon	-	-	-	-	-	MO*	Endemic to the waters off southern coast of Australia. Individuals of this species have been sighted off the eastern coast of Australia in NSWs, as far north as Port Stephens; along the southern coast; and up around the western coast of Australia as far north as Geraldton, WA (Dawson 1985). Typically found in rocky reefs, sea weed beds, sea grass meadows, and kelp gardens. While this may seem like a broad range of habitat, sea dragons have very specific requirements. The water must be between 12 and 23 degrees Celsius, and 10-50 meters deep, although they most often are found between 8 and 12 meters deep (Australian Museum 2021).	10-50
*Pugnaso curtirostris**	Pugnose pipefish	-	-	-	-	-	MO*	Occurs in grass beds (Posidonia and Zostera).	No Data

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Solegnathus hardwickii**	Pallid pipehorse	MO*	MO*	MO*	MO*	MO*	MO*	Mostly known from trawled specimens captured from 12 m to 100 m depth, though it has been collected in depths of up to 180 m. Reported from trawls in less than 100 m, but enters relatively shallow depths of about 40 m. (Kuiter 2009)	12-180
*Solegnathus lettiensis**	Gunther's pipehorse	MO*	MO*	MO*	MO*	MO*	MO*	Benthic inhabitant of outer continental shelf waters and has been captured from depths of 42-180 m. Trawl bycatch records in 150-180 m water depths in Australia.	42-180
*Solenostomus cyanopterus**	Robust ghostpipefish	MO	MO*	MO	MO*	MO*	MO*	Inhabit protected coastal and lagoon reefs, deeper coastal reefs and deep, clear estuaries with seagrass or macro-algae in 4-21 m	4-21
Stigmatopora argus	Spotted pipefish	-	-	-	MO	-	MO*	Endemic to Australia. Usually among vegetation in bays and estuaries, but sometimes offshore among floating Sargassum.	<8
*Stigmatopora nigra**	Widebody pipefish	-	-	-	-	-	MO*	Found in the shallow waters, bays, and estuaries of southern Australia from Shark Bay to Brisbane, Tasmania, and New Zealand. They often inhabit seagrass or algae beds in addition to bare sand.	No Data

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
*Syngnathoides biaculeatus**	Double-end pipehorse	MO	MO*	MO	MO*	MO	MO*	Inhabits shallow, protected waters of bays, lagoons and estuaries including mangrove areas, in association with seagrass beds and macroalgae in depths at 0-10 m.	0-10
*Trachyrhamphus bicoarctatus**	Bentstick pipefish	MO*	MO*	MO	MO*	MO*	MO*	Inhabits sheltered coastal lagoon and reef areas on sandy and rubble habitats amongst seagrasses and macroalgae at 1–30 m. Has been recorded to 42 m. Some populations inhabit seagrass beds and others only rubble sand areas. Most are seen on sand and mud areas, prone to strong currents. Red Sea population occurs in sheltered bays with seagrasses at few metres depth. Elsewhere usually soft bottom to about 25 m (Kuiter 2009).	1-42
*Trachyrhamphus longirostris**	Straightstick pipefish	MO	MO*	MO	MO*	MO*	MO*	Most specimens have been trawled or dredged from muddy to sandy-bottom habitats in depths of 16-91 m, in association with sand, rubble, seagrasses, algae, sponges, sea pens and hydroids. It is less common and is mainly known from deep trawls over muddy substrates, but enters sheltered muddy estuaries where, out in the open, it lays on the bottom (Kuiter 2009).	16-91

Scientific name	Common name	Bonaparte OA	Bonaparte EMBA	Browse OA	Browse EMBA	Carnarvon OA	Carnarvon EMBA	Habitat	Depth Range (m)
Urocampus carnirostris	Hairy pipefish	-	-	-	-	-	MO	Found inhabiting shallow seagrass beds and estuaries in Papua New Guinea and along the southern coast of Australia from Queensland to Swan River, WA. Ambush predator most commonly found on the edges of protected seagrass beds and near mangrove.	No Data
*Vanacampus margartifer**	Mother-of-pearl pipefish	-	-	-	-	-	MO*	Found inhabiting seaweed and seagrass beds in addition to rocky reefs along the southern and eastern coast of Australia from Brisbane to Perth. Commonly found over sand, rubble or vegetation.	No Data

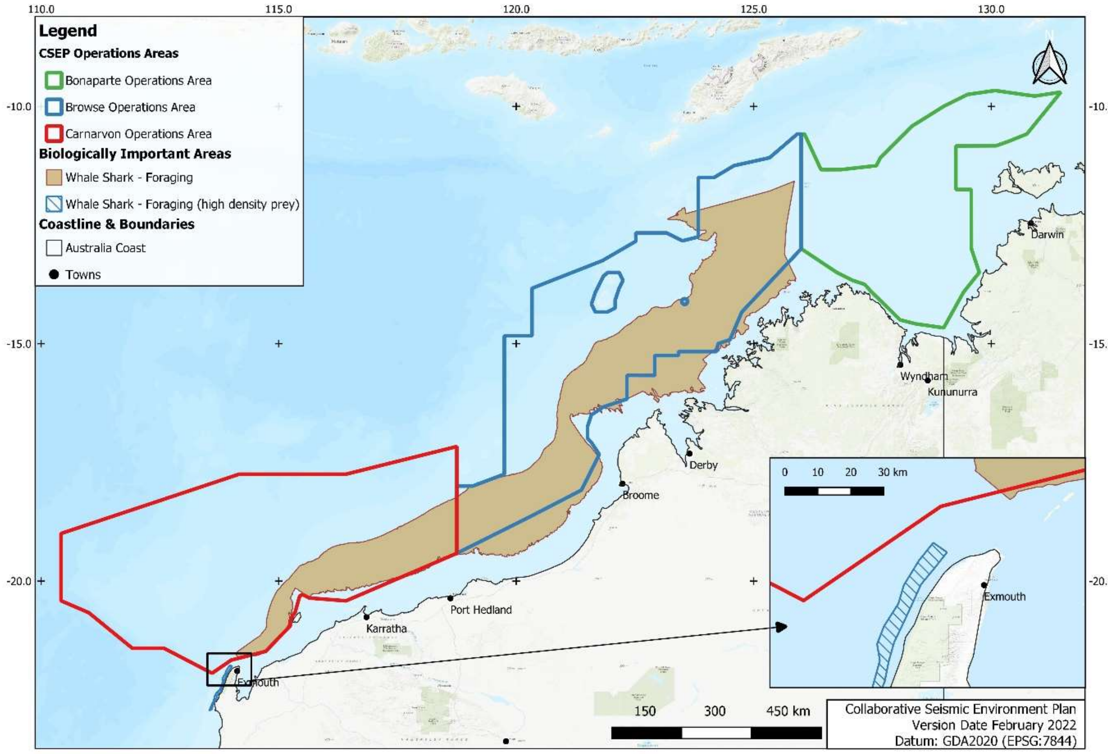


Figure 5-21: BIA for Whale Shark within the CSEP OA

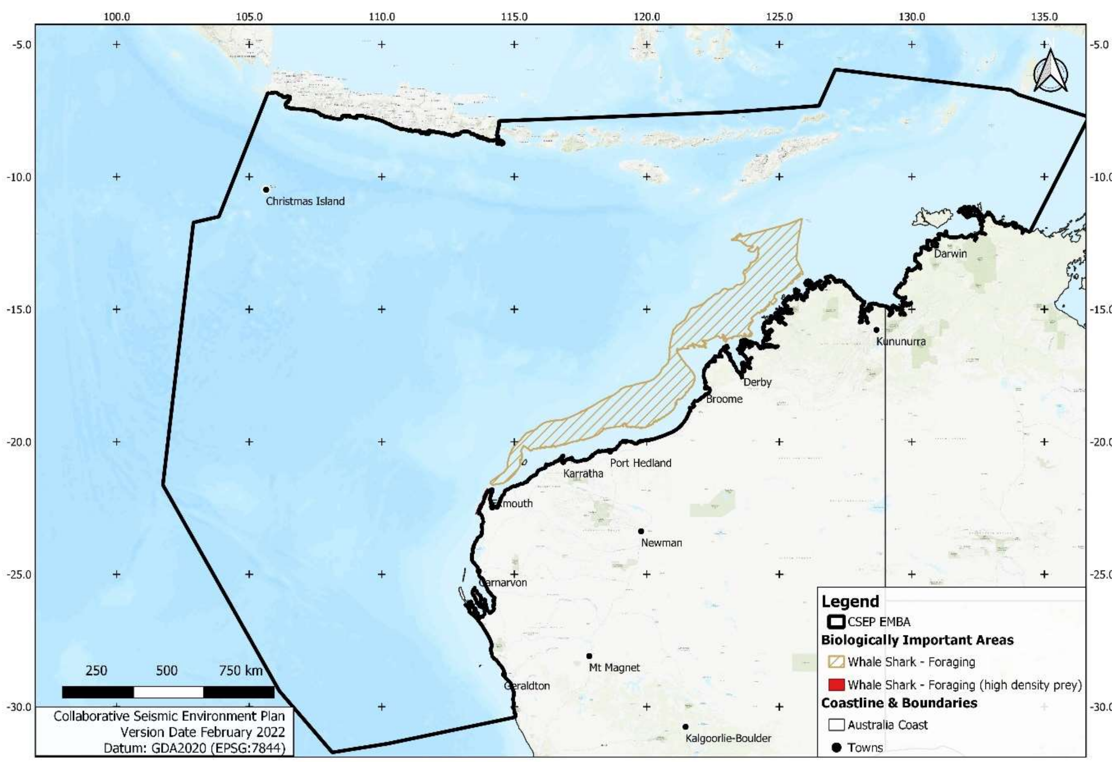


Figure 5-22: BIA for Whale Shark within the CSEP EMBA

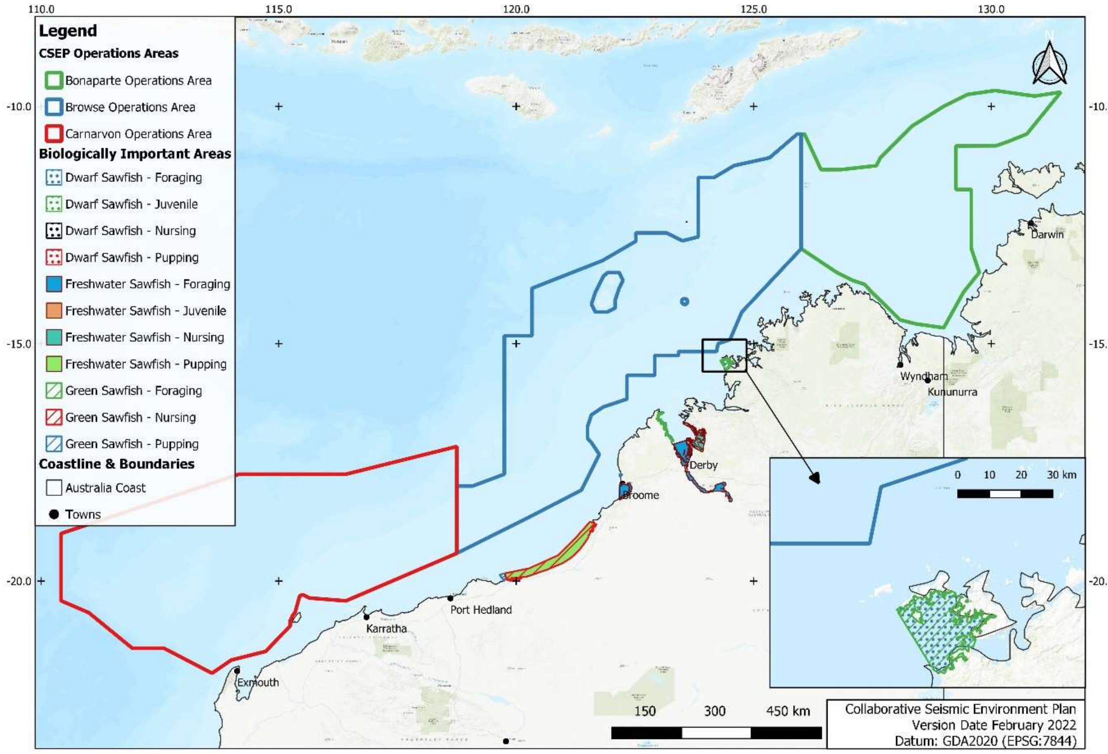


Figure 5-23: BIA for Sawfish within the CSEP EMBA

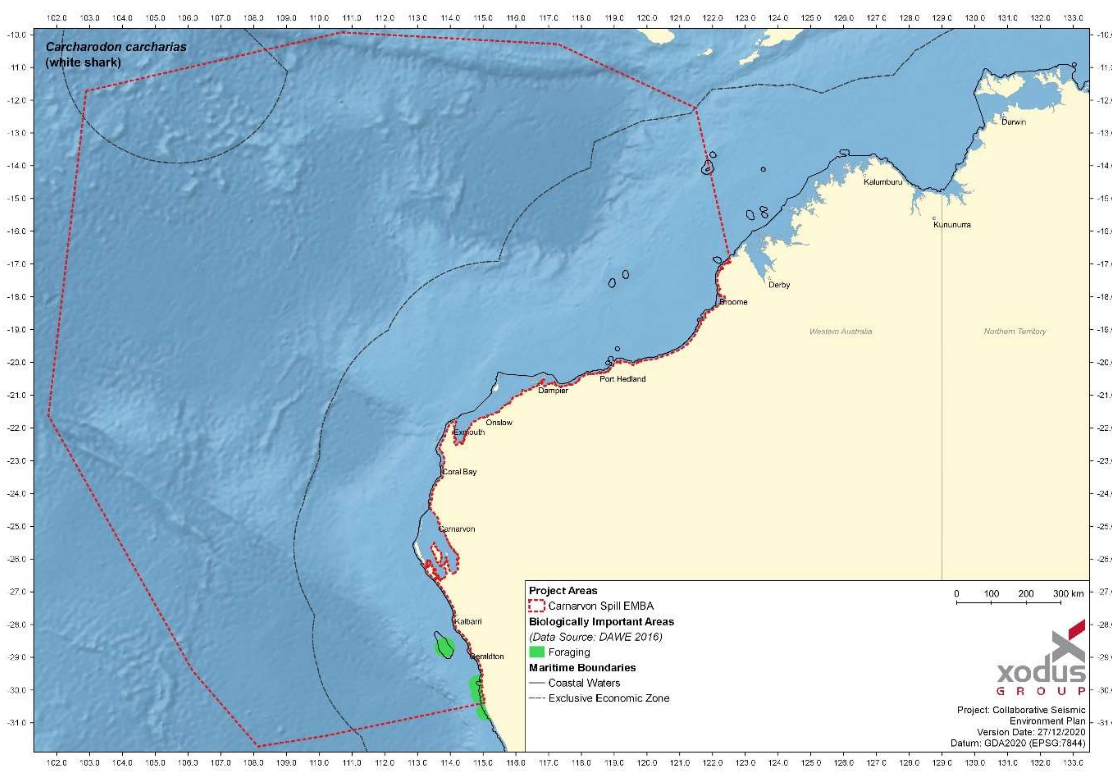


Figure 5-24: BIA for White Shark within the CSEP EMBA

5.5.2 Birds

Birds consist of seabirds and shorebirds. Many species are EPBC Listed, and are broadly covered by the following management documents:

- CoA (2019). Draft Wildlife Conservation Plan for Seabirds. Commonwealth of Australia (https://www.awe.gov.au/sites/default/files/env/consultations/73458222-6905-4100-ac94-d2f90656c05d/files/draft-wildlife-conservation-plan-seabirds.pdf)
- CoA (2015). Wildlife Conservation Plan for Migratory Shorebirds. Commonwealth of Australia Shorebirds. https://www.awe.gov.au/environment/biodiversity/publications/wildlife-conservation-plan-migratory-shorebirds-2016
- DoEE (2018). Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018). Canberra, ACT: Department of the Environment and Energy Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/tap/marine-debris-2018)

Eighty eight bird species were listed as threatened and/or migratory under the EPBC Act (derived from a PMST search) that are known, likely or may occur within the CSEP OA and EMBA are described in Table 5-12. Species captured in the search and designated as terrestrial species are not included.

In addition, there are a further 28 species protected under the EPBC Act as listed marine species that are known, likely or may occur within the CSEP EMBA (Table 5-13).

Relevant information on these species is provided in Existing Environment Addendum.

Bird BIAs that overlap the CSEP OA are in place for the following species:

- brown booby breeding, foraging (Browse OA, Carnarvon OA)
- fairy tern breeding (Carnarvon OA)
- greater frigatebird breeding, foraging (Browse OA)
- lesser crested tern breeding (Bonaparte OA, Browse OA, Carnarvon OA)
- lesser frigatebird breeding, foraging (Bonaparte OA, Browse OA, Carnarvon OA)
- little tern breeding, resting (Browse OA)
- red-footed booby breeding, foraging (Browse OA)
- roseate tern breeding (Carnarvon OA)
- wedge-tailed shearwater breeding, foraging (Browse OA, Carnarvon OA)
- white-tailed tropicbird breeding (Browse OA, Carnarvon OA)

Figure 5-25 details the location of bird BIAs within CSEP OA.

Bird BIAs that overlap the CSEP EMBA are in place for the following species:

- Abbott's booby (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- Australian fairy tern (Carnarvon EMBA)

- Australian lesser noddy (Carnarvon EMBA)
- bridled tern (Bonaparte EMBA, Carnarvon EMBA)
- brown booby (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- Caspian tern (Carnarvon EMBA)
- Christmas Island frigatebird (Browse EMBA, Carnarvon EMBA)
- common noddy (Carnarvon EMBA)
- crested tern (Bonaparte EMBA, Browse EMBA)
- fairy tern (Browse EMBA, Carnarvon EMBA)
- flesh footed shearwater (Browse EBA, Carnarvon EMBA)
- greater frigatebird (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- lesser crested tern (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- lesser frigatebird (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- little shearwater (Carnarvon EMBA)
- little tern (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- pacific gull (Carnarvon EMBA)
- red-footed booby (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- roseate tern (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- soft plumaged petrel (Carnarvon EMBA)
- sooty tern (Carnarvon EMBA)
- white faced storm petrel (Carnarvon EMBA)
- white-tailed tropicbird (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)
- wedge-tailed shearwater (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA)

Figure 5-26 details the location of bird BIAs within CSEP EMBA.

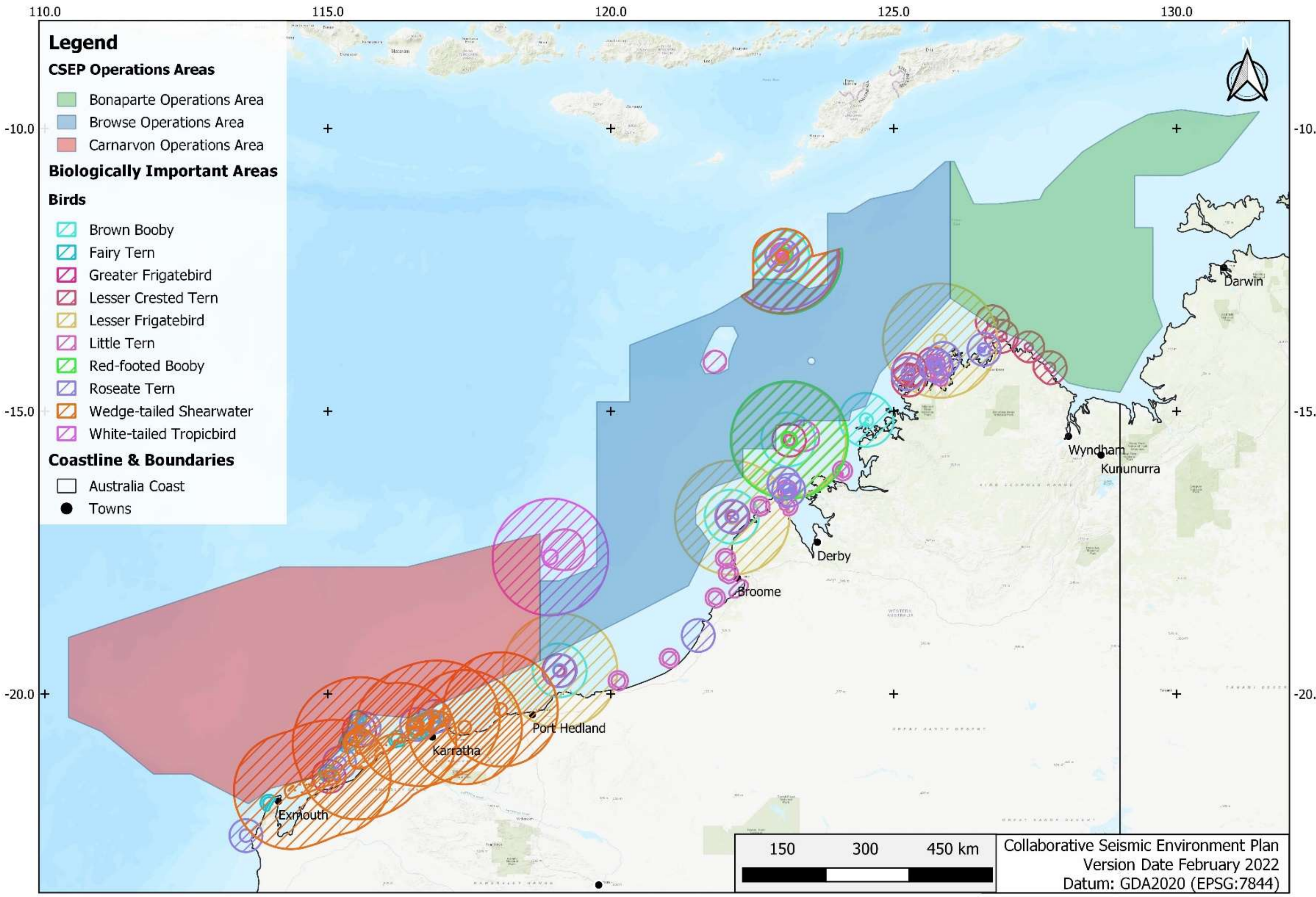


Figure 5-25: BIAs for Birds within the CSEP OA

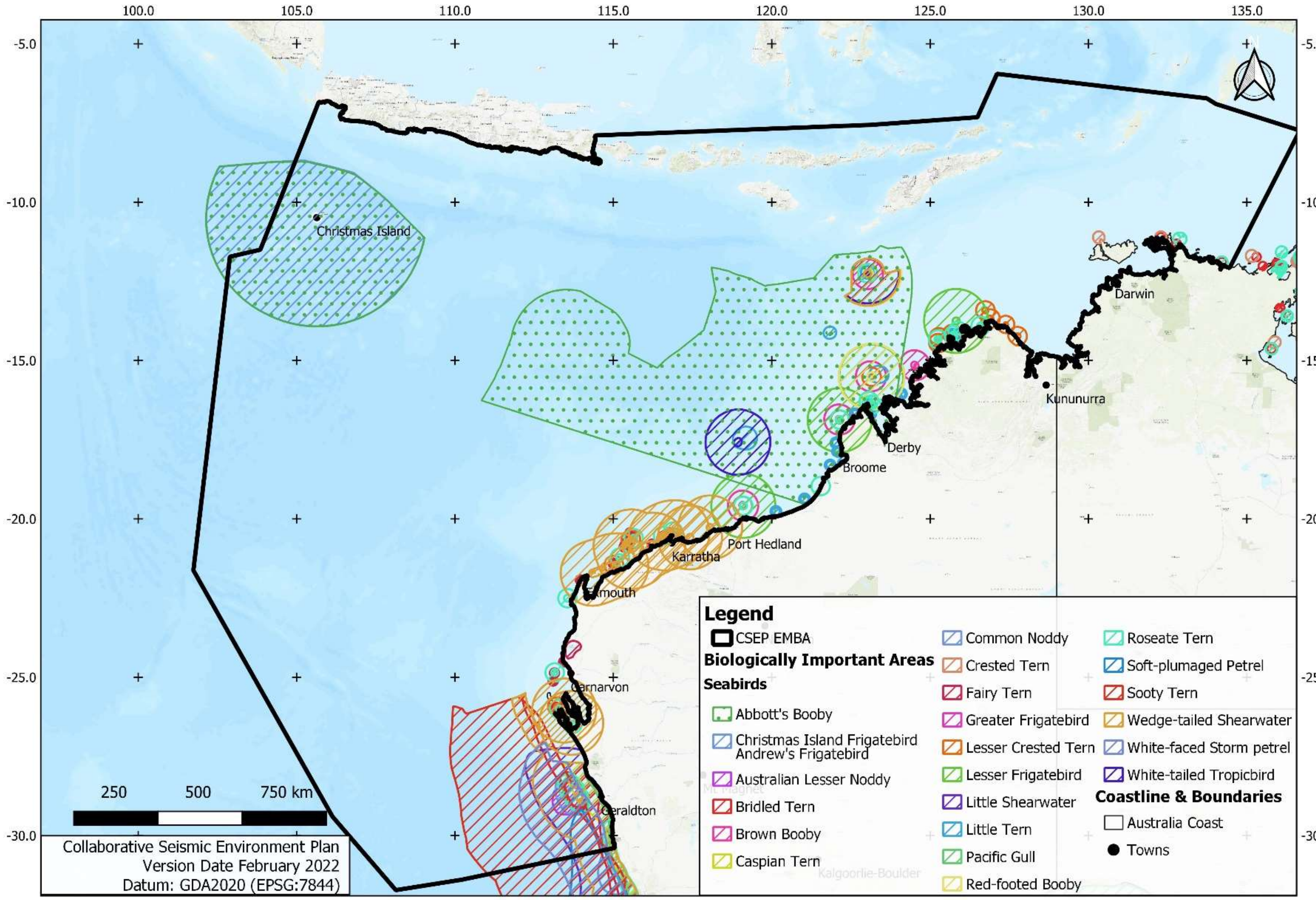


Figure 5-26: BIAs for Birds within the CSEP EMBA

Table 5-12: Seabird and shorebird species (threatened or migratory) or species habitat presence within CSEP OA and EMBA

Relevant commonwealth conservation management plans are referenced for those species that have them.

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Acrocephalus orientalis	Oriental reed-warbler	-	Wetland	-	KO	-	KO	-	-
Actitis hypoleucos	Common sandpiper	-	Wetland	MO	KO	MO	KO	MO	KO
Anous stolidus	Common noddy	-	Marine	MO	FKO	LO	BKO	MO	FKO, BKO
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	-	-	KO	FKO	BKO	-	BKO
		TSSC (2015b). Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/26000-conservation-advice-01102015.pdf) ***Listed threats of pollution and oil spills relevant to seismic surveys.***							
Apus pacificus	Fork-tailed swift	-	Marine	LO	LO	-	LO	LO	LO
Ardenna carneipes	Flesh-footed shearwater	-	Marine	-	-	-	LO	LO	FLO
		TSSC (2014). Commonwealth Listing Advice on *Ardenna carneipes* (flesh-footed shearwater). Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/resource/adrenna-carneipes-flesh-footed-shearwater) ***No listed threats of relevance to seismic surveys.***							
Ardenna pacifica	Wedge-tailed shearwater	-	Marine	-	BKO	-	BKO	-	BKO
Arenaria interpres	Ruddy turnstone	-	Wetland	-	LO	-	RKO	-	RKO
Calidris acuminata	Sharp-tailed sandpiper	-	Wetland	MO	KO	KO	RKO	MO	RKO
Calidris alba	Sanderling	-	Wetland	-	LO	-	RKO	-	RKO
Calidris canutus	Red knot	Endangered	Wetland	MO	KO	MO	KO	MO	KO

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		TSSC (2016a). Conservation Advice *Calidris canutus* Red knot. Threatened Species Scientific Committee Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/855-conservation-advice-05052016.pdf) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Calidris ferruginea	Curlew sandpiper	Critically Endangered	Wetland	MO	KO	MO	KO	MO	KO
		DoE (2015a). Conservation Advice *Calidris ferruginea* curlew sandpiper. Canberra: Department of the Environment. (*http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf)*) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Calidris melanotos	Pectoral sandpiper	-	Wetland	MO	MO	MO	KO	MO	KO
Calidris ruficollis	Red-necked stint	-	Wetland	-	RKO	-	RKO	-	RKO
Calidris subminuta	Long-toed stint	-	Wetland	-	RKO	-	-	-	-
Calidris tenuirostris	Great knot	Critically Endangered	Wetland	-	LO	-	RKO	-	RKO
		TSSC (2016b). Conservation Advice *Calidris tenuirostris* Great knot. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/862-conservation-advice-05052016.pdf) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Calonectris leucomelas	Streaked shearwater	-	Marine	KO	KO	KO	KO	LO	KO
Chalcophaps indica natalis	Christmas Is. Emerald Dove	Endangered	-	-	-	-	KO	-	-
Charadrius bicintus	Double-banded plover	-	Wetland	-	-	-	RKO	-	RKO
Charadrius dubius	Little ringed plover	-	Wetland	-	RKO	-	-	-	-

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Charadrius leschenaultii	Greater sand plover	Vulnerable	Wetland	LO	LO	-	RKO	KO	RKO
		TSSC (2016c). Conservation Advice *Charadrius leschenaultii* Greater sand plover. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/877-conservation-advice-05052016.pdf) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Charadrius mongolus	Lesser sand plover	Endangered	Wetland	-	LO	-	RKO	-	RKO
		Threatened Species Scientific Committee (2016e). Conservation Advice *Charadrius mongolus* Lesser sand plover. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/879-conservation-advice-05052016.pdf) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Charadrius veredus	Oriental plover	-	Wetland	-	MO	-	RKO	-	RKO
Diomedea amsterdamensis	Amsterdam albatross	Endangered	-	-	-	-	-	-	LO
Diomedea epomophora	Southern royal albatross	Vulnerable	Marine	-	-	-	-	-	FLO
Diomedea exulans	Wandering albatross	Vulnerable	Marine	-	-	-	-	-	FLO
Diomedea sandfordi	Northern royal albatross	Endangered	Marine	-	-	-	-	-	FLO
Erythrotriorchis radiatus	Red goshawk	Vulnerable	-	-	KO	-	KO	-	MO
		TSSC (2015c). Conservation Advice *Erythrotriorchis radiatus* red goshawk. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/942-conservation-advice-31102015.pdf) Department of Environment and Resource Management (2012). National recovery plan for the red goshawk *Erythrotriorchis radiatus*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Queensland Department of Environment and Resource							

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		Management, Brisbane. (http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-red-goshawk-erythrotriorchis-radiatus) **_No listed threats of relevance to seismic surveys._**							
Erythrura gouldiae	Gouldian finch	Endangered	-	-	KO	-	KO	-	LO
		TSSC (2016d). Conservation Advice *Erythrura gouldiae* Gouldian finch. Threatened Species Scientific Committee Canberra: Department of the Environment and Energy. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/413-conservation-advice-07122016.pdf) **_No listed threats of relevance to seismic surveys._**							
Falco hypoleucos	Grey falcon	Vulnerable	-	-	KO	-	KO	-	KO
Falcunculus frontatus whitei	Northern shrike-tit	Vulnerable	-	-	LO	-	LO	-	-
		TSSC (2016e). Conservation Advice *Falcunculus frontatus whitei* crested shrike-tit (northern). Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/26013-conservation-advice-05052016.pdf) **_No listed threats of relevance to seismic surveys._**							
Fregata andrewsi	Christmas Island frigatebird	Endangered	-	-	-	-	BKO	-	FKO
Fregata ariel	Lesser frigatebird	-	Marine	LO	BKO	KO	BKO	LO	BKO
Fregata minor	Greater frigatebird	-	Marine	LO	KO	FLO	BKO	MO	KO
Gallinago megala	Swinhoe's snipe	-	Wetland	-	RKO	-	RLO	-	RLO
Gallinago stenura	Pin-tailed snipe	-	Wetland	-	RLO	-	RLO	-	RLO
Glareola maldivarum	Oriental pratincole	-	Wetland	-	MO	-	RKO	-	RKO
Geophaps smithii blaauwi	Partridge pigeon (western)	Vulnerable	-	-	LO	-	LO	-	-

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		DEWHA (2008e). Approved Conservation Advice for *Geophaps smithii blaauwi* (Partridge Pigeon (western)). Canberra: Department of the Environment, Water, Heritage and the Arts. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/66501-conservation-advice.pdf) ***No listed threats of relevance to seismic surveys.***							
Geophaps smithii smithii	Partridge pigeon (eastern)	Vulnerable		-	LO	-	LO	-	-
		TSSC (2015d). Conservation Advice *Geophaps smithii smithii* partridge pigeon (eastern). Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/64441-conservation-advice-01102015.pdf) ***No listed threats of relevance to seismic surveys.***							
Halobaena caerulea	Blue petrel	Vulnerable	Marine	-	-	-	-	-	MO
Heteroscelus brevipes	Grey-tailed tattler	-	Wetland	-	RKO	-	RKO	-	RKO
Hydroprogne caspia	Caspian tern	-	Marine	-	BKO	-	BKO	-	BKO
Limicola falcinellus	Broad-billed sandpiper	-	Wetland	-	RKO	-	RKO	-	RKO
Limnodromus semipalmatus	Asian dowitcher	-	Wetland	-	RKO	-	RKO	MO	RKO
Limosa lapponica	Bar-tailed godwit	-	Wetland	-	KO	-	KO	-	KO
Limosa lapponica baueri	Bar-tailed godwit (baueri)	Vulnerable	-	-	MO	-	KO	-	KO
		TSSC (2016f). Conservation Advice *Limosa lapponica baueri* Bar-tailed godwit (western Alaskan). Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/86380-conservation-advice-05052016.pdf)							
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit	Critically Endangered	-	-	MO	-	KO	-	KO
		TSSC (2016g). Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberian). Threatened Species Scientific Committee. Canberra: Department of the Environment.							

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		(http://www.environment.gov.au/biodiversity/threatened/species/pubs/86432-conservation-advice-05052016.pdf) ***Listed threats of pollution and contamination relevant to seismic surveys.***							
Limosa limosa	Black-tailed godwit	-	Wetland	-	LO	-	RKO	-	RKO
Macronectes giganteus	Southern giant-petrel	Endangered	Marine	-	-	-	MO	MO	MO
Macronectes halli	Northern giant petrel	Vulnerable	Marine	-	-	-	-	-	MO
Malurus leucopterus edouardi	White-winged fairy wren (Barrow Island)	Vulnerable	-	-	-	-	LO	-	LO
Malurus leucopterus leucopterus leucopterus	White-winged fairy wren (Dirk Hartog Island)	Vulnerable	-	-	-	-	-	-	LO
Melanodryas cucullata melvillensis	Tiwi Islands hooded robin	Critically Endangered	-	-	LO	-	LO	-	
		TSSC (2018a). Conservation Advice *Melanodryas cucullata melvillensis* hooded robin (Tiwi Islands). Threatened Species Scientific Committee. Canberra: Department of the Environment and Energy. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/67092-conservation-advice-11052018.pdf) ***No listed threats of relevance to seismic surveys.***							
Mirafra javanica melvillensis	Horsfield's bushlark	Vulnerable	-	-	KO	-	-	-	-
Numenius madagascariensis	Eastern curlew	Critically Endangered	Wetland	MO	KO	MO	KO	MO	KO
		DoE (2015b). Conservation Advice *Numenius madagascariensis* eastern curlew. Canberra: Department of the Environment. *(http://www.environment.gov.au/biodiversity/threatened/species/pubs/847-conservation-advice.pdf))* ***No listed threats of relevance to seismic surveys.***							
Numenius minutus	Little curlew	-	Wetland	-	RKO	-	RKO	-	RKO

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Numenius phaeopus	Whimbrel	-	Wetland	-	LO	-	RKO	-	RKO
Onychoprion anaethetus	Bridled tern	-	Marine	-	BKO	-	BKO	-	BKO
Pandion haliaetus	Osprey	-	Wetland	MO	BKO	MO	BKO	KO	BKO
Papasula abbotti	Abbott's booby	Endangered	-	-	MO	MO	KO	MO	MO
		TSSC (2015e). Conservation Advice *Papasula abbotti* Abbott's booby. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/59297-conservation-advice-01102015.pdf) ***Listed threats of marine pollution relevant to seismic surveys.***							
Phaethon lepturus	White-tailed tropicbird	-	Marine	LO	BLO	FLO	BKO	FLO	BLO
Phaethon lepturus fulvus	Christmas Is. White-tailed tropicbird	Endangered	-	-	-	-	BLO	MO	MO
Phaethon rubricauda	Red-tailed tropicbird	-	Marine	-	BKO	-	BKO	-	BKO
Philomachus pugnax	Ruff	-	Wetland	-	-	-	RKO	-	RKO
Phoebetria fusca	Sooty albatross	Vulnerable	Marine	-	-	-	-	-	MO
Pluvialis fulva	Pacific Golden Plover	-	Wetland	-	RKO	-	RKO	-	RKO
Pluvialis squatarola	Grey plover	-	Wetland	-	LO	-	RKO	-	RKO
Polytelis alexandrae	Princess parrot	Vulnerable	-	-	KO	-	KO	-	LO
		TSSC (2018b). Conservation Advice *Polytelis alexandrae* princess parrot. Threatened Species Scientific Committee. Canberra: Department of the Environment and Energy. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/758-conservation-advice-01022018.pdf) ***No listed threats of relevance to seismic surveys.***							
Pterodroma mollis	Soft-plumaged petrel	Vulnerable	-	-	-	-	FLO	FLO	FKO

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
		TSSC (2015f). Conservation Advice Pterodroma Mollis soft-plumaged petrel. Threatened Species Scientific Committee. Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/1036-conservation-advice-01102015.pdf) ***No listed threats of relevance to seismic surveys.***							
Rostratula australis	Australian painted-snipe	Endangered	-	-	LO	-	LO	-	LO
		DSEWPaC (2013a). Approved Conservation Advice for *Rostratula australis* (Australian painted snipe). Canberra: Department of Sustainability, Environment, Water, Population and Communities. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf) ***No listed threats of relevance to seismic surveys.***							
Rostratula benghalensis (sensu lato)	Painted snipe	Endangered	-	-	LO	-	LO	-	LO-
Sterna dougallii	Roseate tern	-	Marine	-	BLO	-	BKO	FLO	BKO
Sternula albifrons	Little tern	-	Marine	-	BKO	BKO	BKO	BKO	-
		TSSC (2002). Commonwealth Listing Advice on *Sterna albifrons* sinensis (Little Tern (western Pacific). Threatened Species Scientific Committee, (http://www.environment.gov.au/biodiversity/threatened/species/sterna-albifrons-sinensis.html) ***No listed threats of relevance to seismic surveys.***							
Sternula nereis nereis	Australian fairy tern	Vulnerable	-	-	-	-	-	BKO	BKO
		DSEWPaC (2011). Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/82950-conservation-advice.pdf) ***No listed threats of relevance to seismic surveys.***							
Sula dactylatra	Masked booby	-	Marine	-	BKO	-	BKO	-	BKO
Sula leucogaster	Brown booby	-	Marine	-	BKO	BKO	BKO	BKO	BKO

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Sula sula	Red-footed booby	-	Marine	-	BKO	BKO	BKO	-	BKO
Thalassarcher carteri	Indian yellow nosed albatross	Vulnerable	Marine	-	-	-	-	MO	FMO
Thalassarche cauta	Shy albatross	Endangered	Marine	-	-	-	MO	-	MO
Thalassarche impavida	Campbell albatross	Vulnerable	Marine	-	-	-	MO	-	MO
Thalassarche melanophris	Black browed albatross	Vulnerable	Marine	-	-	-	MO	-	MO
Thalassarche steadi	White capped albatross	Vulnerable	Marine	-	-	-	MO	-	FLO
Thalasseus bergii	Crested tern	-	Wetland	-	BKO	-	BKO	-	BKO
Tringa brevipes	Grey-tailed tattler	-	Wetland	-	RKO	-	RKO	-	RKO
Tringa glareola	Wood sandpiper	-	Wetland	-	RKO	-	RKO	-	RKO
Tringa nebularia	Common greenshank	-	Wetland	-	LO	-	KO	-	KO
Tringa stagnatilis	Marsh sandpiper	-	Wetland	-	RKO	-	RKO	-	RKO
Tringa totanus	Common redshank	-	Wetland	-	KO	-	RKO	-	RKO
Turdus poliocephalus erythropleurus	Christmas Is. Thrush	Endangered	-	-	-	-	LO	-	-
Tyto novaehollandiae kimberli	Masked owl	Vulnerable	-	-	LO	-	LO	-	-
		TSSC (2015g). Conservation Advice *Tyto novaehollandiae kimberli* masked owl (northern). Threatened Species Scientific Committee Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/26048-conservation-advice-01102015.pdf) ***No listed threats of relevance to seismic surveys.***							
	Tiwi masked owl	Endangered		-	KO	-	KO	-	-

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Tyto novaehollandiae melvillensis		TSSC (2015h). Conservation Advice *Tyto novaehollandiae melvillensis* masked owl (Tiwi Islands). Threatened Species Scientific Committee Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/26049-conservation-advice-01102015.pdf) ***No listed threats of relevance to seismic surveys.***							
Xenus cinereus	Terek sandpiper	-	Wetland	-	RKO	-	RKO	-	RKO

Type of Presence:

BLO - Breeding likely to occur within area

BKO - Breeding known to occur within area

FKO - Foraging, feeding or related behaviour known to occur within area

FLO - Foraging, feeding or related behaviour likely to occur within area

FMO - Foraging, feeding or related behaviour may occur within area

KO - Species or species habitat known to occur within area

LO - Species or species habitat likely to occur within area

MO - Species or species habitat may occur within area

RLO - Roosting likely to occur within area

RKO - Roosting known to occur within area

Table 5-13: Bird species (listed marine) or species habitat presence within CSEP OA and EMBA

Scientific name	Common name	Bonaparte		Browse		Carnarvon	
		OA	EMBA	OA	EMBA	OA	EMBA
Anous minutus	Black noddy	-	BKO	-	BKO	-	-
Anseranas semipalmata	Magpie goose	-	MO	-	MO	-	MO
Ardea alba	Great egret	-	KO	-	BKO	-	BKO
Ardea ibis	Cattle egret	-	MO	-	MO	-	MO
Catharacta skua	Great skua	-	-	-	-	-	MO
Charadrius ruficapillus	Red capped plover	-	RKO	-	-	-	RKO
Chrysococcyx osculans	Black-eared cuckoo	-	LO	-	KO	-	KO
Haliaeetus leucogaster	White-bellied sea-eagle	-	KO	-	KO	-	MO
Heteroscelus breviceps	Grey tailed tattler	-	-	-	RKO	-	RKO
Himantopus himantopus	Pied stilt	-	RKO	-	RKO	-	RKO
Hirundo daurica	Red rumped swallow	-	MO	MO	KO	-	MO
Larus novaehollandiae	Silver gull	-	BKO	-	BKO	-	BKO
Larus pacificus	Pacific gull	-	-	-	BKO	-	BKO
Pelagodroma marina	White faced storm petrel	-	-	-	-	-	BKO
Phalacrocorax fuscescens	Black faced cormorant	-	-	-	-	-	BLO
Pterodroma macoptera	Great winged petrel	-	-	-	-	-	FKO
Puffinus assimilis	Little shearwater	-	-	-	-	-	BKO
Puffinus carneipes	Flesh footed shearwater	-	-	-	LO	-	FLO
Puffinus huttoni	Hutton's shearwater	-	-	-	-	-	FKO
Recurvirostra novaehollandiae	Red necked avocet	-	-	-	RKO	-	BKO
Sterna anaethetus	Bridled tern	-	BKO	-	BKO	-	BKO
Sterna bengalensis	Lesser crested tern	BKO	BKO	BKO	BKO	BKO	-
Sterna bergii	Crested tern	-	-	-	BKO	-	BKO
Sterna fuscata	Sooty tern	-	BKO	-	BKO	-	BKO
Sterna nereis	Fairy tern	-	BKO	-	BKO	BKO	BKO
Stiltia isabella	Australian pratincole	-	RKO	-	BKO	-	RKO
Thinornis rubricollis	Hooded plover	-	-	-	-	-	KO
Tringa incana	Wandering tattler	-	RKO	-	-	-	-

5.5.3 Marine Reptiles

Marine reptile species including turtles, seasnakes and crocodiles listed as threatened and/or migratory under the EPBC Act (derived from a PMST search) that are known, likely or may occur within the CSEP OA and EMBA are described in Table 5-14.

BIAs and 'critical habitat for the survival of the species' that overlap the CSEP OA and EMBA are:

- Flatback turtle (*Natator depressus*) – CSEP OA (Figure 5-27) and CSEP EMBA (Figure 5-32).
- Green turtle (*Chelonia mydas*) – CSEP OA (Figure 5-28) and CSEP EMBA (Figure 5-32).
- Hawksbill (*Eretmochelys imbricate)* – CSEP OA (Figure 5-29) and CSEP EMBA (Figure 5-32).
- Loggerhead turtle (*Caretta caretta*) – CSEP OA (Figure 5-30) and CSEP EMBA (Figure 5-32).
- Olive Ridley turtle (*Lepidochelys olivacea*) – CSEP OA (Figure 5-31) and CSEP EMBA (Figure 5-32).

There are 25 species of seasnakes, and one crocodile species protected under the EPBC Act as listed marine species that are known, likely or may occur within the CSEP EMBA (Table 5-15).

Relevant information on these species is provided in Existing Environment Addendum.

Table 5-14: Marine Reptile Species or Species habitat presence listed as threatened and/or migratory within CSEP OA and EMBA

Relevant commonwealth conservation management plans are referenced for those species that have them.

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
TURTLES		DoEE (2017). Recovery Plan for Marine Turtles in Australia. Department of the Environment and Energy Australian Government, Canberra. (http://www.environment.gov.au/marine/publications/recovery-plan-marine-turtles-australia-2017). ***Listed threats of marine debris, light pollution, vessel disturbance and noise interference relevant to seismic surveys.*** DoEE (2018). Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018). Department of the Environment and Energy. Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/tap/marine-debris-2018). ***Listed threats of marine debris relevant to seismic surveys.***							
Caretta caretta	Loggerhead turtle	Endangered	Marine	FKO	FKO	FKO	FKO, BKO	BKO (Nesting: Nov – May)	FKO, BKO (Nesting: Nov – May)
Chelonia mydas	Green turtle	Vulnerable	Marine	FKO	FKO, BKO (Nesting: Nov-Mar)	FKO, BKO (Nesting: Nov- Mar)	FKO, BKO (Nesting: Nov – Mar)	FKO, BKO (Nesting: Nov – Mar)	FKO, BKO (Nesting: Nov – Mar)
Dermochelys coriacea	Leatherback turtle	Endangered	Marine	FLO	FKO	FLO	FKO	KO	FKO
		DEWHA (2008f). Approved Conservation Advice for *Dermochelys coriacea* (leatherback turtle). Canberra: Department of the Environment, Water, Heritage and the Arts. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/1768-conservation-advice.pdf). ***Listed threats of marine debris and vessel disturbance relevant to seismic surveys.***							

Scientific Name	Common Name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Eretmochelys imbricate	Hawksbill turtle	Vulnerable	Marine	KO	FKO, BKO (Nesting Peak: Jul -Dec)	KO	FKO, BKO (Nesting: Oct – Feb)	BKO (Nesting: Oct – Feb)	FKO, BKO (Nesting: Oct – Feb)
Lepidochelys olivacea	Olive Ridley turtle	Endangered	Marine	KO	FKO, BKO (Nesting Peak: Apr- Jul)	KO	FKO, BKO (Nesting: May – Jul)	-	FLO
Natator depressus	Flatback turtle	Vulnerable	Marine	FKO, BKO	FKO, BKO (Nesting peak: Jun – Sep)	FKO, BKO (Nesting: Oct – Mar)	FKO, BKO (Nesting: Dec – Feb)	BKO (Nesting: Dec – Feb)	FKO, BKO (Nesting: Dec – Feb)
SEASNAKES									
Aipysurus apraefrontalis	Short-nosed seasnake	Critically Endangered	Marine	-	KO	LO	KO	KO	KO
		DSEWPaC (2011a). Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/1115-conservation-advice.pdf). ***No listed threats of relevance to seismic surveys.***							
Aipysurus foliosquama	Leaf-scaled seasnake	Critically Endangered	Marine	MO	KO	MO	KO	-	-
		DSEWPaC (2011b). Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1118-conservation-advice.pdf. ***No listed threats of relevance to seismic surveys.***							
CROCODILES									
Crocodylus porosus	Saltwater crocodile	-	Marine	MO	LO	LO	LO	-	LO

Type of Presence:	

BKO – Breeding known to occur within area CKO – Congregation or aggregation known to occur within area LO – Species or species habitat likely to occur within area	FLO – Foraging, feeding or related behaviour likely to occur within area FKO - Foraging, feeding or related behaviour known to occur within area KO - Species or species habitat known to occur within area

Table 5-15: Seasnake and crocodile species or species habitat presence within CSEP EMBA

Scientific Name	Common Name	Bonaparte	Browse	Carnarvon
Seasnakes				
Acalyptophis peronii	Horned seasnake	MO	MO	-
Aipysurus duboisii	Dubois' seasnake	MO	MO	MO
Aipysurus eydouxii	Spine-tailed seasnake	MO	MO	MO
Aipysurus fuscus	Dusky seasnake	KO	KO	KO
Aipysurus laevis	Olive seasnake	MO	MO	MO
Aipysurus pooleorum	Shark Bay seasnake	-	MO	MO
Aipysurus tenuis	Brown-lined seasnake	MO	MO	MO
Astrotia stokesii	Stokes' seasnake	MO	MO	MO
Disteira kingie	Spectacled seasnake	MO	MO	MO
Disteira major	Olive-headed seasnake	MO	MO	MO
Emydocephalus annulatus	Turtle-headed seasnake	MO	MO	MO
Enhydrina schistose	Beaked seasnake	MO	MO	-
Ephalophis greyi	North-western mangrove seasnake	MO	MO	MO
Hydrelaps darwiniensis	Black-ringed seasnake	MO	MO	MO
Hydrophis atriceps	Black-headed seasnake	MO	MO	-
Hydrophis coggeri	Slender-necked seasnake	MO	MO	MO
Hydrophis czeblukovi	Fine-spined seasnake	MO	MO	MO
Hydrophis elegans	Elegant seasnake	MO	MO	MO
Hydrophis inornatus	Plain seasnake	MO	MO	-
Hydrophis mcdowelli	Small-headed seasnake	MO	MO	MO
Hydrophis ornatus	Spotted seasnake	MO	MO	MO
Hydrophis pacificus	Large-headed seasnake	MO	MO	-
Lapemis hardwickii	Spine-bellied seasnake	MO	MO	MO
Parahydrophis mertoni	Northern mangrove seasnake	MO	MO	-
Pelamis platurus	Yellow-bellied seasnake	MO	MO	MO
Crocodiles				
Crocodylus johnstoni	Freshwater crocodile	MO	MO	MO

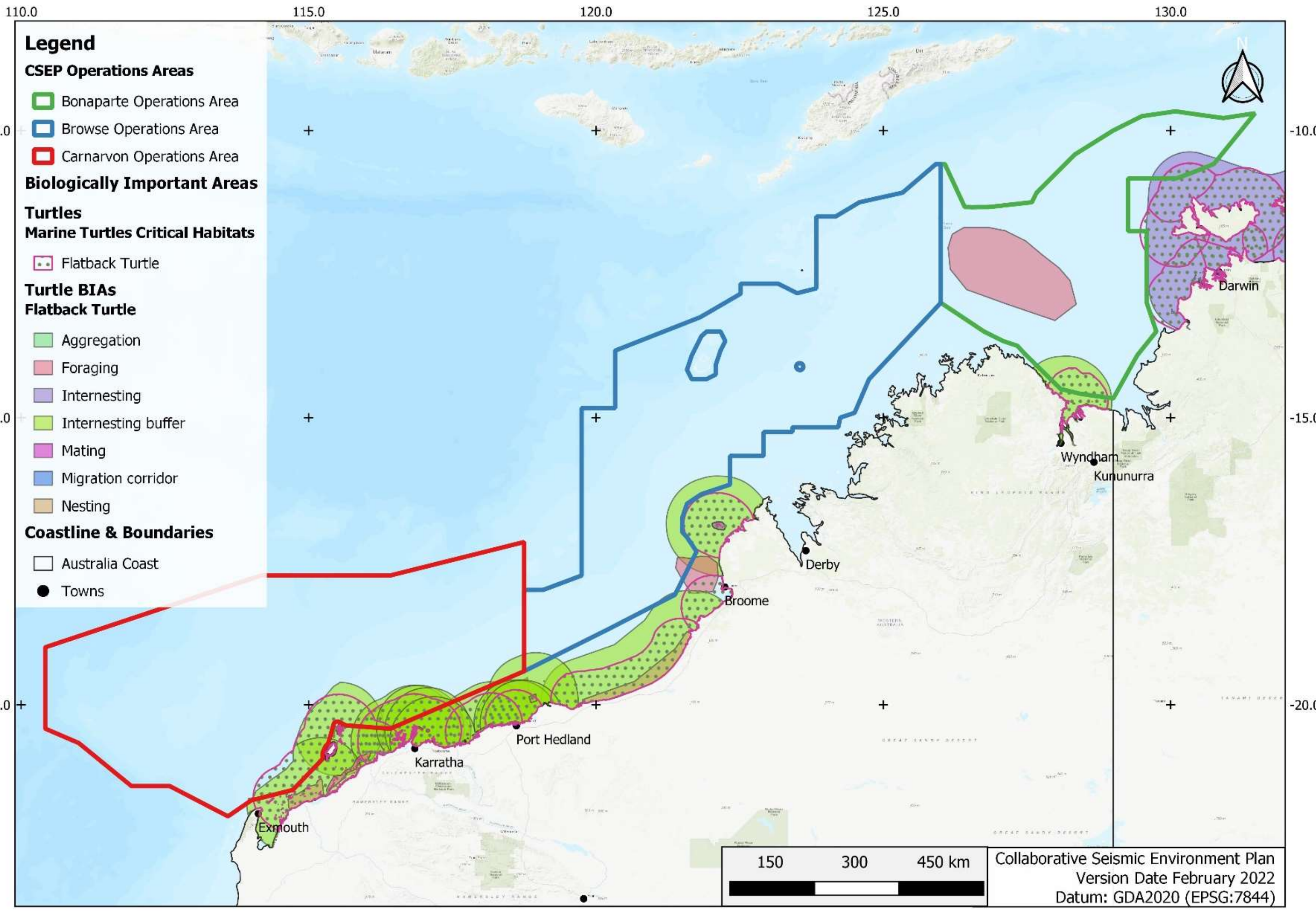


Figure 5-27: Flatback Turtle BIAs and Habitat Critical for Survival within the CSEP OA

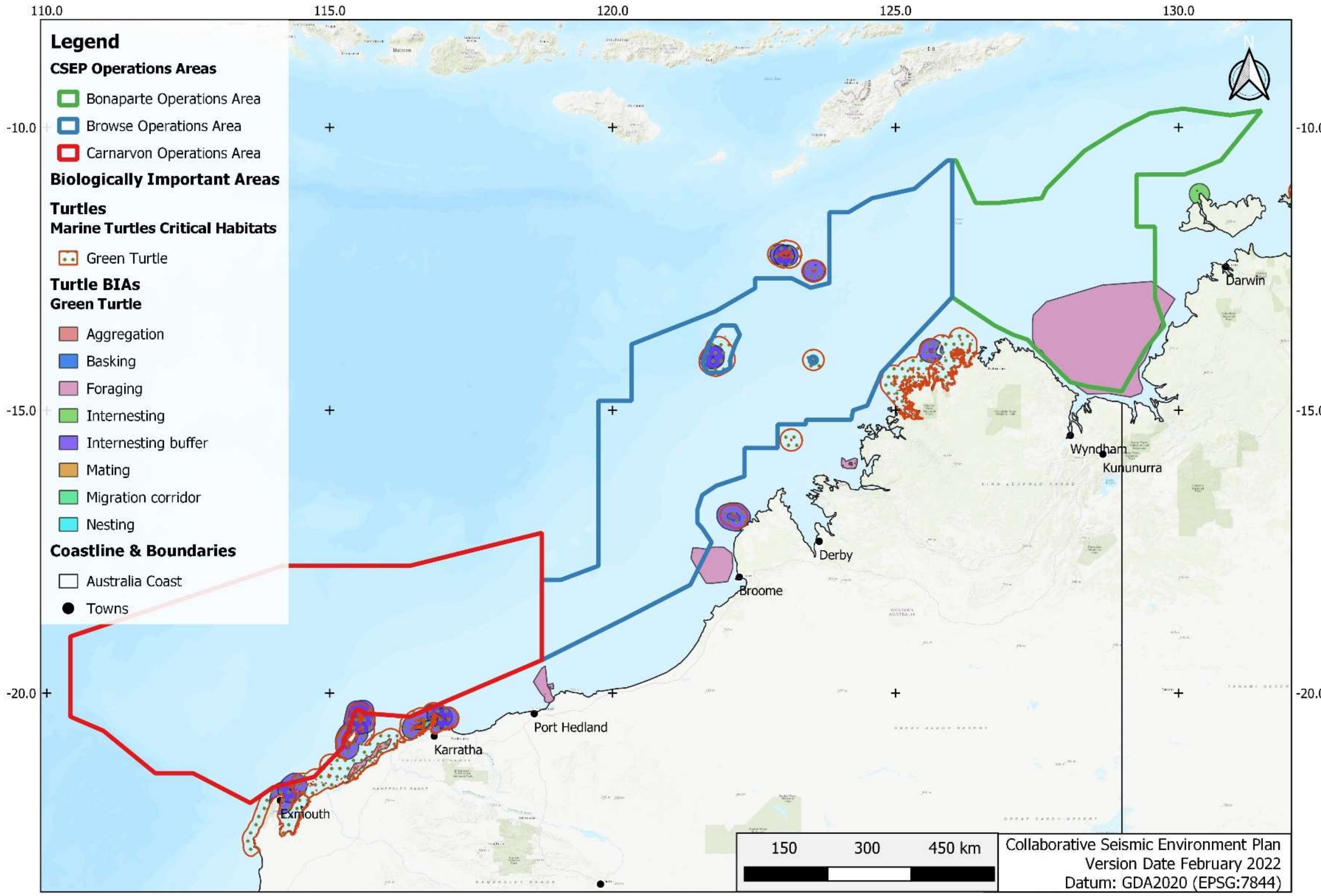


Figure 5-28: Green Turtle BIAs and Habitat Critical for Survival within the CSEP OA

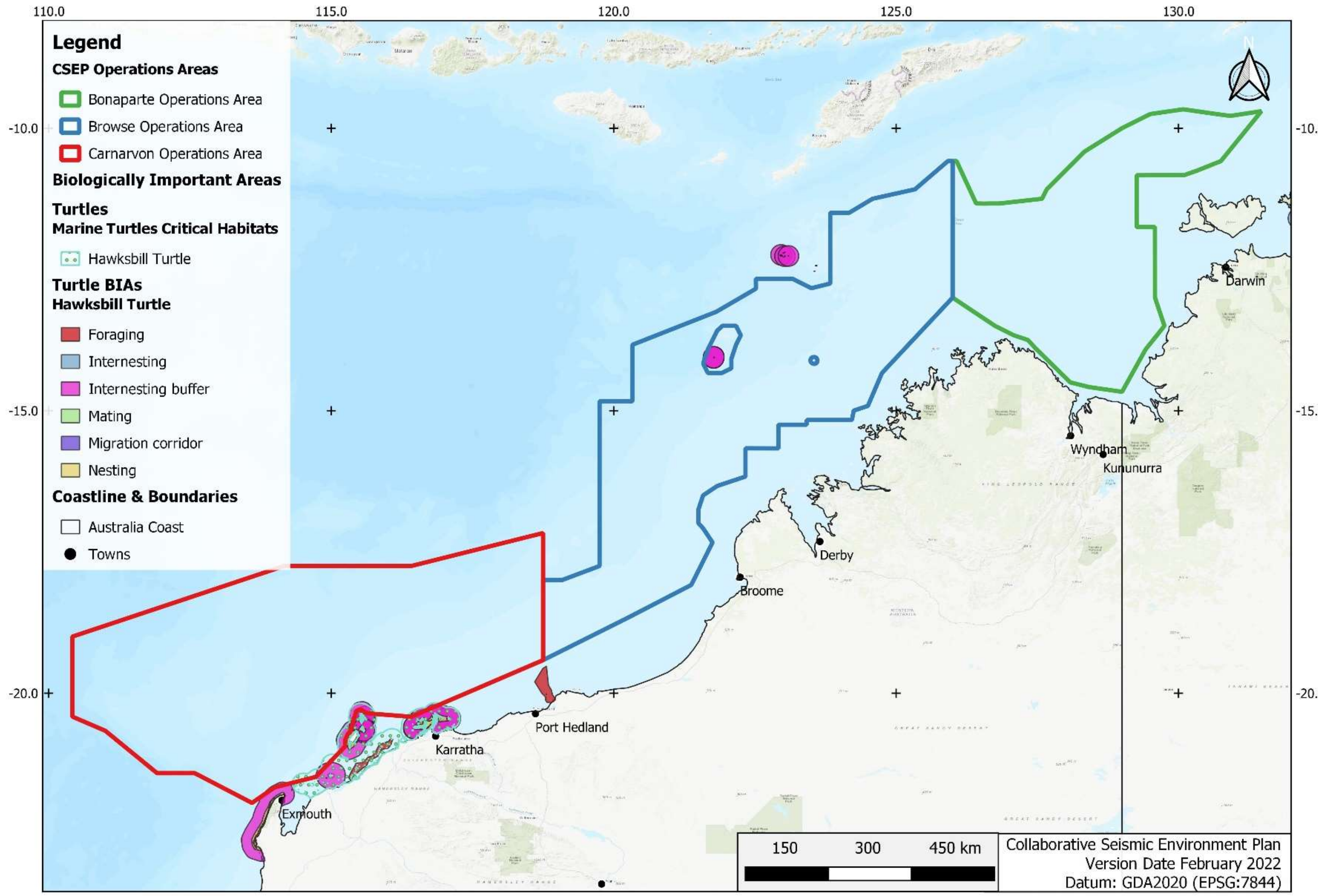


Figure 5-29: Hawksbill Turtle BIAs and Habitat Critical for Survival within the CSEP OA

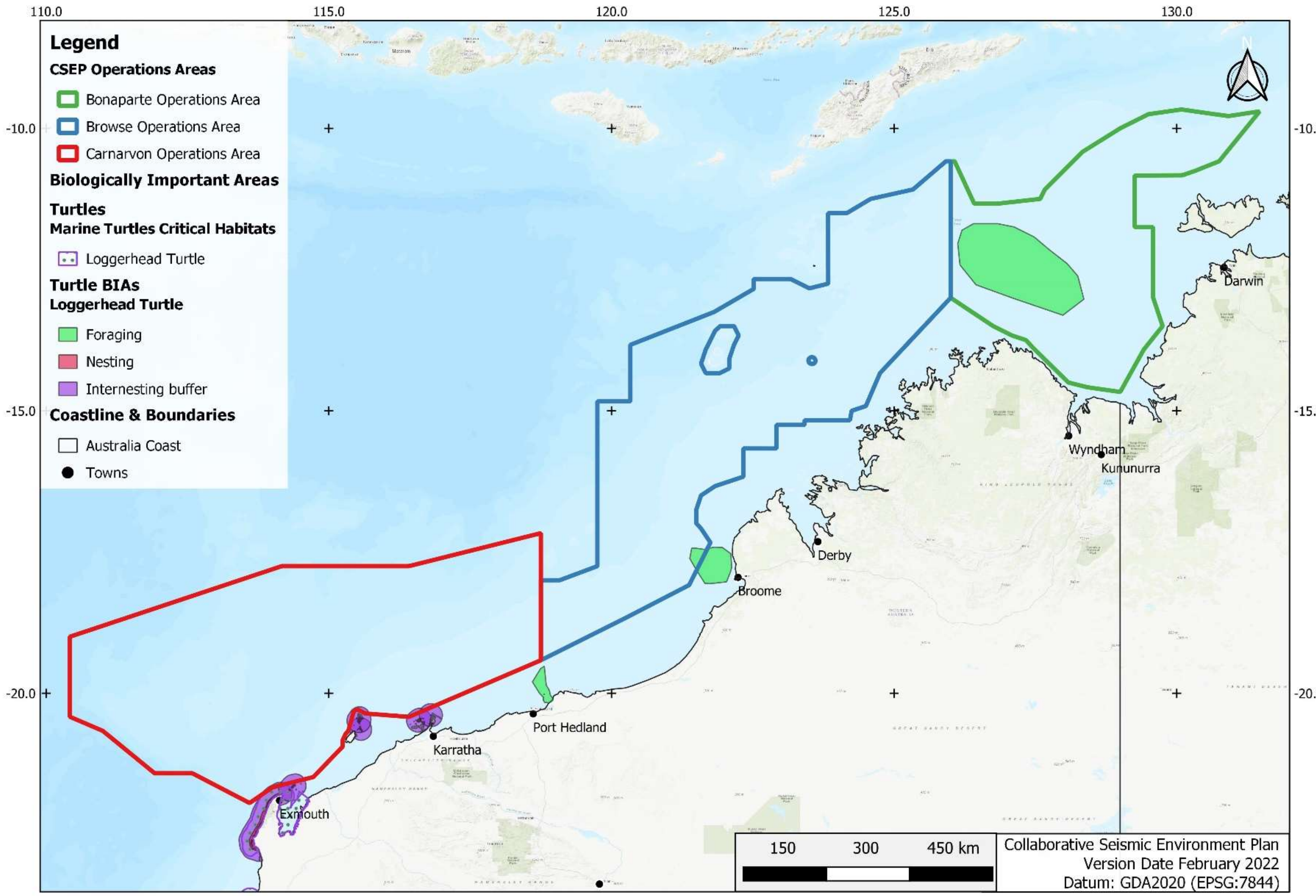


Figure 5-30: Loggerhead Turtle BIAs and Habitat Critical for Survival within the CSEP OA

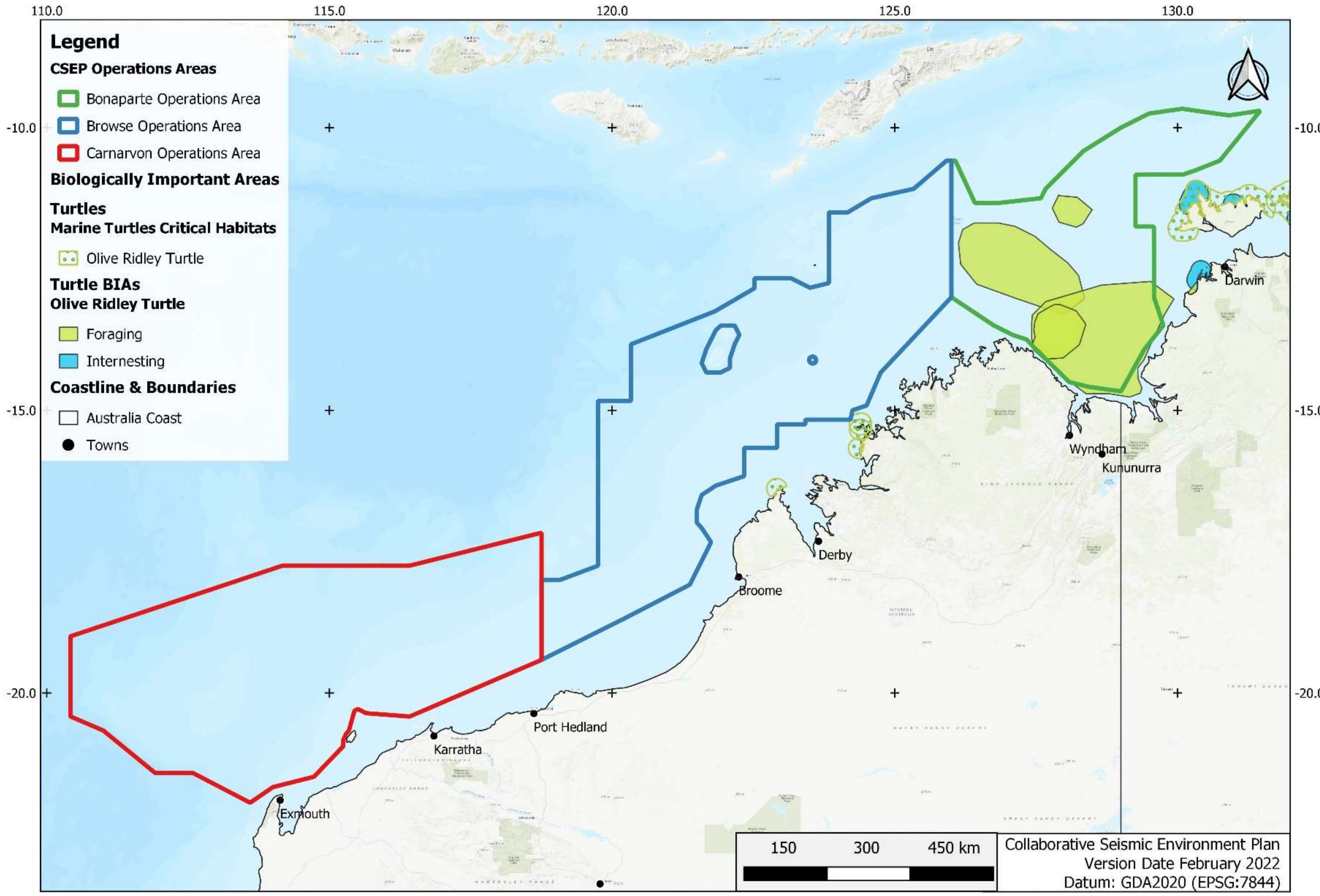


Figure 5-31: Olive Ridley Turtle BIAs and Habitat Critical for Survival within the CSEP OA

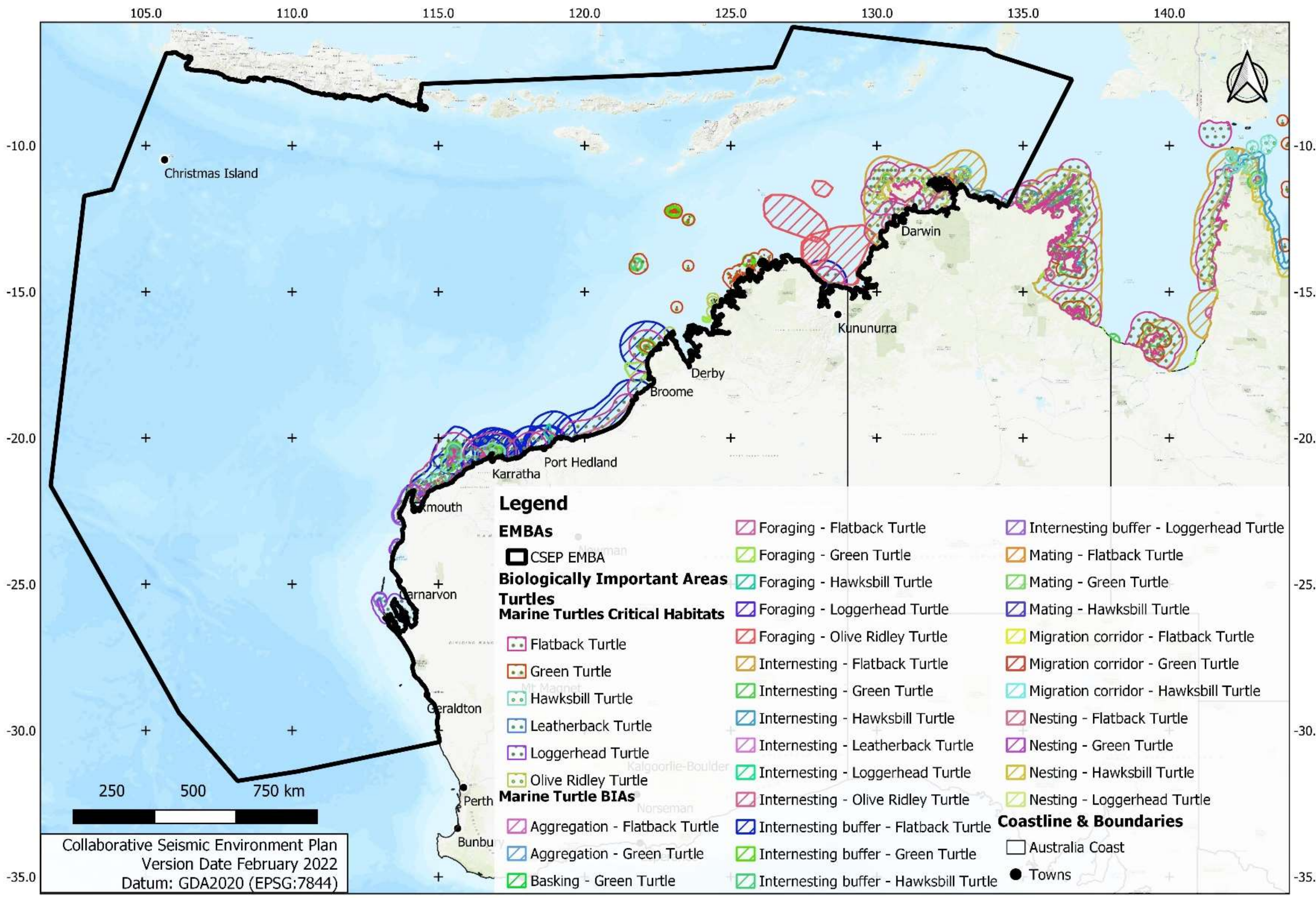


Figure 5-32: Turtle BIAs and Habitat Critical for Survival within the CSEP EMBA

5.5.4 Marine Mammals

Marine mammals consist of cetaceans (whales and dolphins), pinnipeds (seals) and sirenians (dugongs). Many species are EPBC Listed and, as vertebrates, are covered by the:

- DoEE (2018). Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018). Department of the Environment and Energy Canberra, ACT: Commonwealth of Australia. (http://www.environment.gov.au/biodiversity/threatened/publications/tap/marine-debris-2018)

Sixteen mammal species were listed as threatened and/or migratory under the EPBC Act (derived from a PMST search) that are known, likely or may occur within the CSEP Operational Areas and EMBAs (Table 5-16).

There are a further 28 species protected under the EPBC Act as listed marine species that are known, likely or may occur within the CSEP OAs and EMBAs (Table 5-17).

Relevant information on these species is provided in Existing Environment Addendum.

BIAs that overlap the CSEP OA are in place for the following species:

- Blue whale (Figure 5-35)
- Humpback whale (Figure 5-38)

BIAs that overlap the CSEP EMBA are in place for the following species:

- Australian sea-lion - Carnarvon EMBA only (Figure 5-33)
- Australian snubfin dolphin (Figure 5-34)
- Blue whale (Figure 5-36)
- Dugong (Figure 5-37)
- Humpback whale (Figure 5-39)
- Indian Ocean bottlenose dolphin (Figure 5-40)
- Indo-Pacific humpback dolphin (Figure 5-41)

In addition to the marine mammals identified in the PMST acoustic recordings have documented the year-round presence of Omura’s whales (*Balaenoptera omurai*) throughout north-western Australia, including in the Joseph Bonaparte Gulf (McCauley 2009, 2014; McPherson et al. 2016, 2017).

Table 5-16: Marine mammal species or species habitat presence listed as threatened and/or migratory within CSEP OA and EMBA

Relevant Commonwealth management plans are referenced for those species that have them.

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Dolphins									
Lagenorhynchus obscurus	Dusky dolphin	-	Marine	-	-	-	-	-	LO
Orcaella heinsohni	Australian snubfin dolphin	-	Marine	KO	KO	MO	KO	-	KO
Orcinus orca	Killer whale	-	Marine	MO	MO	MO	MO	MO	MO
Sousa chinensis	Indo-pacific humpback dolphin	-	Marine	MO	BKO	MO	BKO	MO	BKO
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	-	Marine	KO	KO	LO	KO	KO	KO
Dugong									
Dugong dugon	Dugong	-	Marine	MO	BKO	LO	BKO	KO	BKO
Sealion									
Neophoca cinerea	Australian sealion	Vulnerable	-						BKO
Whales									
Balaenoptera bonaerensis	Antarctic minke whale	-	Marine	-	-	-	LO	LO	LO
Balaenoptera borealis	Sei whale	Vulnerable	Marine	LO	FLO	FLO	FLO	FLO	FLO
		TSSC (2015i). Conservation Advice *Balaenoptera borealis* sei whale. Threatened Species Scientific Committee Canberra: Department of the Environment. (https://environment.gov.au/biodiversity/threatened/species/pubs/34-conservation-advice-01102015.pdf) ***Listed threats of anthropogenic noise and acoustic disturbance and vessel strike relevant to seismic surveys***							

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Balaenoptera edeni	Bryde's whale	-	Marine	MO	LO	LO	LO	LO	LO
Balaenoptera musculus	Blue whale (includes pygmy blue whale)	Endangered	Marine	LO	MKO	MKO	MKO	MKO	MKO
		DoE (2015). Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment Canberra, ACT: Commonwealth of Australia. (https://www.awe.gov.au/sites/default/files/documents/blue-whale-conservation-management-plan.pdf) ***Listed threats of noise interference and vessel disturbance relevant to seismic surveys*** Department of Agriculture, Water and the Environment (2021) Guidance on Key terms within the Blue Whale Conservation Management Plan.							
Balaenoptera physalus	Fin whale	Vulnerable	Marine	LO	FLO	FLO	FLO	FLO	FLO
		TSSC (2015j). Conservation Advice *Balaenoptera physalus* fin whale. Threatened Species Scientific Committee Canberra: Department of the Environment. (http://environment.gov.au/biodiversity/threatened/species/pubs/37-conservation-advice-01102015.pdf) ***Listed threats of anthropogenic noise and acoustic disturbance and vessel strike relevant to seismic surveys***							
Caperea marginata	Pygmy right whale	-	Marine	-	-	-	-	-	MO
Eubalaena australis	Southern right whale	Endangered	Marine	-	-	-	LO	LO	LO
Megaptera novaeangliae	Humpback whale	Vulnerable	Marine	LO	BKO	BKO	BKO	BKO	BKO
		TSSC (2015k). Conservation Advice *Megaptera novaeangliae* humpback whale. Threatened Species Scientific Committee Canberra: Department of the Environment. (http://www.environment.gov.au/biodiversity/threatened/species/pubs/38-conservation-advice-10102015.pdf). ***Listed threats of noise interference, entanglement and vessel disturbance and strike relevant to seismic surveys.***							

Scientific name	Common name	Listed Threatened Species	Listed Migratory Species	Bonaparte		Browse		Carnarvon	
				OA	EMBA	OA	EMBA	OA	EMBA
Physeter macrocephalus	Sperm whale	-	Marine	MO	MO	MO	MO	MO	MO

Type of Presence:

BLO - Breeding likely to occur within area

BKO - Breeding known to occur within area

FLO - Foraging, feeding or related behaviour likely to occur within area

FKO - Foraging, feeding or related behaviour known to occur within area

FMO - Foraging, feeding or related behaviour may occur within area

LO - Species or species habitat likely to occur within area

KO - Species or species habitat known to occur within area

MO - Species or species habitat may occur within area

MKO – Migration route known to occur within area

Table 5-17: List Marine Mammal Species or Species Habitat Presence within CSEP OA and EMBA

Scientific name	Common name	Bonaparte		Browse		Carnarvon	
		OA	EMBA	OA	EMBA	OA	EMBA
Arctocephalus forsteri	New Zealand Fur seal	-	-	-	-	-	MO
Balaenoptera acutorostrata	Minke whale	-	-	-	MO	LO	MO
Delphinus delphis	Common dolphin	MO	MO	MO	MO	MO	MO
Feresa attenuate	Pygmy killer whale	MO	MO	MO	MO	MO	MO
Globicephala macrorhynchus	Short-finned pilot whale	MO	MO	MO	MO	MO	MO
Globicephala melas	Long-finned pilot whale	-	-	-	-	-	MO
Grampus griseus	Risso's dolphin	MO	MO	MO	MO	MO	MO
Hyperoodon planifrons	Southern bottlenose whale	-	-	-	-	-	MO
Indopacetus pacificus	Longman's beaked whale	-	MO	-	MO	MO	MO
Kogia breviceps	Pygmy sperm whale	MO	MO	MO	MO	MO	MO
Kogia simus	Dwarf sperm whale	MO	MO	MO	MO	MO	MO
Lagenodelphis hosei	Fraser's dolphin	MO	MO	MO	-	MO	MO
Mesoplodon bowdoini	Andrew's beaked whale	-	-	-	-	-	MO
Mesoplodon densirostris	Blainville's beaked whale	-	MO	MO	MO	MO	MO
Mesoplodon ginkgodens	Gingko-toothed beaked whale	-	MO	-	MO	MO	MO
Mesoplodon grayi	Gray's beaked whale	-	-	-	-	-	MO
Mesoplodon layardii	Strap-toothed beaked whale	-	-	-	-	-	MO
Mesoplodon mirus	True's beaked whale	-	-	-	-	-	MO
Orcaella brevirostris	Irrawaddy dolphin	KO	KO	MO	KO	-	KO
Peponocephala electra	Melon-headed whale	MO	MO	MO	MO	MO	MO
Pseudorca crassidens	False killer whale	LO	-	LO	-	LO	-
Stenella attenuate	Spotted dolphin	MO	MO	MO	MO	MO	MO
Stenella coeruleoalba	Striped dolphin	MO	MO	MO	MO	MO	MO
Stenella longirostris	Long-snouted spinner dolphin	MO	MO	MO	MO	MO	MO
Steno bredanensis	Rough-toothed dolphin	MO	MO	MO	MO	MO	MO
Tursiops aduncus	Indian Ocean bottlenose dolphin	LO	LO	LO	LO	LO	MO
Tursiops truncatus s. str.	Bottlenose dolphin	MO	MO	MO	MO	MO	MO
Ziphius cavirostris	Cuvier's beaked whale	MO	MO	MO	MO	MO	MO

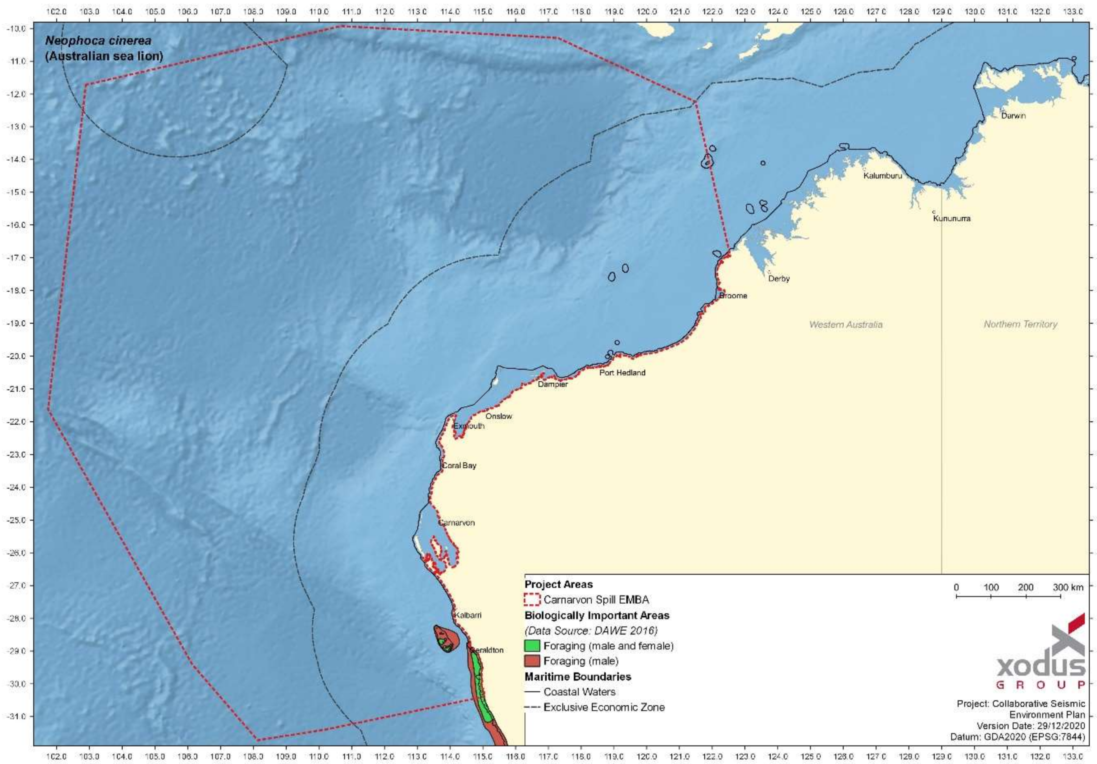


Figure 5-33: Australian Sea Lion BIAs within the Carnarvon EMBA

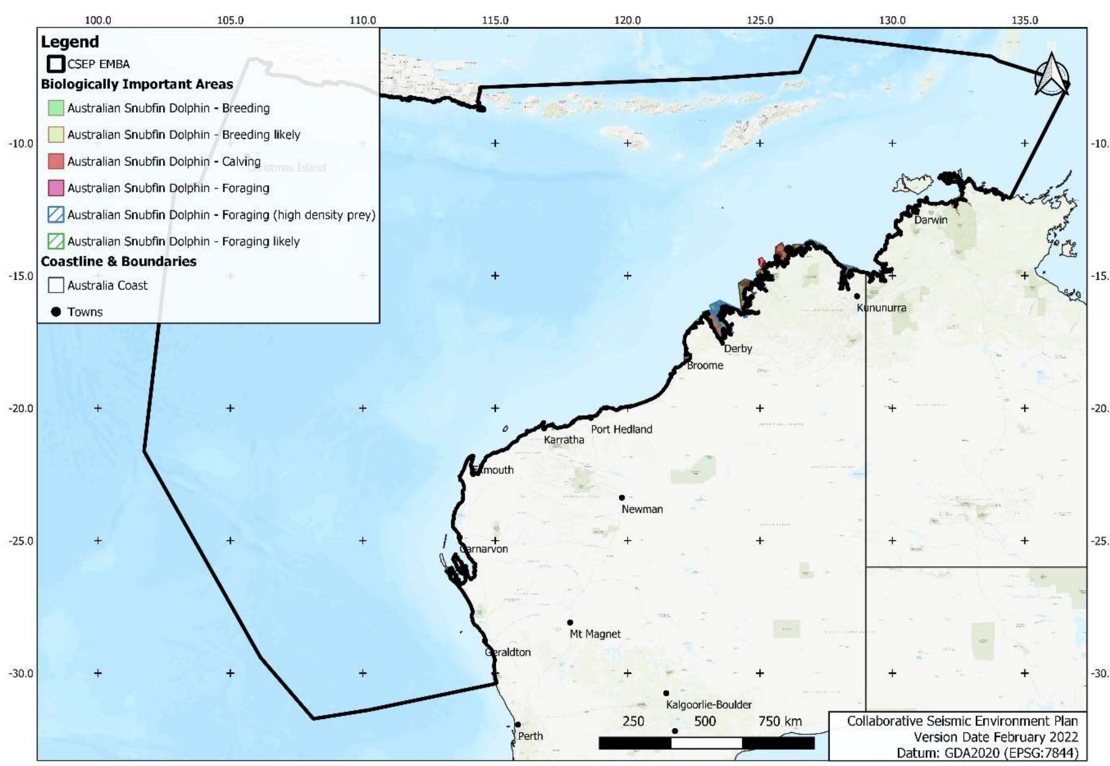


Figure 5-34: Australian Snubfin Dolphin within the CSEP EMBA

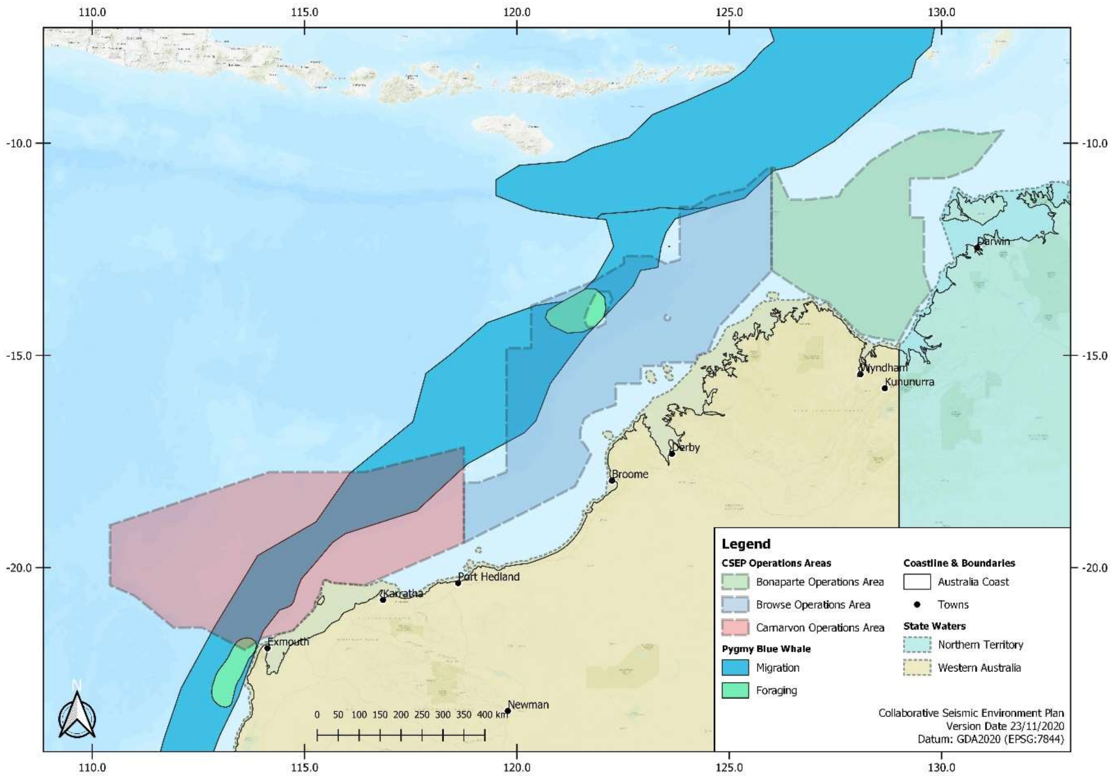


Figure 5-35: Blue Whale BIA and Distribution within the CSEP OA

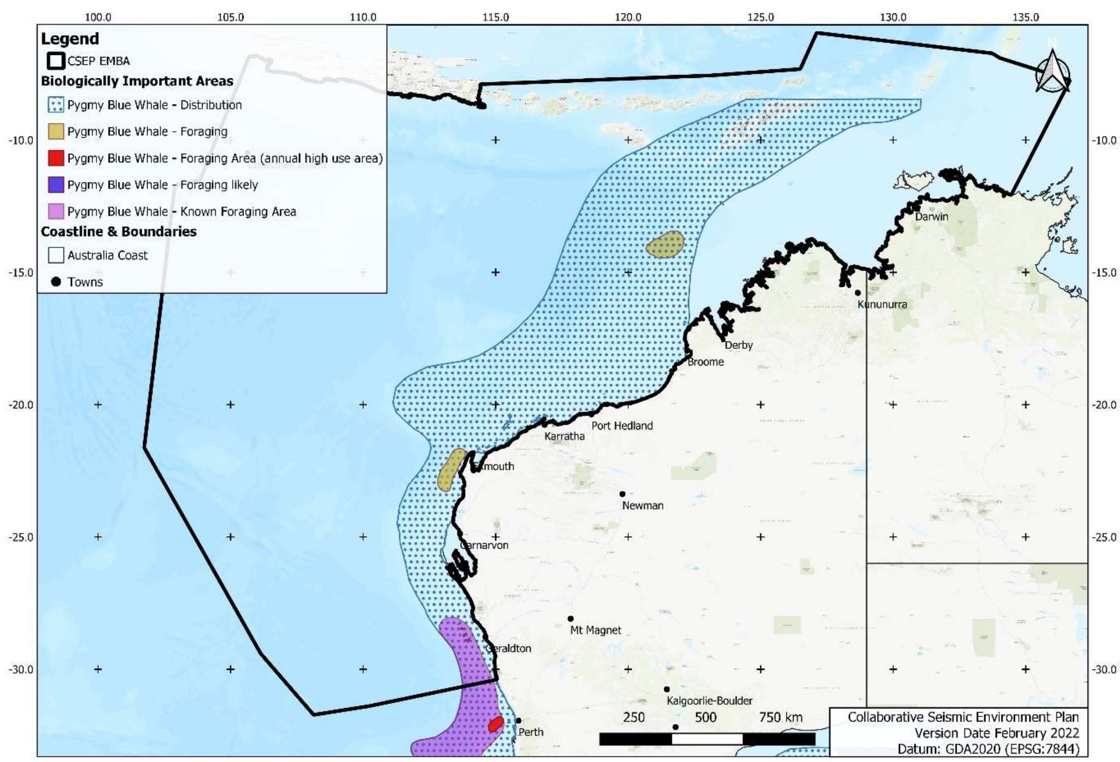


Figure 5-36: Blue Whale BIAs and Distribution within the CSEP EMBA

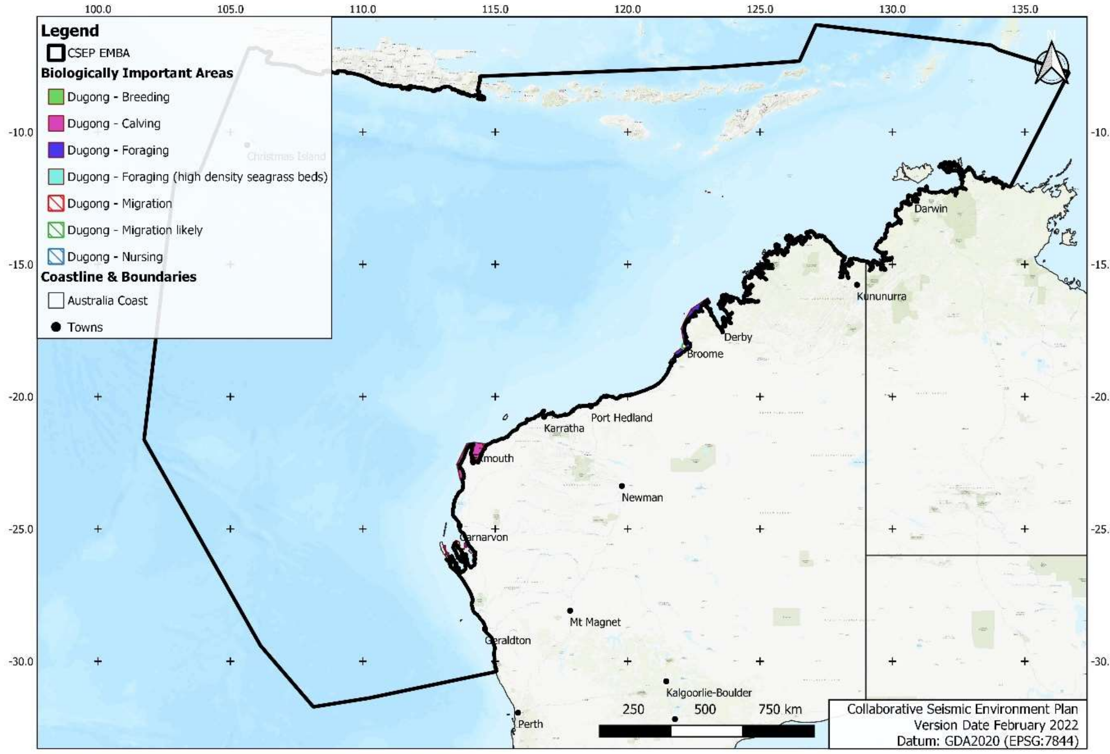


Figure 5-37: Dugong BIAs within CSEP EMBA

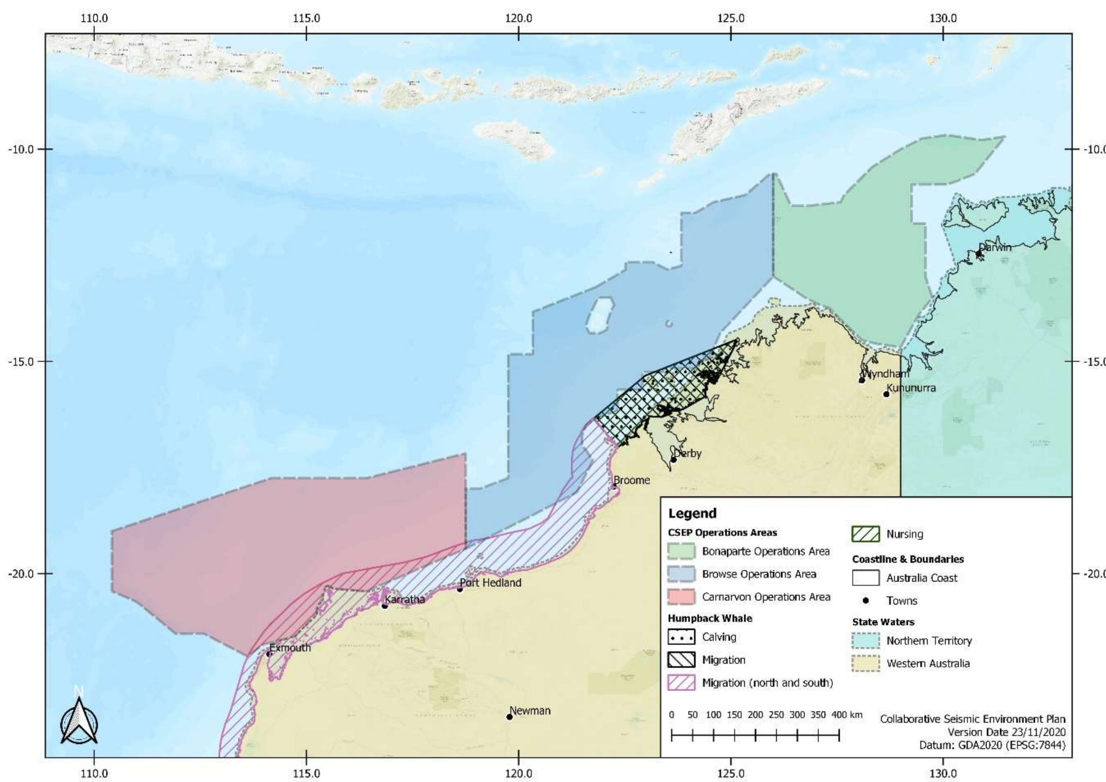


Figure 5-38: Humpback Whale BIAs within the CSEP OA

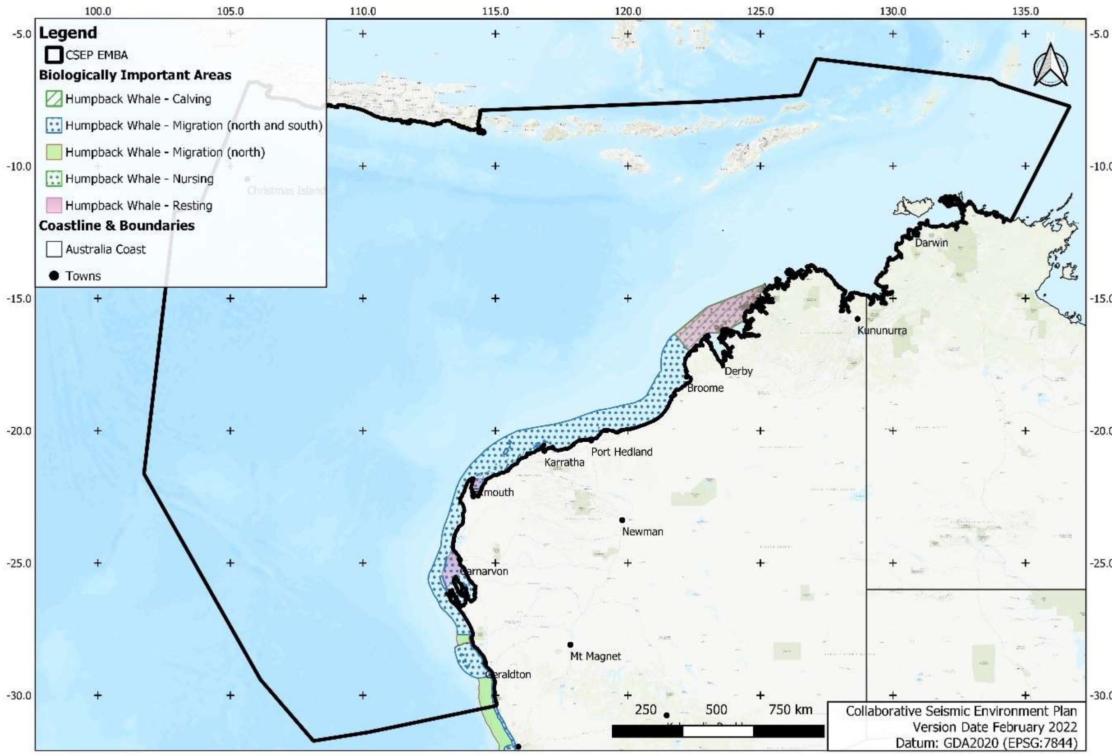


Figure 5-39: Humpback Whale BIAs within the CSEP EMBA

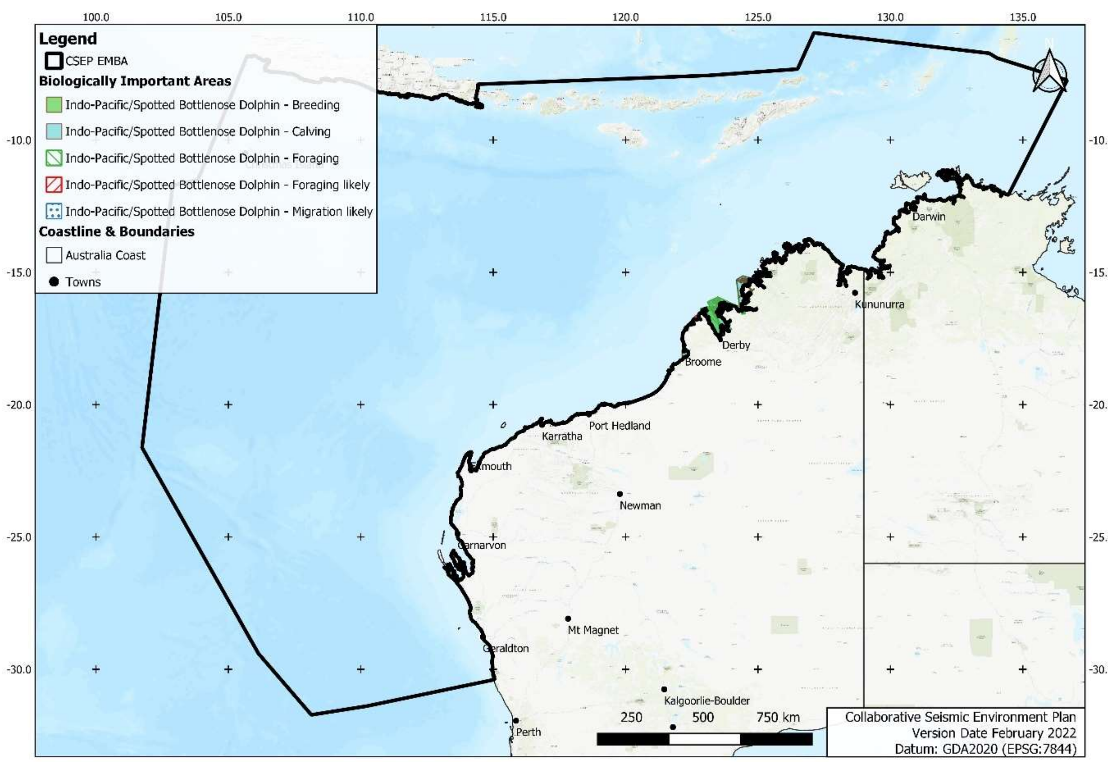


Figure 5-40: Indo-pacific Humpback Dolphin BIAs within the CSEP EMBA

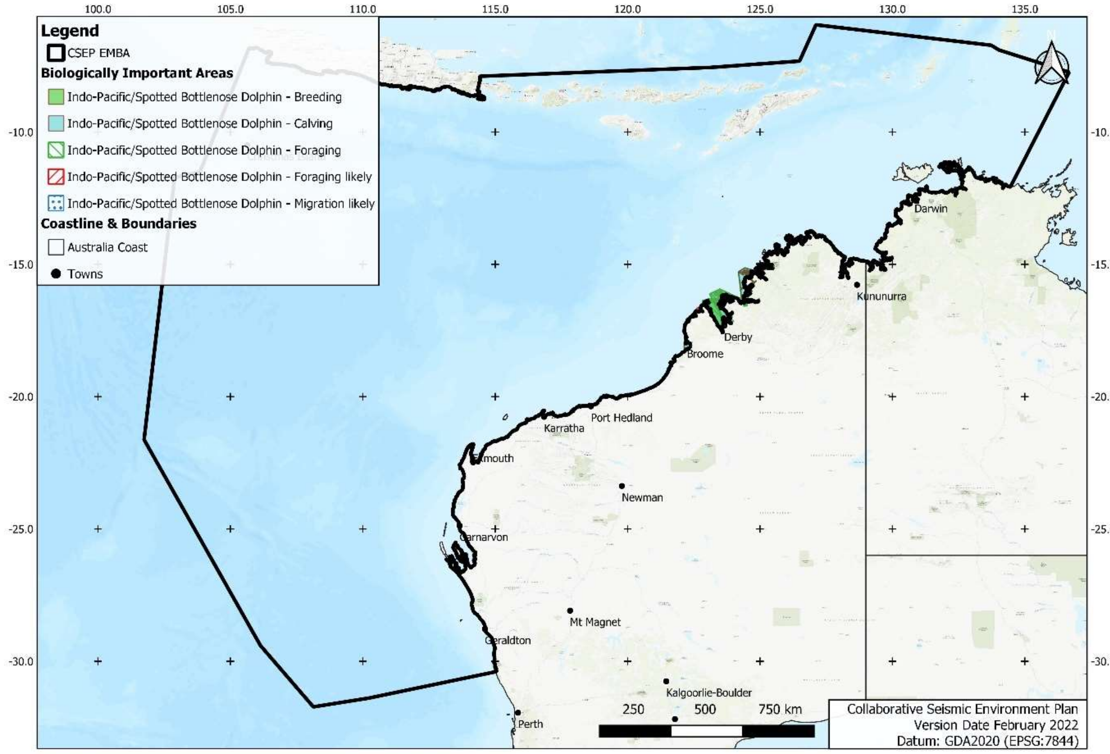


Figure 5-41: Indian Ocean Bottlenose Dolphin BIAs within the CSEP EMBA

5.6 Threatened Ecological Communities

Threatened ecological communities are matters of national environmental significance and are protected under the EPBC Act.

There are no threatened ecological communities within the CSEP OA and two within the CSEP EMBA, being:

- Monsoon vine thickets on the coastal and sand dunes of Dampier Peninsula – Endangered (Bonaparte EMBA, Browse EMBA, Carnarvon EMBA).
- Subtropical and temperate coastal saltmarsh (Carnarvon EMBA).

In addition, the WA Minister for Environment has endorsed Roebuck Bay mudflats as a threatened ecological community (non-statutory process).

Relevant information on these communities is provided in Existing Environment Addendum.

5.7 Socio-economic Values and Sensitivities

5.7.1 Shipping

Commercial shipping operates within the marine and coastal environment within the CSEP OA and EMBA.

Sea transport is an important activity, with international transit routes and shipping lanes occurring within the region (Figure 5-42 CSEP OA and Figure 5-43 CSEP EMBA).

There are no ports within the CSEP OA.

Ports within the CSEP EMBA include:

- Port of Darwin - important for trading vessels, fishing vessels, navy ships and cruise ships and also services activity associated with the operation of the Australasia Railway and the Timor Sea oil and gas developments.
- Derby, Cockatoo Island and Koolan Island – non-port authority ports, associated with the export of commodities such as iron ore, lead and zinc.
- Port Hedland – second largest Australian port, with main bulk export commodities being iron ore and salt
- Port of Broome - important for the importing of petroleum products, the export of livestock and the services for offshore oil and gas exploration, pearling and fishing vessels, charter boats and large cruise ships
- Port of Dampier – one of the major tonnage ports in Australia, with prime export commodities of iron ore, LNG and salt.

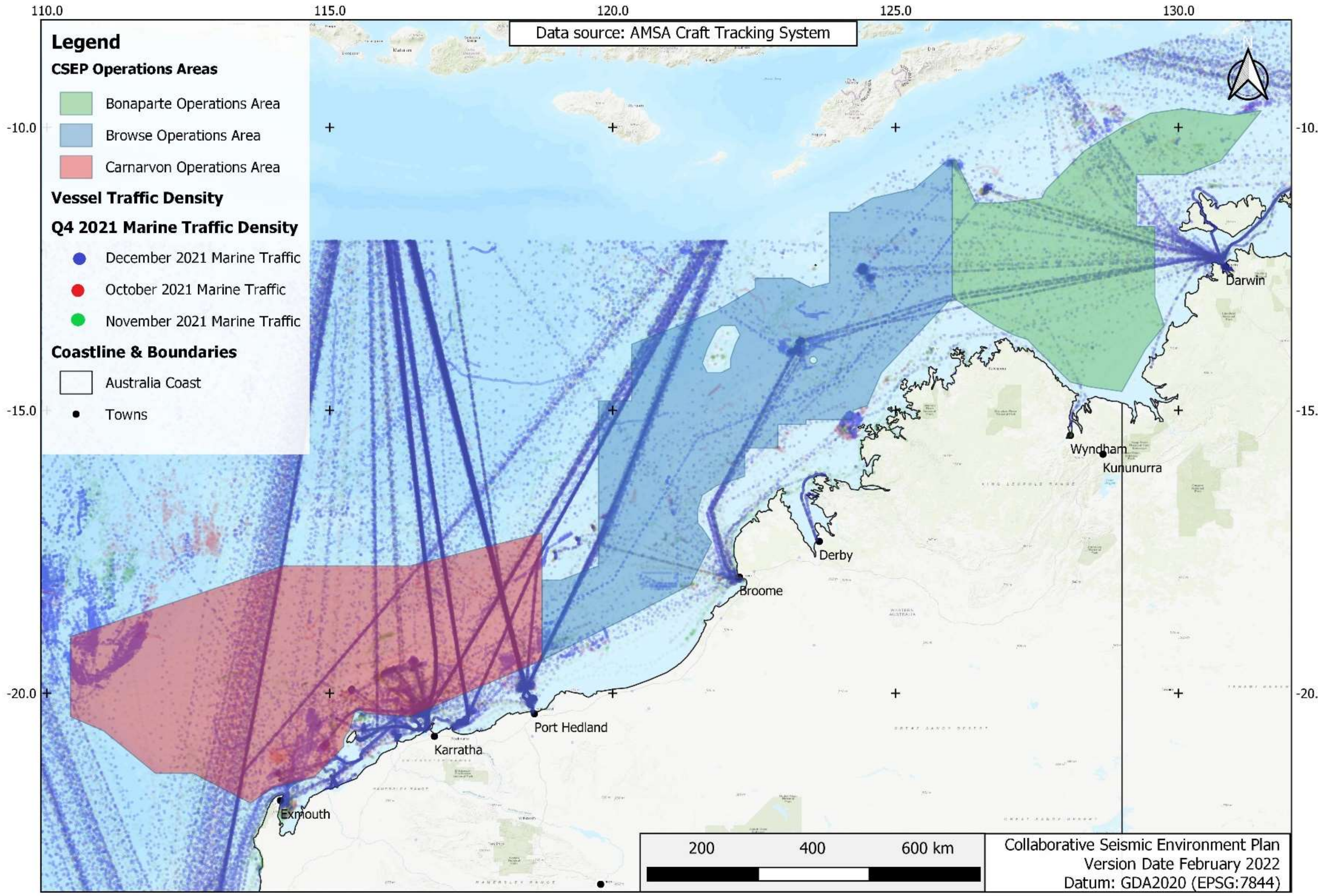


Figure 5-42: Recorded vessel traffic through the CSEP OA

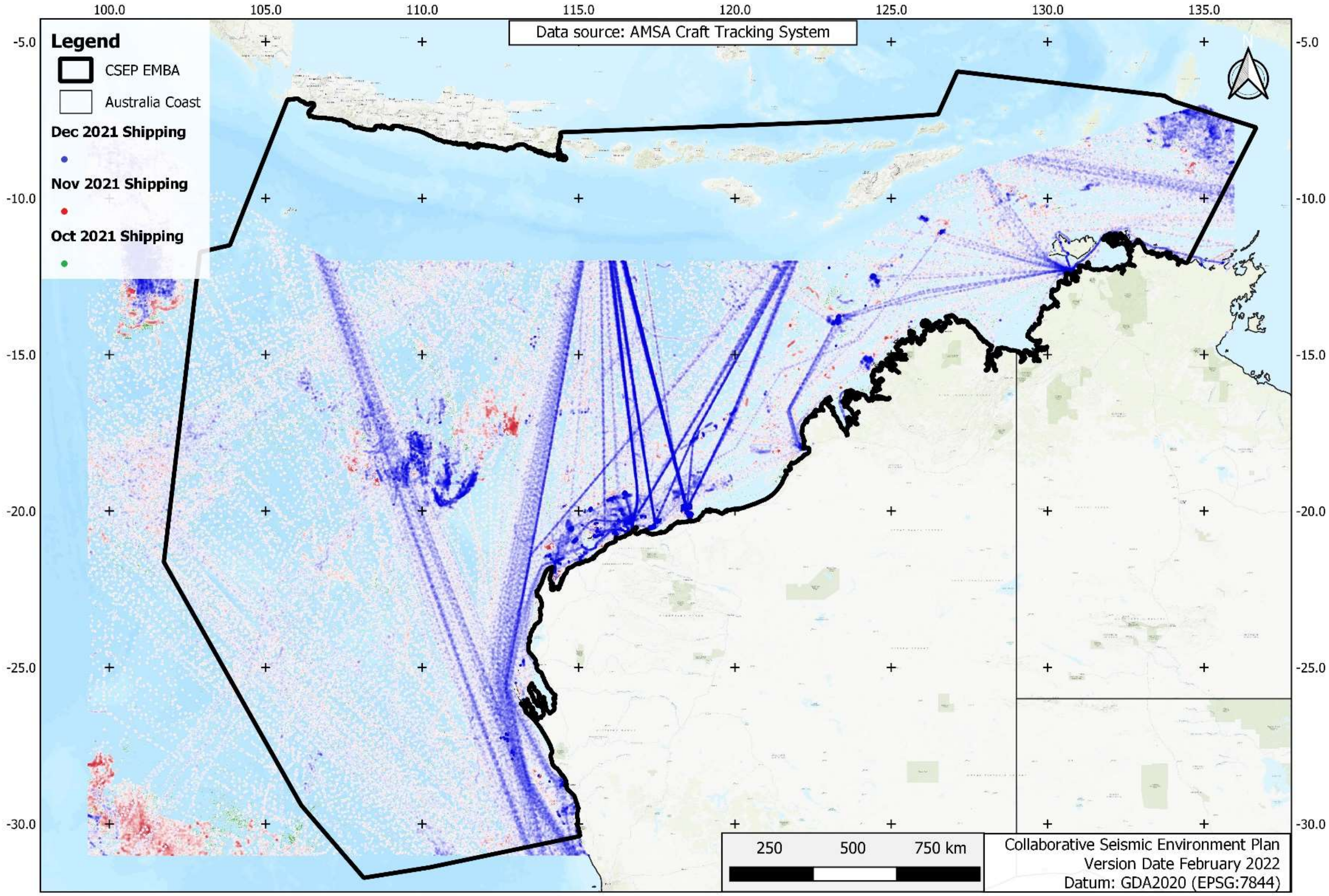


Figure 5-43: Recorded vessel traffic through the CSEP EMBA

5.7.2 Recreational Fishing

A wide range of recreational fishing activities occur in coastal areas within the CSEP EMBA with limited activity within the CSEP OA. Recreational fishing activities peak in winter and are concentrated in coastal waters along the Gascoyne, Pilbara, Kimberley and NT coastlines, generally around the population centres of Geraldton, Carnarvon, Exmouth, Onslow, Dampier/Karratha, Port Hedland, Broome, Wyndham and Darwin. Some of the recreationally important species of the coastal areas include snappers, barramundi, mangrove jack, jewfish and bream.

Offshore islands, coral reef systems and continental shelf waters are increasingly targeted by fishing-based charter vessels (Gaughan & Santoro 2021). Extended fishing charters are known to operate during certain times of the year to fishing spots off the WA and NT coast.

Further information on recreational fishing is provided in the Existing Environment Addendum.

5.7.3 Traditional Fishing

Traditional fishing occurs along most of the Kimberley and NT coastline. Traditional fishing includes taking turtles, dugong, fish and other marine life (DEE 2018g) using methods such as line fishing, spearing, cast net and hand collection. Indigenous Protected Areas within the CSEP EMBA (Section 5.2.3) are areas where traditional fishing can occur.

In 1974 the Australian and Indonesian Governments signed a memorandum of understanding (MoU) which permits fishing by traditional Indonesian and Timorese fisherman within an area of Australian waters. The area, known as the MoU Box, covers an area of approximately 50,000 km^2 and includes Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals. Traditional fishermen target several species, including reef fish, sharks, beche-de-mer and trochus. The CSEP OA and EMBA overlaps the MoU Box.

5.7.4 Oil and gas facilities and activities

There are multiple petroleum oil and gas production facilities that operate within the CSEP OA and EMBA as shown in Figure 5-44 and Figure 5-45. Exploration and production activities including platforms, floating, production, storage and offloading vessels, pipelines and drilling occur within these permit areas.

Table 5-18 details the accepted and proposed seismic surveys on NOPSEMA website (27 April 2022) that overlap with the CSEP OA and any stakeholder engagement with survey operators that are not CSEP titleholders.

Table 5-18: Seismic Surveys Proposed within the CSEP OA

Survey	Timing	Days
Accepted Open		
Capreolus-2 3D Marine Seismic Survey 2020-2024 (TGS-NOPEC Geophysical Company Pty Ltd)	October 2020 to 31 December 2024 Up to 10,000 km^2 may be acquired per calendar year.	Up to 190 days per calendar year
Rollo Multiclient Marine Seismic Surveys Environment Plan (PGS Australia Pty Ltd)	October 2018 to October 2023	NA

Survey	Timing	Days
Accepted Completed		
2D Seismic Survey WA-532-P, WA-535-P and WA-50-L (INPEX Browse E&P Pty Ltd)	1 November 2021 – 31 May 2022 (planned acquisition). 1 November 2022 – 31 May 2023 (contingency only). 1 November 2023 – 31 December 2023 (contingency only). Survey complete in May 2022 – see Stakeholder Record Inpex-01.	Up to 140 days
Galactic Hybrid 2D MSS (Woodside Energy Ltd)	Undertaken 12 – 28 May 2022	16 days
Keraudren Extension 3D Marine Seismic Survey (Santos WA Northwest Pty Ltd)	1 February to 31 July 2022 Survey complete.	Up to 132 days
Petrel Sub-basin South-West 3D Marine Seismic Survey (Santos Offshore Pty Ltd)	1 December 2021 and 31 March 2022. 1 December 2022 and 31 March 2023 Survey complete.	Up to 60 days
Sauropod 3D Marine Seismic Survey (CGG Services (Australia) Pty Ltd)	January to May 2022 Survey not completed within accepted EP timeframe.	Up to 60 days
Not accepted		
Bonaparte MC3D Marine Seismic Survey (Schlumberger)	1 September 2022 to 30 June 2024	Up to 190 days
Possum 3D Marine Seismic Survey (Searcher Seismic Pty Ltd)	1 January 2022 and end July 2023 Acquisition during Dec to end July.	Up to 70 days
Scarborough 4D B1 Marine Seismic Survey (Woodside Energy Scarborough Pty Ltd)	1 January 2022 to 31 December 2023.	Up to 80 days
Bonaparte MC3D Marine Seismic Survey (Schlumberger)	1 September 2022 to 30 June 2024	Up to 190 days
Wheatstone 4D Marine Seismic Survey (Chevron Australia Pty Ltd)	Mid-December 2022 or mid-April 2023	Up to 75 days

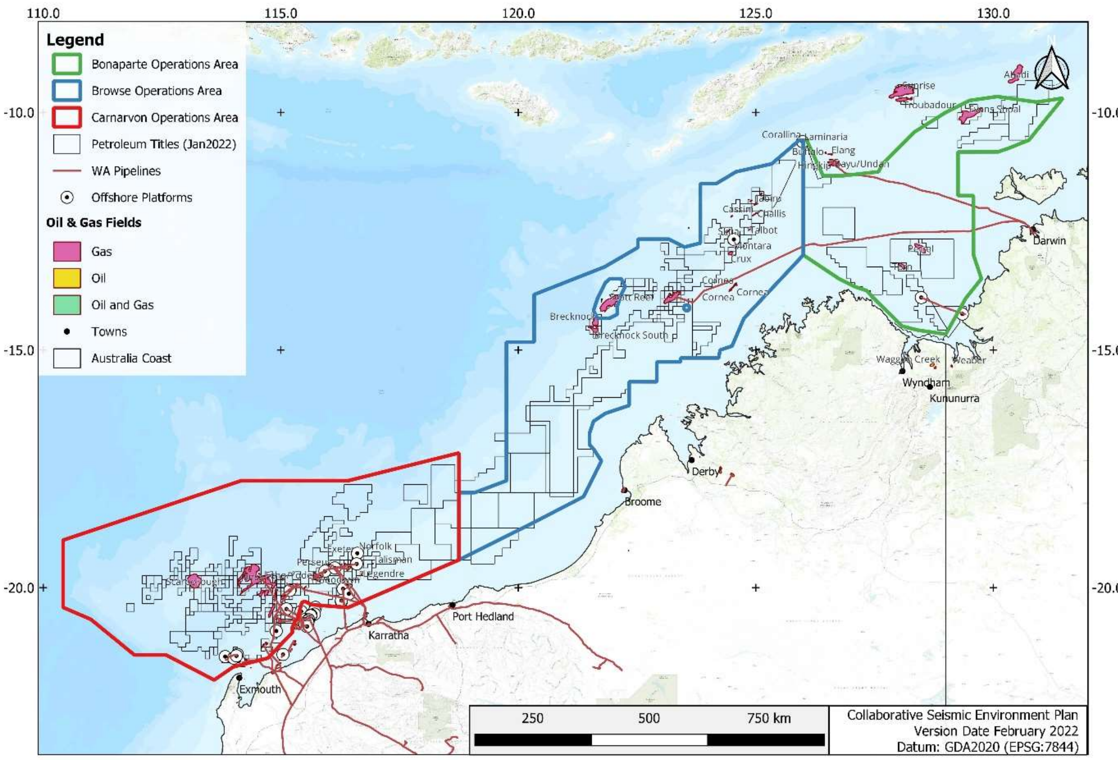


Figure 5-44: Oil and gas facilities within the CSEP OA

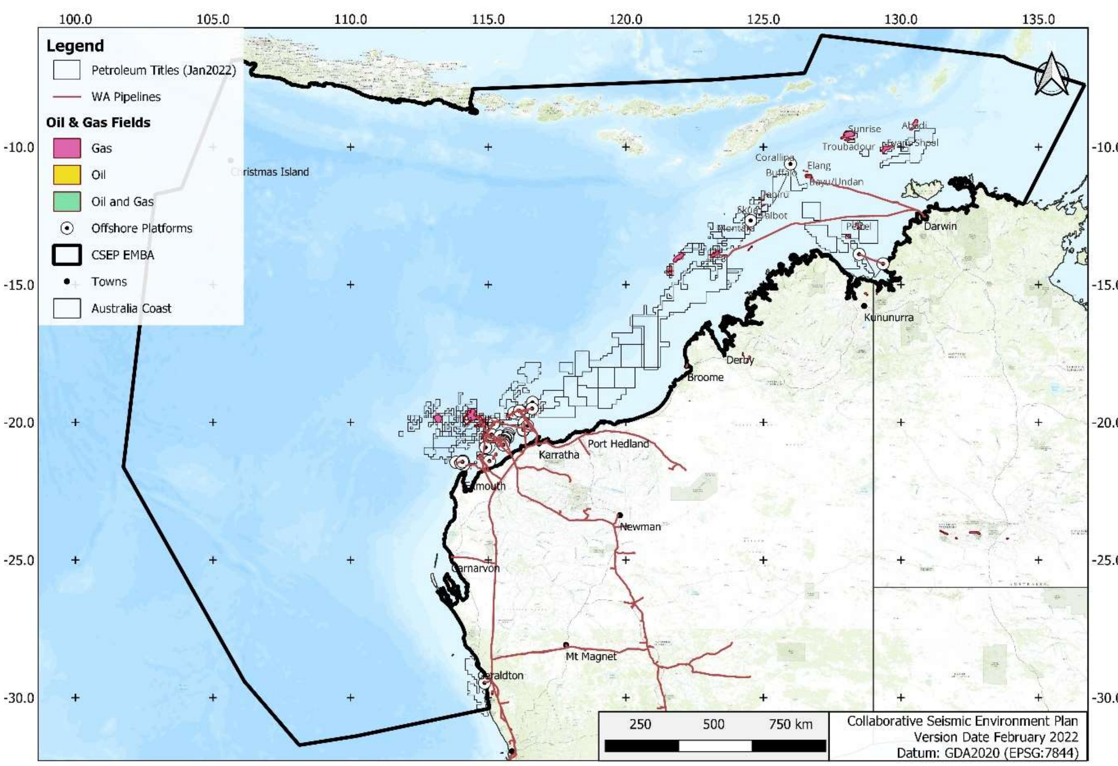


Figure 5-45: Oil and gas facilities within the CSEP EMBA

5.7.5 Tourism and Recreation

Tourism is the largest individual sub-sector of the marine industry with a total measurable output of $30.9 billion in 2015-16. This is followed by the marine oil and gas sector which produced $23.3 billion in the same period (AIMS 2018). Within the North west region $1.7 billion is spent through tourism activities (Austrade 2018).

Charter fishing, recreational fishing, marine fauna watching, and cruising are the main commercial tourism and recreational activities that may occur within the CSEP OA and CSEP EMBA.

Charter boats operating out of Darwin in the NT and Broome, Derby, Port Hedland, Dampier, Onslow and Exmouth in WA, generally target areas of high scenic value and/or offshore coral reef areas. As these attributes are generally sparse in offshore waters and at considerable distance from shore, the level of charter fishing and tourism is expected to be low within the CSEP OA. Popular offshore fishing and tourist locations such as Ningaloo Reef, Montebello Islands, Rowley Shoals and Ashmore and Cartier Islands are within the CSEP EMBA but have been excluded from the CSEP OA.

Whale and dolphin watching is popular with charters operating from Broome from June to early October as humpback whales migrate along the coast. Humpback whale and whale shark tours are popular from late March to October especially out of Exmouth. Humpback whales migrate along the coast around April to July with whale shark tours between March and October.

Boutique cruise liners operate out of Broome travelling to Wyndham (via Kununurra) and sometimes Darwin during April and October to view waterfalls in the area which are in full force after the wet season (Tourism Australia 2020).

Port Hedland, Dampier/Karratha and Darwin have been known to accommodate large cruise ships bringing with them significant benefits to the local economy. Exmouth is occasionally used by the cruise ship industry; however, given the size of existing infrastructure and facilities available at Exmouth, this limits the size and number of vessels that use the marina.

5.7.6 Submarine cables

Within Commonwealth and State/Territory waters there are various subsea cable systems that provides Australia with connectivity, bandwidth, and reliability. All subsea cables have a landing point that runs out of Australia's onshore regions to offshore (Figure 5-46).

Subsea telecommunications cables within the CSEP EMBA are listed in Table 5-19. The North West Cable System, Darwin-Jakarta-Singapore Cable and Hawaiki Nui Cable are within the CSEP OA.

Figure 5-46: Map of the Australia’s Subsea Cables (Submarine Cable Map 2021)

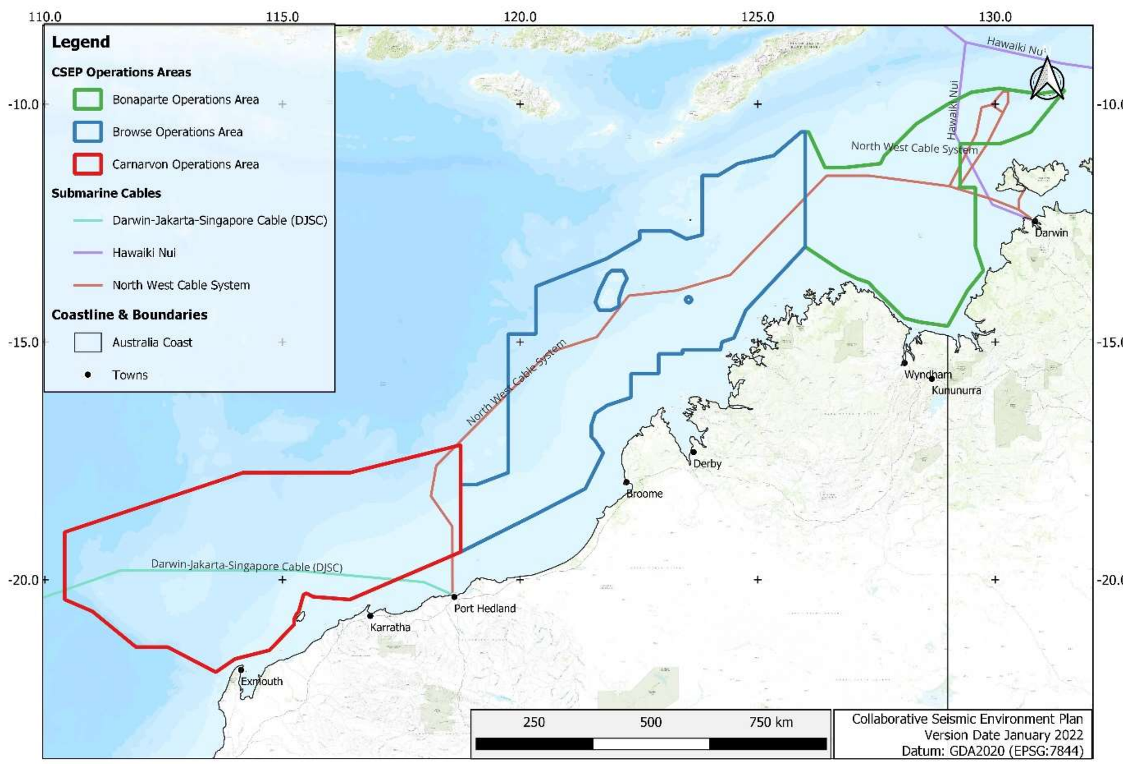


Figure 5-47: Subsea cables within the CSEP OA

Table 5-19: Description of Subsea telecommunications cables within the CSEP EMBA

Cable Name	Description (Submarine Cable Networks 20210)
Australia-Singapore Cable (ASC)	A 4,600 km submarine cable system linking Perth, Australia and Singapore, through the Sunda Strait in Indonesia.
BALOK	A 60 km cable connecting Bali and Lombok.
Darwin-Jakarta-Singapore Cable	The JASURAUS submarine cable system (also known as APCN Australian Extension) connects Australia (Port Hedland) with Indonesia (Jakarta), with total cable length of 2,800 km.
Hawaiki Nui Cable	Spatial division multiplexing cable linking South-East Asia, Australasia and North America.
INDIGO-West	A 9,200 km cable consisting of two distinct cable projects, Indigo West is 4,600 km connecting Singapore to Perth via Jakarta and Indigo Central is 4,600 km connecting Perth to Sydney.
Indonesia Global Gateway (IGG) System	A 5,169 km cable connecting the cities of Dumai, Batam, Jakarta, Madura, Bali, Makassar, Bilikpapan, Takaran and Manado with Singapore.
JaKa2LaDeMa	A 1,800 km cable that links the five Indonesian islands of Kalimantan, Sulawesi, Java, Bali, and Lombok.
Java Bali Cable System (JBCS)	A 27 km cable and the first segment of Phase 1 of the Ultimate Java Backbone Project, connecting Jawa – Bali via Muncar – Candi Kesuma.
Link 1 Phase-2; Link 2 Phase-2; Link 3 Phase-1	A 94 km connecting various Indonesia islands including Bali and Lombok.
Mataram Kupang Cable System (MKCS)	A 1,300 km cable connecting five islands in eastern Indonesia.
North West Cable System	A subsea telecommunications network and resources industry cable with a total length of 2,000 km spanning Port Hedland and Darwin.
Palapa Ring East	Approximately 13,000 km cable connecting 35 districts/ cities in East Nusa Tenggara, Maluku, Papua and West Papua.
SeaMeWe-3	A submarine cable linking 39 cable landing stations in 33 countries and 4 continents, including a Singapore to Australia section. The cables the longest submarine cable system in the world with a total length of 39,000 km.

5.7.7 Defence activities

Commonwealth land and water are matters of national environment significance under the EPBC Act. There are various defence areas around Australia that operate within the marine and coastal environment. The following defence areas and activities overlap the CSEP EMBA and are shown in Figure 5-48.

- Northern Australia Exercise Area (NAEA), a military exercise area incorporates an offshore area extending from the Northern Territory coast. The NAEA is mainly utilised for activities associated with border protection including surveillance, illegal immigration, and illegal fishing. Consultation with the Department of Defence has indicated that unexploded ordnance may be present on and in the seafloor.

- Royal Australian Air Force (RAAF) base in Darwin has offshore training areas and air to air weapons ranges.
- RAAF Base Curtin, located in Derby, also has an air-to-air weapons range.
- Royal Australian Air Force Base Learmonth - located near Ningaloo Marine Park at Exmouth.

The CSEP OA only overlaps the offshore practice and trainings area of Darwin and Exmouth (in Figure 5-48).

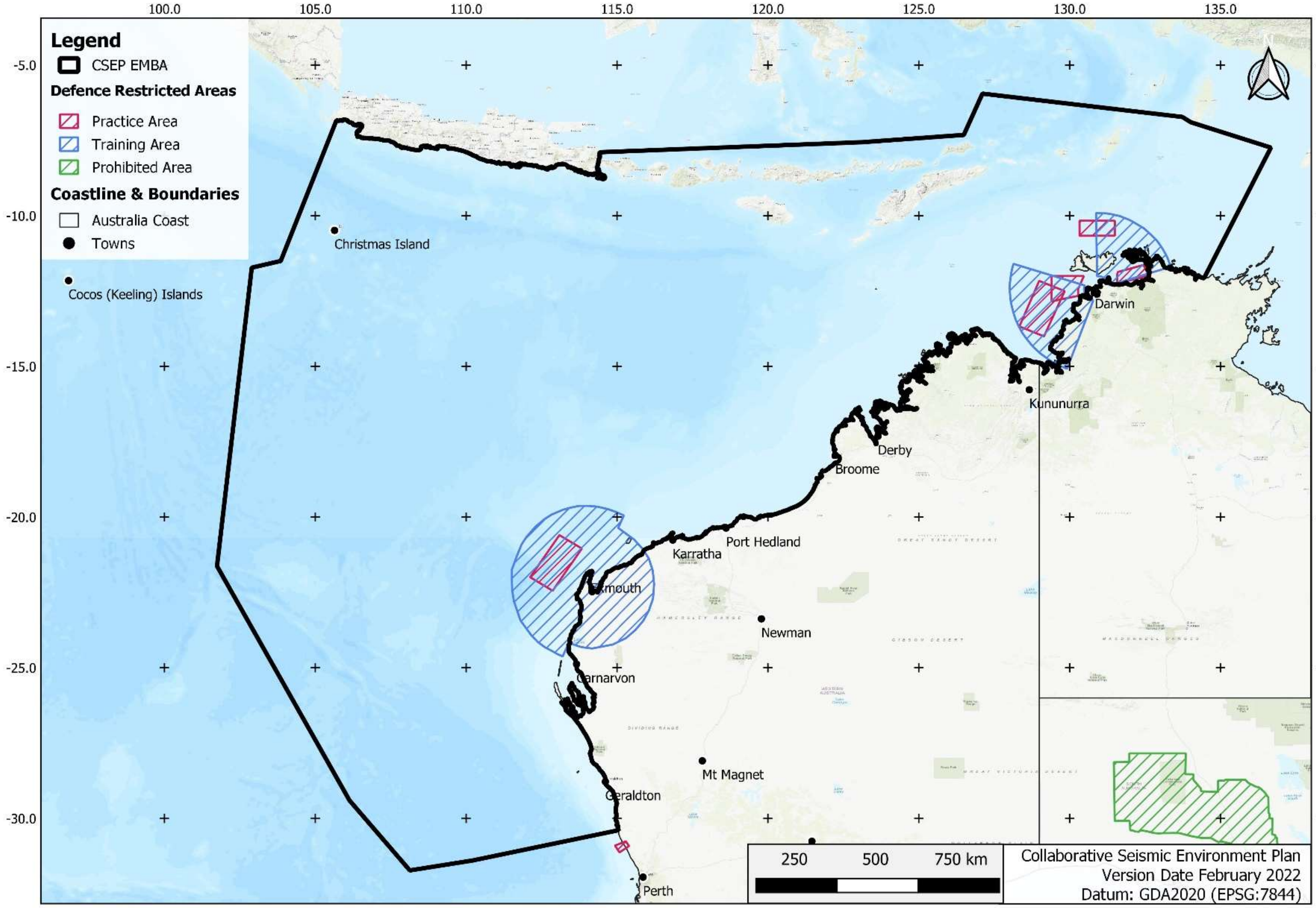


Figure 5-48: Defence Areas within the CSEP EMBA

5.7.8 Diving Activity

Diving within Australian waters is undertaken for:

- Commercial operations - inspection, repair and maintenance services for the oil and gas, shipping, defence and marine infrastructure industries.
- Fishing – pearl oyster, bêche-de-mer (sea cucumber) and specimen shell.
- Research – scientific studies.
- Recreational – training and leisure scuba diving.

Commercial

Commercial diving activities are most likely to occur within the vicinity of subsea oil and gas installations (see Oil and Gas Activities Section 5.7.4) and major coastal developments such as ports (see Shipping Section 5.7.1).

Fishing (Pearling, Bêche-de-mer and Specimen Shell)

The Western Australian pearl oyster fishery is the only remaining significant wild-stock fishery for pearl oysters in the world. It is a quota-based, dive fishery, operating in shallow coastal waters along the north coast bioregion and targets the silver lipped pearl oyster (*Pinctada maxima*) (Hart et al. 2018).

Section 5.8.2.8 details that the nearest pearl diving activities to the CSEP OA based on 2016 - 2020 DPIRD FishCube data occurred over 25 km south of the Carnarvon and Browse OAs in waters between Port Hedland and Broome between 2014 and 2016 (Figure 5-63).

The WA Sea Cucumber fishery (Bêche-de-mer) is a commercial only fishery, with animals caught principally by diving. Fishing occurs from Exmouth Gulf to the Northern Territory border (Hart et al. 2017b). FishCube data (2016 to 20200 details no activity since January 2019. The current FishCube data using 10x10 blocks shows three blocks overlap the CSEP OA (Figure 5-49), however this is due to the size of the blocks as the previous 5x5 blocks did not overlap the CSEP OA and there has been no catch in the fishery in 2020.

As detailed in Section 5.8.2.13, there diving occurs in the Specimen Shell Fishery outside of the CSEP OA.

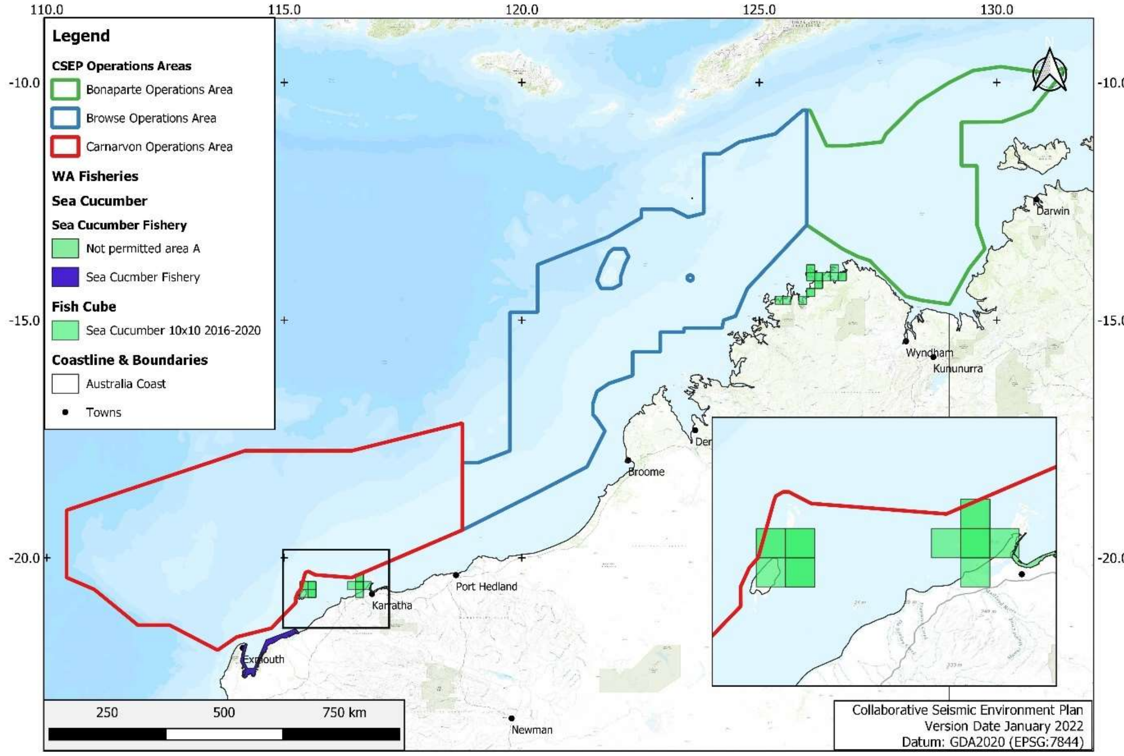


Figure 5-49: CSEP OA overlap with WA Sea Cucumber Fishery

Research

Isolation and the associated difficulties with conducting research in offshore areas covered by the CSEP EMBA due to the presence of saltwater crocodiles and sharks in the region makes research that requires diving particularly risky. However, intermittent research conducted by divers may occur in offshore locations such as:

- Ashmore Reef
- Barrow Island
- Ningaloo Reef
- Rowley Shoals
- Scott Reef

Research diving is likely to be limited to depths of <18 m.

Recreational

The following are popular dive sites in the CSEP EMBA:

- Ashmore Reef
- Cartier Island
- Dampier Archipelago
- Mackerel Islands
- Montebello Islands
- Muiron Islands
- Navy Pier in Exmouth

- Ningaloo reef
- Rowley Shoals

Recreational diving is generally restricted to water depths <40 m, which is the prescribed depth limit for recreational divers (World Recreational Scuba Training Council 2020.

Charter boat operators in the region generally do not offer bluewater diving tours (i.e., depths >40 m) and the maximum dive depths of 40 m is limited to exceptionally experienced divers. The majority of the Bonaparte Gulf is a very isolated area with very few population centres and only limited access to the coast and does not contain features targeted by dive charter vessels. In addition, recreational scuba diving and snorkelling is very unlikely due to the large tides (up to 7 m) which ebb and flood across a shallow muddy seafloor resulting in low visibility.

5.8 Commercial Fisheries

Figure 5-50 details the commercial fisheries screening process undertaken to identify commercial fishery values and sensitivities. The screening process is used to identify fisheries and stock that may be affected by the activity and licence holders who would be relevant stakeholders. The following sections detail the information used to determine if a commercial fishery may be affected by the activity.

Information on the commercial fisheries that fish or may fish within the CSEP OAs is provided in Sections 5.8.1, 5.8.2 and 5.8.3. Information on the commercial fisheries targeted species is provided in Section 5.8.4.

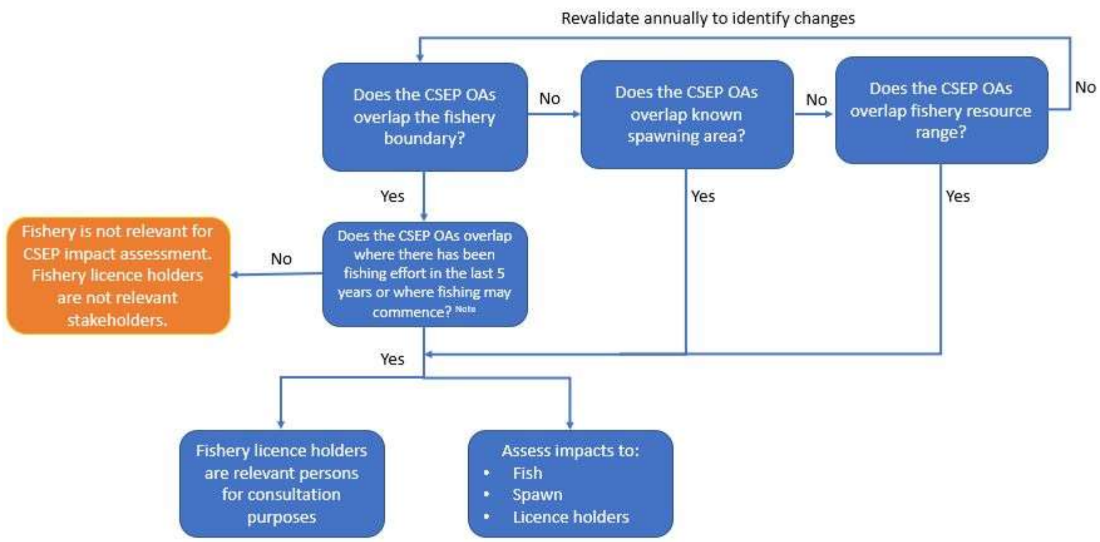


Figure 5-50: Commercial Fisheries CSEP Screening Process

5.8.1 Commonwealth Fisheries

The Australian Fisheries Management Authority (AFMA) manages Australian fisheries on behalf of the Commonwealth Government from 3 nm to the edge of the Australian fishing Zone (AFZ). AFMA carry out objectives that are listed in the *Fisheries Administration Act 1991* and the *Fisheries Management Act 1991.*

To identify Commonwealth commercial fishing activities and resources that may be affected by the activity the following was undertaken:

- Review of ABARES Fisheries Status Report 2021 (Patterson et al. 2021)
- Analysis of ABARES Fishery Status Reports Map Data (https://www.awe.gov.au/abares/research-topics/fisheries/fishery-status/fsr-map-data)
- Engagement with AFMA and fishing industry associations.

This information was used to identify those Commonwealth fisheries that fish within the CSEP OAs.

The CSEP OAs overlap the following Commonwealth fisheries:

- Northern Prawn Fishery
- North West Slope Trawl Fishery
- Southern Bluefin Tuna Fishery
- Western Deepwater Trawl Fishery
- Western Skipjack Fishery - no fishing effort since the 2008-09
- Western Tuna and Billfish Fishery

However, based on the ABARES Fishery Status Reports Map Data 2010 – 2020 only the following have fished within the CSEP OA:

- Northern Prawn Fishery
- North West Slope Trawl Fishery
- Western Deepwater Trawl Fishery

Via consultation it was identified that a fisher within the Western Tuna and Billfish Fishery may commence fishing within the Carnarvon OA.

There has been no fishing effort in the Western Skipjack Fishery since the 2008-09 fishing season (ABARES 2021) and consultation with AFMA did not identify that this would change within the 5-year period of the CSEP. Thus, information is not provided on this fishery in the following sections.

5.8.1.1 Northern Prawn Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	CSEP Operational Area Presence
The Northern Prawn Fishery (NPF) extends from Joseph Bonaparte Gulf across the top end to the Gulf of Carpentaria, out to the Australian Fishing Zone limit.	Otter trawl	• Red-legged banana prawn (*Fenneropenaeus indicus)* • White banana prawn (*Fenneropenaeus merguiensis)* • Brown tiger prawn (*Penaeus esculentus*) • Grooved tiger prawn (*Penaeus semisulcatus*) • Blue endeavour prawn (*Metapenaeus endeavouri*) • Red endeavour prawn (*Metapenaeus ensis*)	The NPF has two seasons: a predominantly banana prawn season that runs from 1 April to 15 June and a longer tiger prawn season that runs from 1 August to 30 November. White banana prawn is mainly caught during the day on the eastern side of the Gulf of Carpentaria, whereas red-legged banana prawn is caught during both day and night, mainly in Joseph Bonaparte Gulf. Most tiger prawn catches come from the southern and western Gulf of Carpentaria, and along the Arnhem Land coast. Tiger prawn fishing grounds may be close to those of banana prawns, but the highest catches come from areas near coastal seagrass beds, the nursery habitat for tiger prawns. In 2020 there were 52 vessels active in the fishery, through 52 fishing permits, the same as the 2019 season. Current levels of effort are around 8,000 days. Total NPF catch in 2020 was 4,767 t (down from 8,581 t in 2019) comprising 4,653 t of prawns and 114 t of by-product species (predominantly squid, bugs and scampi). White banana prawn and of tiger prawn (brown and grooved) account for around 80% of the landed catch.	Fishing effort for the NPF occurs within the Bonaparte OA within the Joseph Bonaparte Gulf (Figure 5-51). The NPF area is 794,790 km^2 (Table 5-20 and Figure 5-51). Based on the ABARES Fishery Status Reports Map Data, 65 x 60 nm^2 blocks were fished in the 2016 - 2020 seasons, totalling a maximum area of 602,580 km^2 (Table 5-20). Of the 65 x 60 nm^2 blocks fished in the 2016 - 2020 seasons 15 blocks overlap the Bonaparte OA, totalling 102,371 km^2, or 17% (Table 5-20). Relative fishing intensity in the areas overlapped by the Bonaparte OA during the 2016 - 2020 seasons was generally low (<0.1 days per km^2), with some medium (0.1-0.25 days per km^2) and high (0.25-0.7 days per km^2) levels seen in the area near the north-west side of the Joseph Bonaparte Gulf (Figure 5-51). That area has been fished annually in the 5 year historical analysis period. The highest effort intensity levels are in the coastal areas in the Gulf of Carpentaria outside of the CSEP OAs (Figure 5-51).

Table 5-20: CSEP OA overlap with Northern Prawn Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Northern Prawn Fishery	Fishery	-	794,790	794,790	65	60	602,580	-	-	102,371	102,371	0%	0%	17%	17%

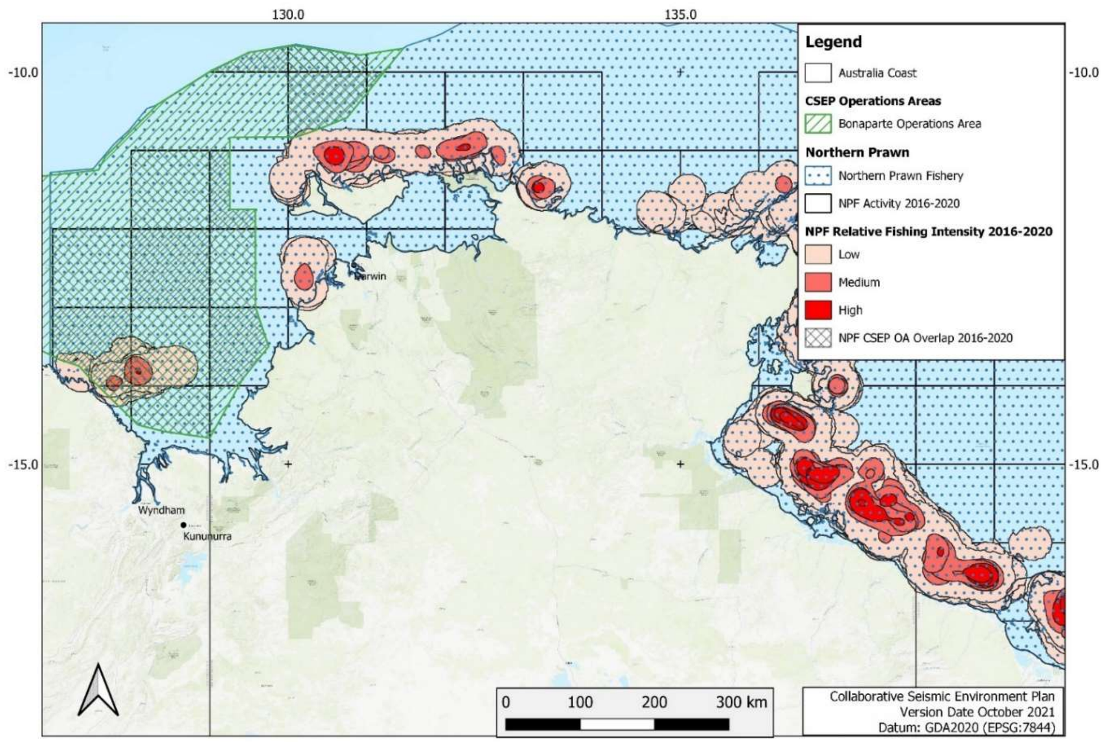


Figure 5-51: CSEP OA overlap with Northern Prawn Fishery

5.8.1.2 North West Slope Trawl

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The North-West Slope Trawl (NWST) Fishery is from the coast of the Prince Regent National Park to Exmouth between the 200 m depth contour to the outer limit of the Australian Fishing Zone.	Deep water demersal trawling	• Australian scampi (*Metanephrops australiensis)* • Smaller quantities of velvet scampi (*M. velutinus*) and Boschma's scampi (*M. boschmai)* are also harvested. • Mixed deep-water snappers are also a component of the catch	Fishing occurs on the continental slope in water depths greater than 200 m. Fishing effort has typically occurred along the slope offshore from the Pilbara region, in the Rowley Shoals area and north-east towards and around Scott Reef. Fishing occurs year-round. Historically, the number of vessels involved in the fishery has been one or two vessels each year since 2008/2009, increasing to four vessels in the 2017/18 and 2018/19 seasons and six vessels in the 2019/20 season. The primary landing ports are Point Samson in WA and Darwin in the NT. Total catch in 2019–20 was 111.5 t, up from 67.4 t in 2018–19. Scampi made up approximately 65% of the total catch in 2019–20, with the rest made up of various finfish and other crustaceans Fishing effort was 151 days in 2018-19 and 306 days in 2019-20.	Fishing effort for the NWST Fishery occurs throughout the Carnarvon and Browse OAs in water depths greater than 200 m (Figure 5-52). The NWST fishery area is 393,967 km^2 (Table 5-21 and Figure 5-52). Based on the ABARES Fishery Status Reports Map Data, 23 x 60 nm^2 blocks were fished in the 2016 - 2020 seasons, totalling 205,991 km^2 (Table 5-21). The CSEP OA overlaps 72.5% of the fished area, with 34.5% (71,159 km^2) in the Carnarvon OA and 38% (78,263 km^2) in the Browse OA. Target species occur throughout the deeper waters of the CSEP OA, although they are most common on Globigerina ooze (deep sea muds rich in the shells of planktonic organisms) at depths of 420 – 500 m.

Table 5-21: CSEP OA overlap with North West Slope Trawl Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
North-West Slope Trawl	Fishery	-	393,967	393,976	23	60	205,991	71,159	78,263	-	149,422	34.5%	38%	-	72.5%

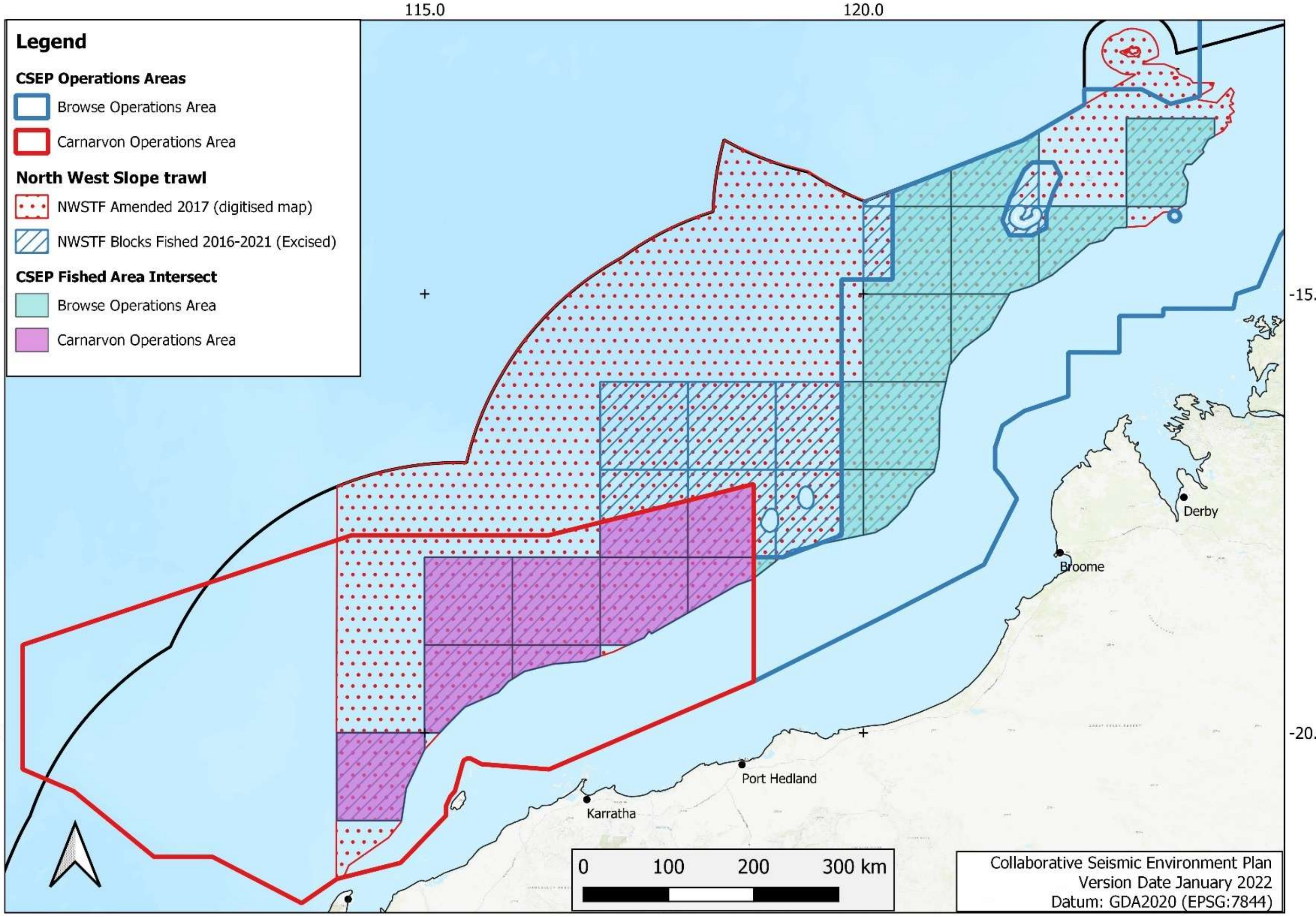


Figure 5-52: CSEP OA overlap with North West Slope Trawl Fishery

5.8.1.3 Southern Bluefin Tuna Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Southern Bluefin Tuna (SBT) Fishery includes all waters in the Australian Fishing Zone. Young fish move from spawning grounds in the north-east Indian Ocean into the Australian EEZ and southward along the WA coast.	Purse seine Pelagic longline	Southern bluefin tuna	Most of the Australian catch has been taken by purse seine, targeting juvenile tuna in the Great Australian Bight. Australian domestic longliners operating along the east coast catch some tuna and recreational fishing has increased in recent years.	There is no recent (5 year) historical overlap of the SBT Fishing activities with the CSEP OA, with all effort concentrated on the southern and eastern Australia offshore areas (Figure 5-53 and Table 5-22). The CSEP OA does intersect the SBT spawning grounds in the north-east Indian Ocean (Figure 5-53). This spawning area covers approximately 1.9 million km^2. The CSEP OA overlaps the spawning grounds by ~11.5% (218,700 km^2) although the actual size of the spawning area is somewhat arbitrary. Juvenile target species may occur in the CSEP OA from time to time during movement from the spawning grounds to the Great Australian Bight.

Table 5-22: CSEP OA overlap with Southern Bluefin Tuna Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Southern Bluefin Tuna	Fishery	-	7,879,655	7,879,655	101	60	960,342	-	-	-	-	-	-	-	-

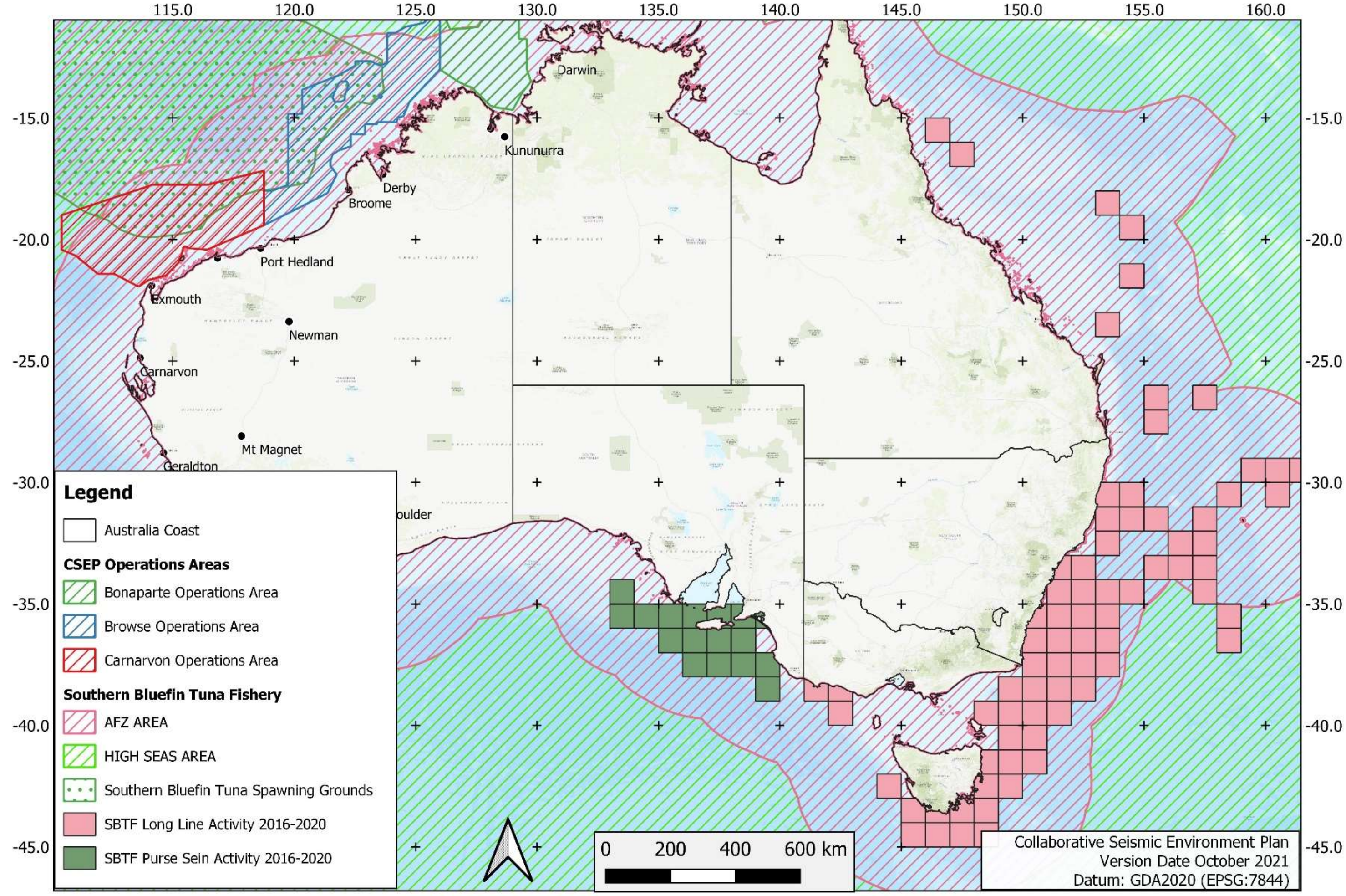


Figure 5-53: CSEP OA overlap with Southern Bluefin Tuna Fishery

5.8.1.4 Western Deepwater Trawl Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Western Deepwater Trawl Fishery (WDTF) operates off the coast of WA between the western boundary of the Southern and Eastern Scalefish and Shark Fishery in the south and the western boundary of the North West Slope Trawl Fishery in the north.	Demersal trawl	• Deepwater bugs *(Ibacus spp.)* • Ruby snapper (*Etelis carbunculus, Etelis spp.)*	In 2019–20, 31 t of catch was landed in the WDTF, down from 53 t in 2018–19. Deepwater bugs made up 26% of the 2019–20 catch (0% in 2018–19), while ruby snapper made up a further 25% (40% in 2018–19). Other species that contributed to the catch in 2019–20 were amberjack and rosy snapper. The number of vessels active in the fishery and total hours trawled have been variable but relatively low since 2005–06. In 2019–20, 524 trawl-hours were recorded in the fishery, down from a recent peak of 1,108 in 2017–18. No activity was recorded in the fishery in 2015 or 2016. There has been 1–3 active vessels in the fishery since 2004–05.	The boundary of the fishery has recently been changed to align more closely with the 200 m isobath. Effort in recent years has been localised in the area offshore and slightly south of Shark Bay in Western Australia. The WDTF area is 820,528 km^2 fishery (Table 5-23 and Figure 5-54). Based on the ABARES 2021 Fishery Status Reports Map Sata, 11 x 60 nm^2 blocks were fished in the 2016 - 2020 seasons, totalling 73,714 km^2 (Table 5-23). The Carnarvon OA overlaps 15% of the fished area.

Table 5-23: CSEP OA overlap with Western Deepwater Trawl Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Western Deepwater Trawl Fishery	Fishery	-	820,528	820,528	11	60	73,174	10,904	-	-	10,904	15%	-	-	15%

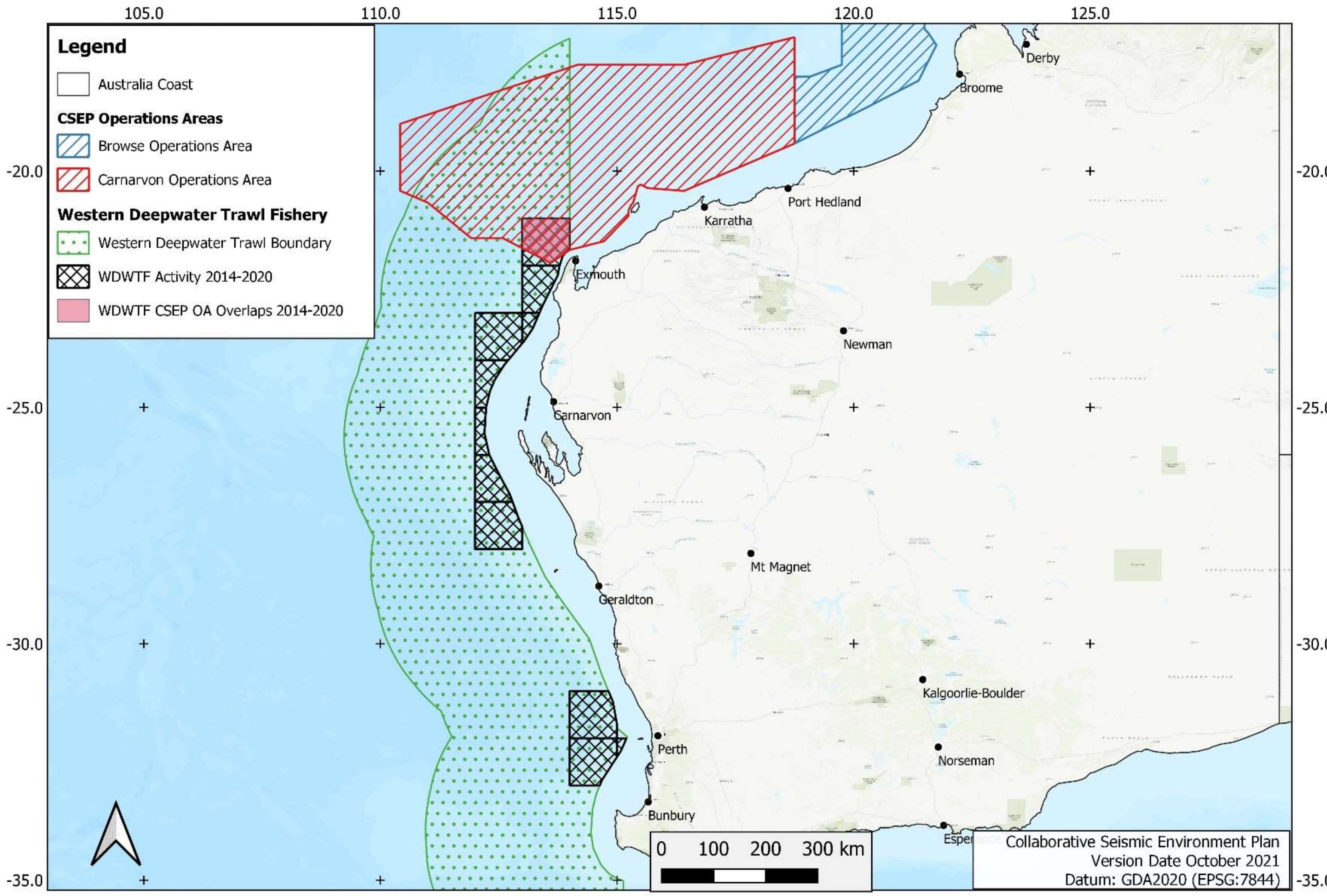


Figure 5-54: CSEP OA overlap with Western Deepwater Trawl Fishery

5.8.1.5 Western Tuna and Billfish Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Western Tuna and Billfish Fishery (WTBF) covers the sea area west from the tip of Cape York in Queensland, around WA, to the border between Victoria and South Australia.	Primarily pelagic longline. Minor line (including handline, troll, rod and reel) and purse seine are also used.	• Bigeye tuna • Yellowfin tuna • Broadbill swordfish • Striped marlin • Albacore tuna	Fishing occurs in both the Australian Fishing Zone and adjacent high seas of the Indian Ocean. Fishing occurs year-round. Pelagic longline vessels account for around 97% of catch volume. In recent years, fishing effort has concentrated off south-west Western Australia and South Australia. Between 2014 and 2018, fishing effort has consistently focussed on waters west of Carnarvon and to the south off south-west WA.	Based on the ABARES 2021 Fisheries Status Report Map Data for the WTBF fishery there has been no fishing effort within the CSEP OA in the last 5 years (Figure 5-55 and Table 5-24. Via consultation it was identified that a fisher within the Western Tuna and Billfish Fishery may commence fishing within the Carnarvon Basin.

Table 5-24: CSEP OA overlap with Western Tuna and Billfish Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Western Tuna and Billfish	Fishery	-	2,463,447	2,463,447	75	60	767,886	-	-	-	-	-	-	-	-

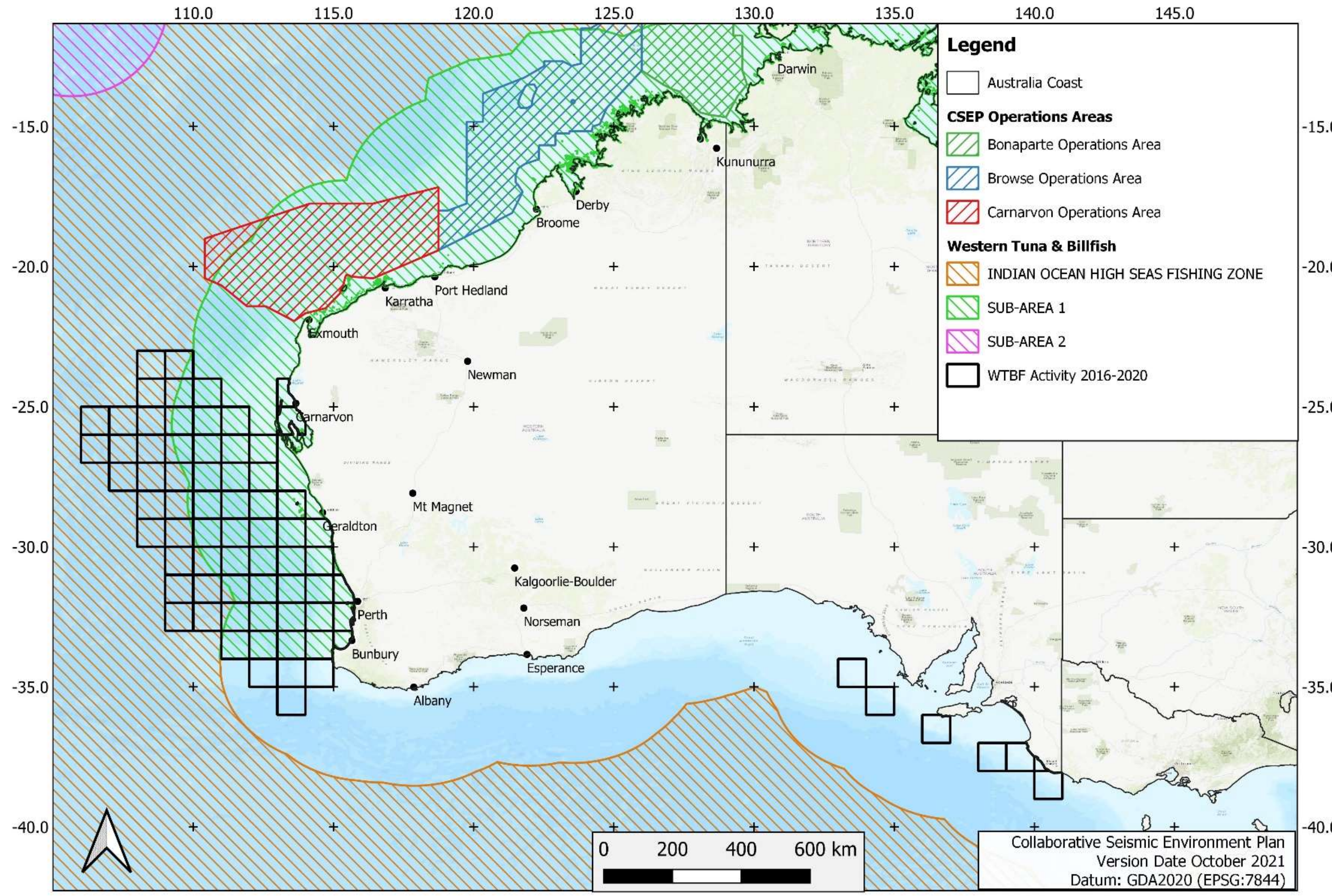


Figure 5-55: CSEP OA overlap with Western Tuna and Billfish Fishery

5.8.2 Western Australian Fisheries

The Department of Primary Industries and Regional Development (DPIRD) manage fisheries that take place predominantly within the offshore waters of Western Australia and within 3 nm of the coastline.

To identify Western Australian (WA) commercial fishing activities and resources that may be affected by the activity the following was undertaken:

- Review of DPRID Status Reports of the Fisheries and Aquatic Resources of Western Australia 2019/20 (Gaughan and Santoro 2021).
- Analysis of DPIRD FishCube Data 2016 – 2020.
- Engagement with DPIRD and WA Fishing Industry Council (WAFIC).

This information was used to identify those fisheries that fish and/or have spawning areas within the CSEP OAs.

The CSEP OAs overlap the following WA fisheries:

- Broome Prawn Managed Fishery
- Kimberley Prawn Managed Fishery
- Mackerel Managed Fishery
- Marine Aquarium Managed Fishery
- Nickol Bay Prawn Managed Fishery
- North Coast Shark Fishery - No fishing effort since 2008/09.
- Northern Demersal Scalefish Managed Fishery
- Onslow Prawn Managed Fishery
- Pearl Oyster Managed Fishery
- Pilbara Crab Managed Fishery
- Pilbara Fish Trawl (Interim) Managed Fishery
- Pilbara Line Fishery
- Pilbara Trap Managed Fishery
- Specimen Shell Managed Fishery
- West Coast Deep Sea Crustacean

However, based on the DPIRD FishCube Data 2016 – 2020 only the following have fished within the CSEP OA:

- Kimberley Prawn
- Mackerel Managed
- Northern Demersal Scalefish
- Pilbara Crab
- Pilbara Line

- Pilbara Fish Trawl (Interim) Managed
- Pilbara Trap Managed
- Specimen Shell Managed Fishery

5.8.2.1 Broome Prawn Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The boundaries of the Broome Prawn Managed Fishery (BPMF) are WA waters of the Indian Ocean lying east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath.	Trawl	• Banana prawns (*Penaeus merguiensis*) • Western king prawns (*Penaeus latisulcatus*). • Brown tiger prawns (*Penaeus esculentus*) • Endeavour prawns (*Metapenaeus endeavouri*)	Low fishing effort occurred in 2019 as only one boat undertook trial fishing to investigate whether catch rates were sufficient for commercial fishing. This resulted in negligible landings of western king prawns with no by product recorded.	2016 - 2020 DPIRD FishCube data shows no overlap between the fishery and the CSEP OA (Table 5-25). The closest point of the fishery to the CSEP OA is ~9 km.

Table 5-25: CSEP OA overlap with Broome Prawn Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Broome Prawn	Fishery		139,440	861	3	10	861	-	-	-	-	-	-	-	-

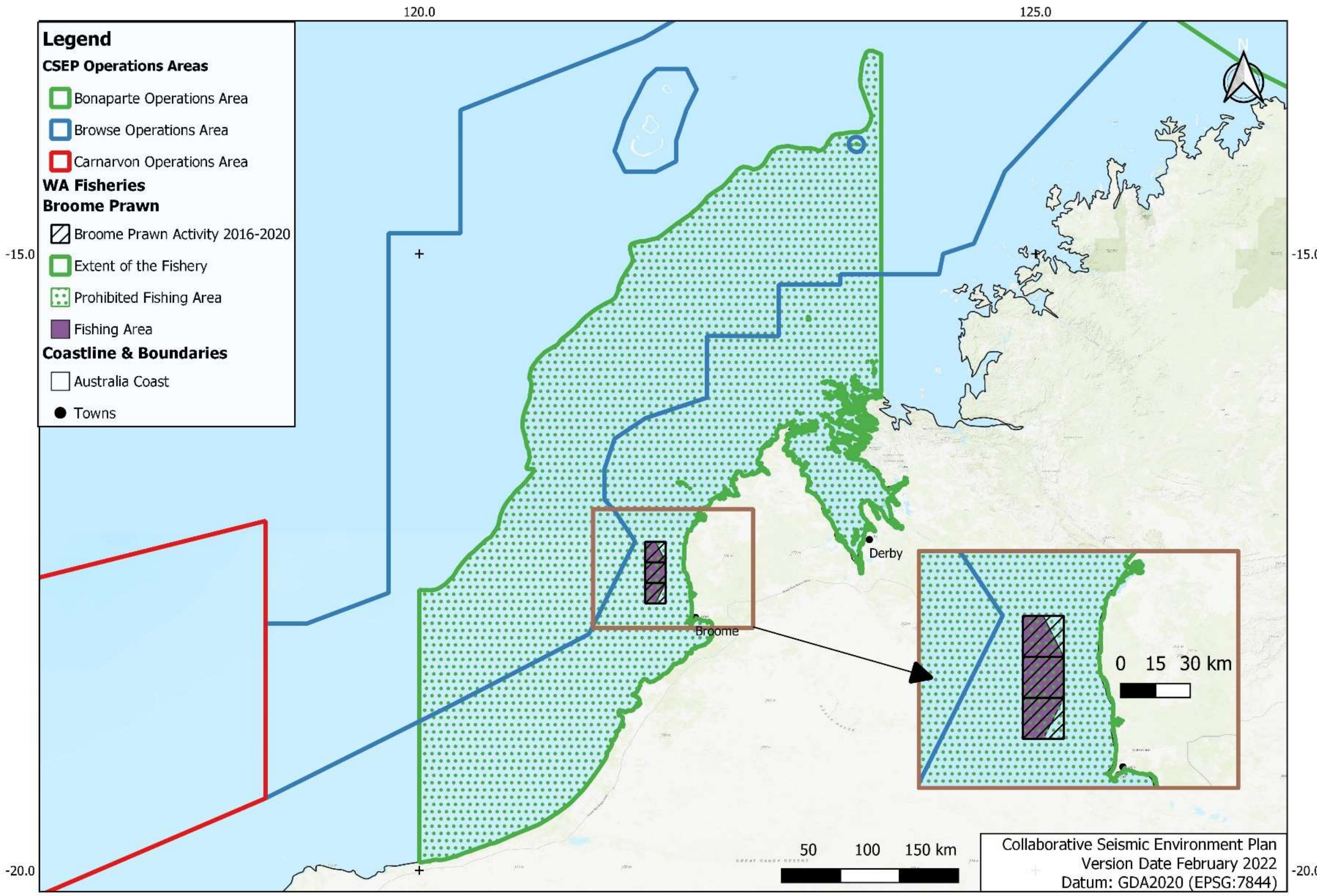


Figure 5-56: CSEP OA overlap with Broome Prawn Managed Fishery

5.8.2.2 Kimberley Prawn Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Kimberley Prawn Managed Fishery (KPMF) operates off the north of WA between Koolan Island and Cape Londonderry.	Otter trawl	• Banana prawns (*Penaeus merguiensis*) • Brown tiger prawns (*Penaeus esculentus*) • Endeavour prawns (*Metapenaeus endeavouri*) • Western king prawns (*Penaeus latisulcatus*).	The permitted fishing area of the fishery is 126,799 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 18,958 km^2, based on 10 nm^2 reporting blocks (Table 5-26 and Figure 5-56). Seasonal dates for the KPMF are generally aligned with those of the adjacent Commonwealth Northern Prawn Fishery (NPF). A significant number of vessels hold authorizations to operate in both the KPMF and the NPF. There are two fishing periods for the season (April to mid-June, then from August to the end of November) with around 90% of the total landings taken in the first fishing period. The total prawn landings in 2019 for the KPMF were 100 t which was the lowest catch on record. The catch was primarily banana prawns (97 t), with 2 t of brown tiger prawns and 1 t of blue endeavour prawns also taken. The banana prawn landings were below both the target catch range and the catch prediction.	The CSEP OA overlaps with 10% of the fished area based on 2016 - 2020 DPIRD FishCube data 10 nm^2 reporting blocks (Table 5-26 and Figure 5-56). Browse OA overlaps 55% of the permitted fishing area, while the Bonaparte OA overlaps 18%. Of the fished 10 nm^2 reporting blocks during the 2016 - 2020 period: • Browse OA overlaps 6% of the fished area. • Bonaparte OA overlaps 4% of the fished area.

Table 5-26: CSEP OA overlap with Kimberley Prawn Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Kimberley Prawn	Fishery	-	132,823	126,799	64	10	18,958	-	1,135	761	1,896	-	6%	4%	10%

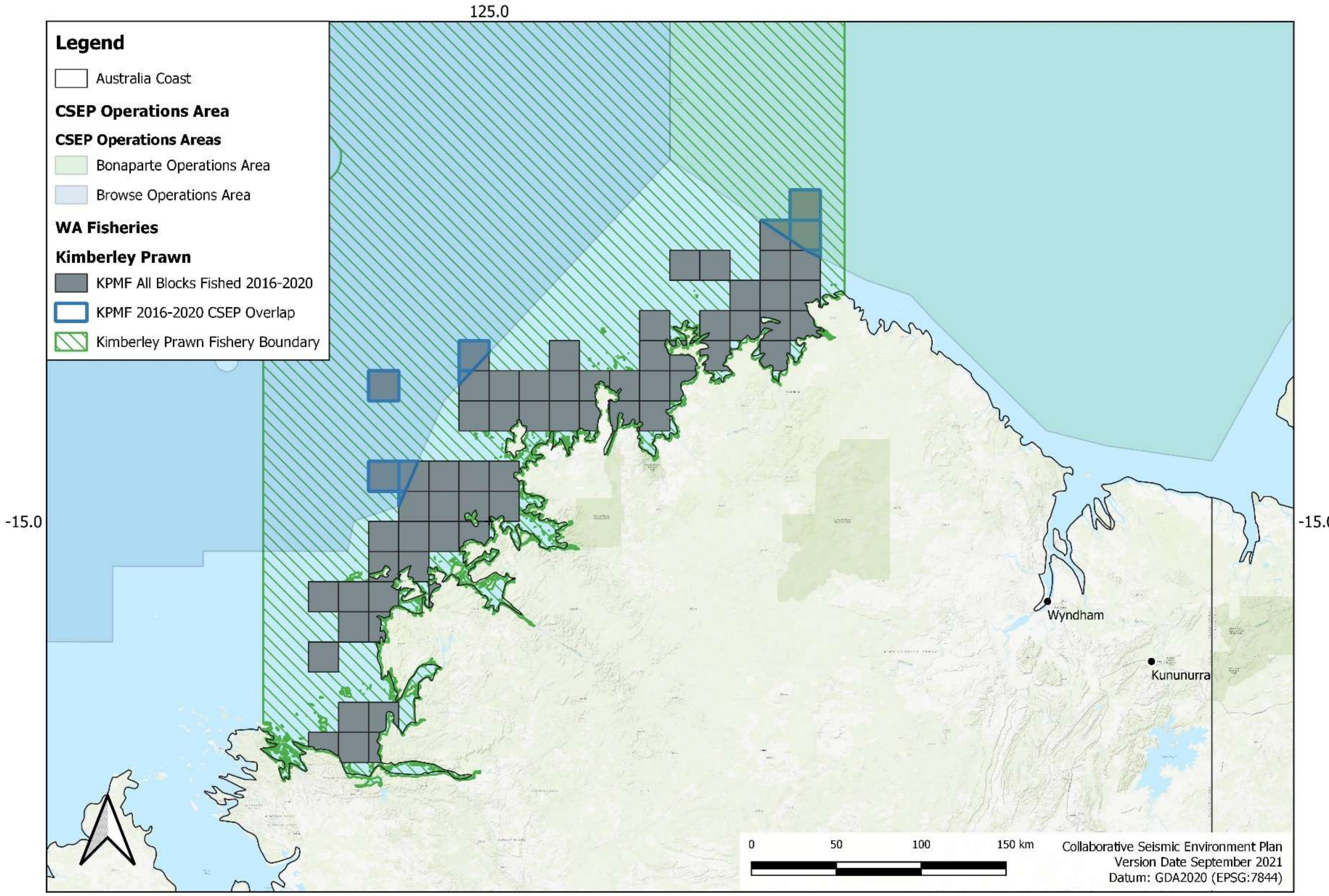


Figure 5-57: CSEP OA overlap with Kimberley Prawn Managed Fishery

5.8.2.3 Mackerel Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Mackerel Managed Fishery (MMF) extends from Cape Leeuwin in the south west of WA to the WA/NT border. Management Area 1 (Kimberley sector) extends from 121° E to the WA/NT border. Management Area 2 (Pilbara sector) extends from 114° E near the North West Cape to 121° E. Management Area 3 (Gascoyne/West Coast sector) extends south from 114° E to Cape Leeuwin.	Surface or mid-water trolling by line. Jigging methods also used.	• Spanish mackerel (*Scomberomorus commerson*) • Grey mackerel (also called broad-barred Spanish mackerel), school mackerel, spotted mackerel, shark mackerel and other pelagic species are also caught as bycatch species.	The MMF consists of three Management Areas, Area 1, Area 2, and Area 3 (Figure 5-58). The permitted fishing area of the three management areas is ~1,741,321 km^2. Table 5-27 details the breakdown by Area. FishCube data (2016-2020) shows fishing effort within an area of 88,570 km^2, based on 10 nm^2 reporting blocks (Figure 5-58). Table 5-27 details the breakdown by Area. Mackerel fishers troll for mackerel in nearshore waters. The fishery operates year-round, however, most fishing effort occurs from April/May to October/November. The MMF Management Plan includes limitations on the number of permits to fish in the MMF. There are currently 65 permits in the MMF with 23, 21 and 21 permits in Areas 1, 2 and 3 (respectively), with the combined quota allocations being consolidated onto 4, 3 and 9 boats operating within Areas 1, 2 and 3 (respectively). The main commercial catch is of Spanish mackerel which has been 270 – 330 t since quotas were introduced in 2006 and in 2019 was at 291.5 t.	The CSEP OA overlaps with 33% of the fished area based on 2016 - 2020 DPIRD FishCube data 10 nm^2 reporting blocks (Table 5-27 and Figure 5-58). Carnarvon OA overlaps 16% of the permitted fishing area, while the Browse OA overlaps 15% and Bonaparte OA 4%. Table 5-27 details the breakdown by Area. FishCube data (2016-2020) shows the CSEP OA overlaps the MMF according to the following Area breakdown: Area 1 • 38% of the fished area (Browse OA 31%, Bonaparte OA 7%). Area 2 • 30% of the fished area (Carnarvon OA 24%, Browse OA 6%). Area 3 • No overlap with the fished area. Area 3 showed 1x10nm^2 unique block fished, with the CSEP OA not overlapping that block. This single record is likely a reporting error due to the extreme distances and water depths involved.

Table 5-27: CSEP OA overlap with Mackerel Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Mackerel Managed	Fishery		1,741,321	1,741,321	280	10	88,571	10,546	15,990	2,994	29,530	12%	18%	3%	33%
	Area 1		394,943	394,943	139	10	44,042	-	13,464	2,994	16,458	-	31%	7%	38%
	Area 2		533,068	533,068	147	10	44,529	10,546	2,526	-	13,072	24%	6%	-	30%
	Area 3		813,310	813,310	-	10	-	-	-	-	-	-	-	-	-

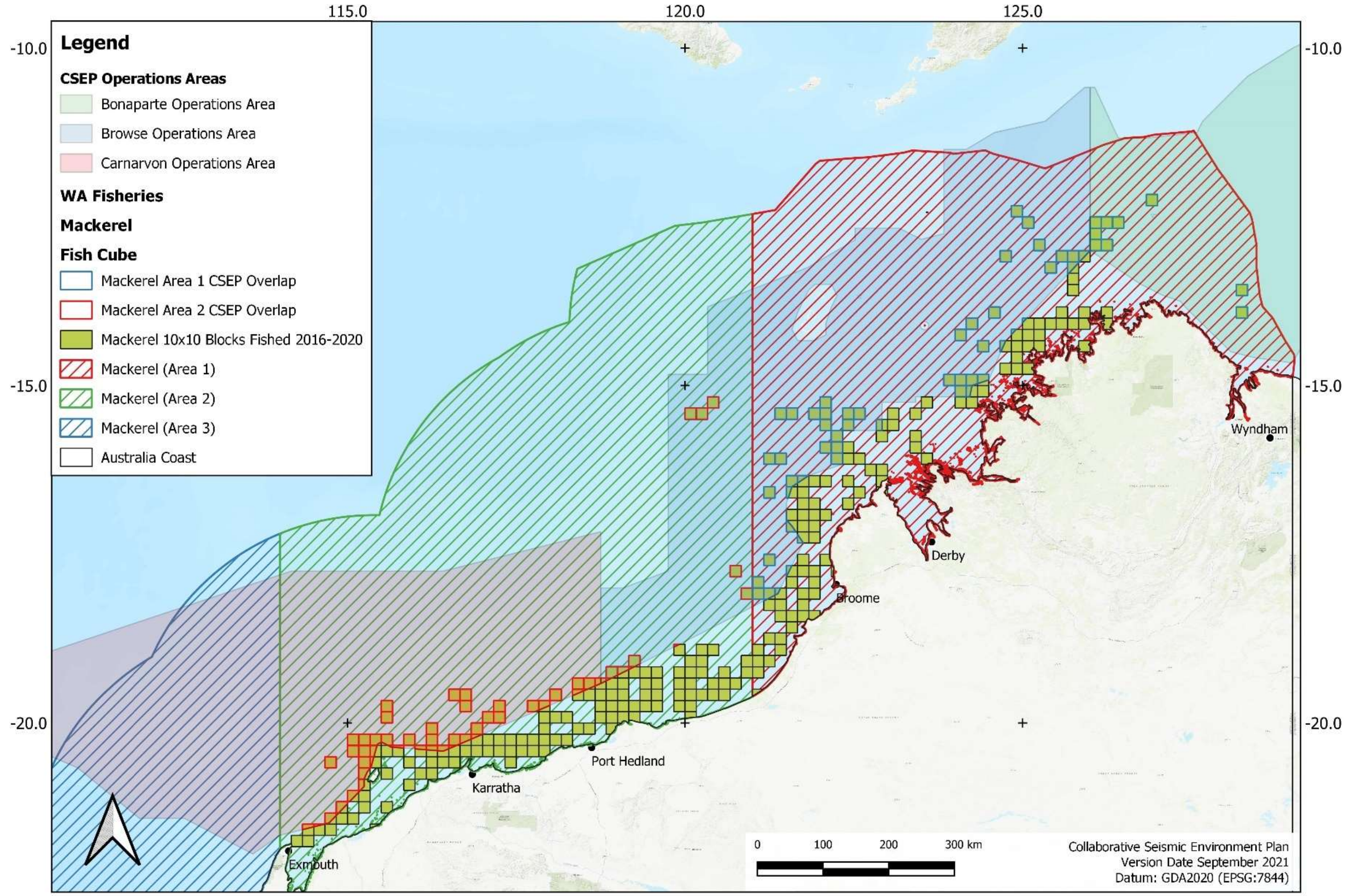


Figure 5-58: CSEP OA overlap with Mackerel Managed Fishery

5.8.2.4 Marine Aquarium Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Marine Aquarium Fish Managed Fishery (MAFMF) can operate in all State waters between the Northern Territory border and South Australian border.	Hand collection and diving	• Various species of fish, coral, algae, seagrass and invertebrates	The permitted fishing area of the fishery is 2,492,532 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 17,424 km^2, based on 10 nm^2 reporting blocks (Figure 5-59). The fishery is typically more active in waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier and Broome. The MAFMF resource potentially includes more than 1,500 species of marine aquarium fishes under the Marine Aquarium Fish Managed Fishery Management Plan 2018. Operators in the MAFMF are also permitted to take coral, live rock, algae, seagrass and invertebrates. There were ten out of the twelve licences that were active in the MAFMF in 2019. The total catch in the MAFMF in 2019 was 69,446 fishes, 36.325 t of coral, live rock & living sand and 12 L of marine plants and live feed. While the fishery can potentially operate over large areas, catches are relatively low due to the special handling requirements of live fish.	FishCube data (2016-2020) shows six 10x10 km^2 reporting blocks fished in 2020 were overlapped by the CSEP OA, with a total maximum fished area of 436.8 km^2, or 2.6% of the total fishery (Carnarvon OA 2.0%, Bonaparte 0.6%) (Table 5-28 and Figure 5-59). However, as the CSEP OA is within Commonwealth waters and the fishery can only operate in State waters these overlaps are likely to be due to the block reporting size (Figure 5-59.

Table 5-28: CSEP OA overlap with Marine Aquarium Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Marine Aquarium	Fishery		2,492,532	2,492,532	64	10	16,783	330	-	107	437	2.0%	-	0.6%	2.6%

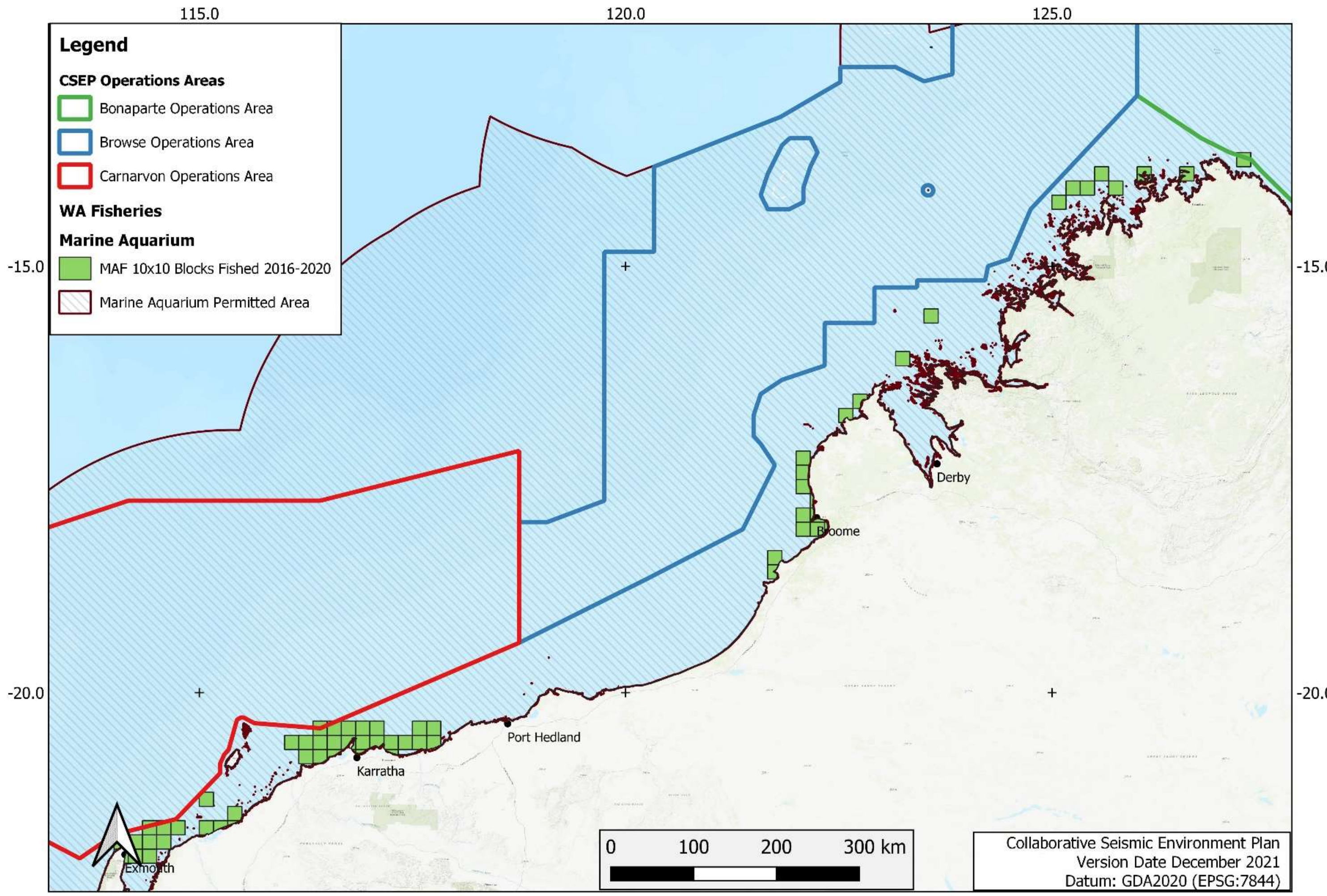


Figure 5-59: CSEP OA overlap with Marine Aquarium Managed Fishery

5.8.2.5 Nickol Bay Prawn Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The boundaries of the Nickol Bay Prawn Managed Fishery (NBPMF) are all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120°east longitude on the landward side of the 200 m isobath.	Trawl	• Banana prawns (*Penaeus merguiensis*) • Brown tiger prawns (*Penaeus esculentus*)	The four northern prawn managed fisheries (Kimberley, Broome, Nickol Bay and Onslow) all use low opening, otter prawn trawl systems High opening, otter trawl systems are also used when targeting banana prawns. Management of the north coast prawn managed fisheries is based on input controls, including limited entry, gear controls (maximum headrope units), seasonal and area openings and closures. The total landings of major penaeids for the 2019 season were 254 t. This comprised 216 t of banana prawns, which was well above the predicted range (110 – 165 t), 28 t of brown tiger prawns, 4 t of blue endeavour and 5 t western king prawns. Due to the expected higher landings of banana prawns in 2019 compared to 2018, fishing effort was greater at 353 days, compared to 284 boat days in 2018.	2016 - 2020 DPIRD FishCube data shows fished areas in the NBPMF do not intersect the CSEP OA (Figure 5-60). The nearest fishing activities occur closer to the coast with one 10 nm^2 reporting block within 2.5 km of the southern boundary of the CSEP OA logged with activity during June of 2018 (Figure 5-60). The remainder of fished reporting blocks are located >10 km from the CSEP OA (Figure 5-60). Target species may occur in the CSEP OA, but are found predominantly in shallow, turbid nearshore waters.

Table 5-29: CSEP OA overlap with Nickol Bay Prawn Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Fishery	-	-	78,930	77,290	32	10	8,528	-	-	-	-	-	-	-	-

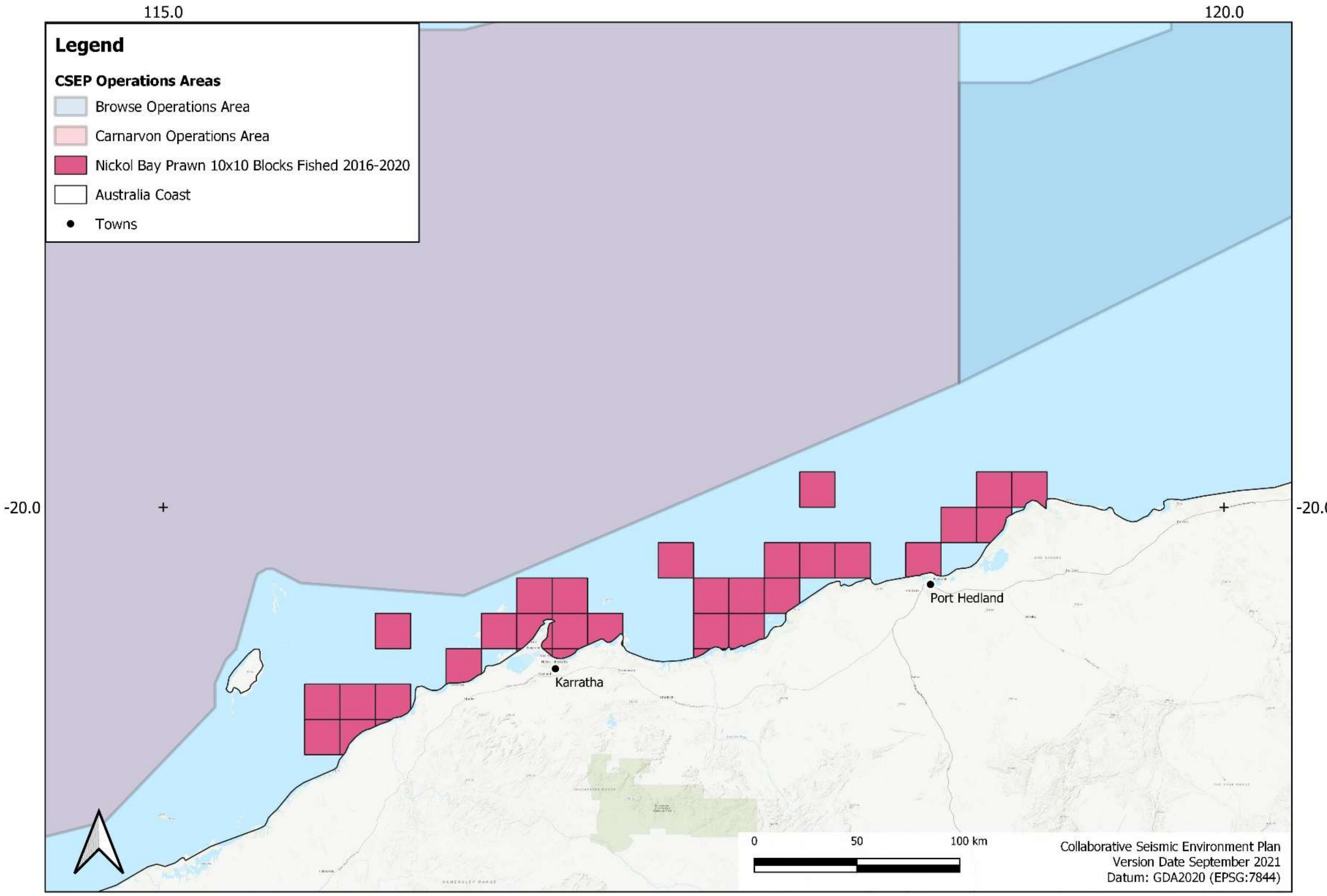


Figure 5-60: CSEP OA overlap with Nickol Bay Prawn Managed Fishery

5.8.2.6 Northern Demersal Scalefish Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Northern Demersal Scalefish Managed Fishery (NDSMF) includes waters off the north-west coast of WA in the waters east of 120° E longitude, extending from Eighty Mile Beach to the WA-NT border and out to the edge of the Australian Fishing Zone (200 nm).	Fish traps Handlines and droplines permitted	• Red emperor (*Lutjanus sebae*) • Goldband snapper (*Pristipomoides multidens*) • Other demersal snapper, emperor, cod and grouper species are also caught ▪ bluespotted emperor ▪ spangled emperor ▪ saddletail snapper • Crimson snapper and Rankin cod	The fishery is divided into two fishing areas: an inshore sector (Area 1) and an offshore sector (Area 2). Area 2 extends offshore from the 30 m depth contour and is further subdivided into Zones A, B and C. The fishery principally operates in depths of 60–150 m water. Most catch occurs in Zone B of Area 2. The permitted fishing area of the fishery is 479,124 km^2 (Figure 5-61). Table 5-30 details the breakdown by Area. FishCube data (2016 - 2020) shows fishing effort within an area of 122,983 km^2, based on 10 nm^2 reporting blocks (with mainland and island areas excised) (Figure 5-61). Table 5-30 details the breakdown by Area. Vessels in the fishery operate out of Broome and Darwin. Fishers travel long distances to fishing grounds and typically fish at multiple sites over a period of 4-10 days. Including steaming time, vessels are typically away from port for 1-2 weeks at a time. Traps are typically set for 4-5 hours or left overnight before being pulled. In 2019, total catch was 1,507 t with the majority from Zone B, with a catch of 1,313 t. Eight vessels operated in the fishery between 2013 and 2015, reducing to seven vessels 2015 and 2017 and six in the 2018 season. Six vessels also fished in the 2019 fishing season Fishing occurs year-round.	The CSEP OA overlaps with 89% of the fished area based on 2016 - 2020 DPIRD FishCube data 10 nm^2 reporting blocks (Table 5-30 and Figure 5-61). Browse OA overlaps 48% of the permitted fishing area, while the Bonaparte OA overlaps 15%. Of the fished 10 nm^2 reporting blocks during the 2016 - 2020 period: • Browse OA overlaps 82% of the fished area. • Bonaparte OA overlaps 7% of the fished area. Table 5-30 details the breakdown by Area.

Table 5-30: CSEP OA overlap with Northern Demersal Scalefish Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Northern Demersal Scalefish Managed	Fishery	-	484,811	479,124	376	10	122,983	-	100,441	8,985	109,426	-	82%	7%	89%
	Area 1	-	75,384	71,063	3	10	372	-	-	-	-	-	-	-	-
	Area 2	A	161,449	160,089	185	10	47,384	-	31,598	8,985	40,583	-	67%	19%	86%
	Area 2	B	76,912	76,912	259	10	67,100	-	63,612	-	63,612	-	95%	-	95%
	Area 2	C	171,060	171,060	60	10	8,127	-	5,231	-	5,231	-	64%	-	64%

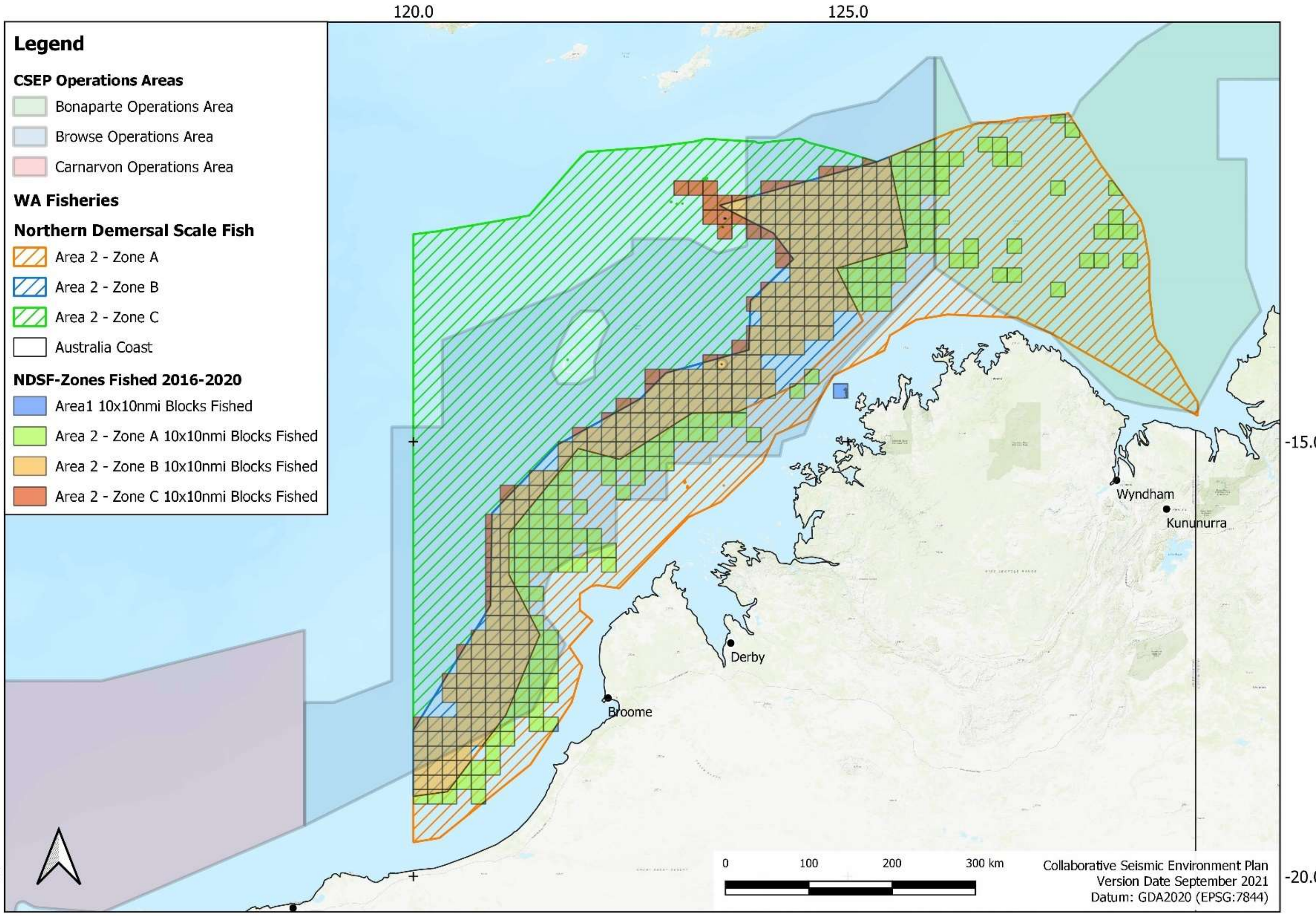


Figure 5-61: CSEP OA overlap with Northern Demersal Scalefish Managed Fishery

5.8.2.7 Onslow Prawn Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The boundaries of the Onslow Prawn Managed Fishery (OPMF) are all the WA waters between the Exmouth Prawn Fishery and the Nickol Bay Prawn Fishery east of 114°39.9' on the landward side of the 200 m depth isobath'.	Trawl	• Brown tiger prawns (*Penaeus esculentus*) • Banana prawns (*Penaeus merguiensis*)	The permitted fishing area of the fishery is 39,924 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 797 km^2, based on 10 nm^2 reporting blocks (Table 5-31). The total landings in 2019 were less than 50 t, below the target catch range. Twenty eight days of fishing effort (308 hours) was undertaken by one boat in 2019. In 2020-2022 fishing in the fishery is restricted to between April 1st through October 30th except as described otherwise in DPIRD's "*Notice of Areas Closed To Fishing For Prawns In The Onslow Prawn Managed Fishery for 2020, 2021 and 2022* ", "*Notice 1 of 2020*".	The Carnarvon OA overlaps with 1.8% of the fished area based on 2016 - 2020 DPIRD FishCube data 10 nm^2 reporting blocks (Figure 5-62 and Table 5-31).

Table 5-31: CSEP OA overlap with Onslow Prawn Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Onslow Prawn	Fishery		41,043	39,924	4	10	797	-	-	-	-	-	-	-	-
	Area 1		750	663	3	10	367	-	-	-	-	-	-	-	-
	Area 2		14,565	14,164	2	10	430	8	-	-	8	1.8%	-	-	1.8%
	Area 3		25,982	25,097	1	10	-	-	-	-	-	-	-	-	-

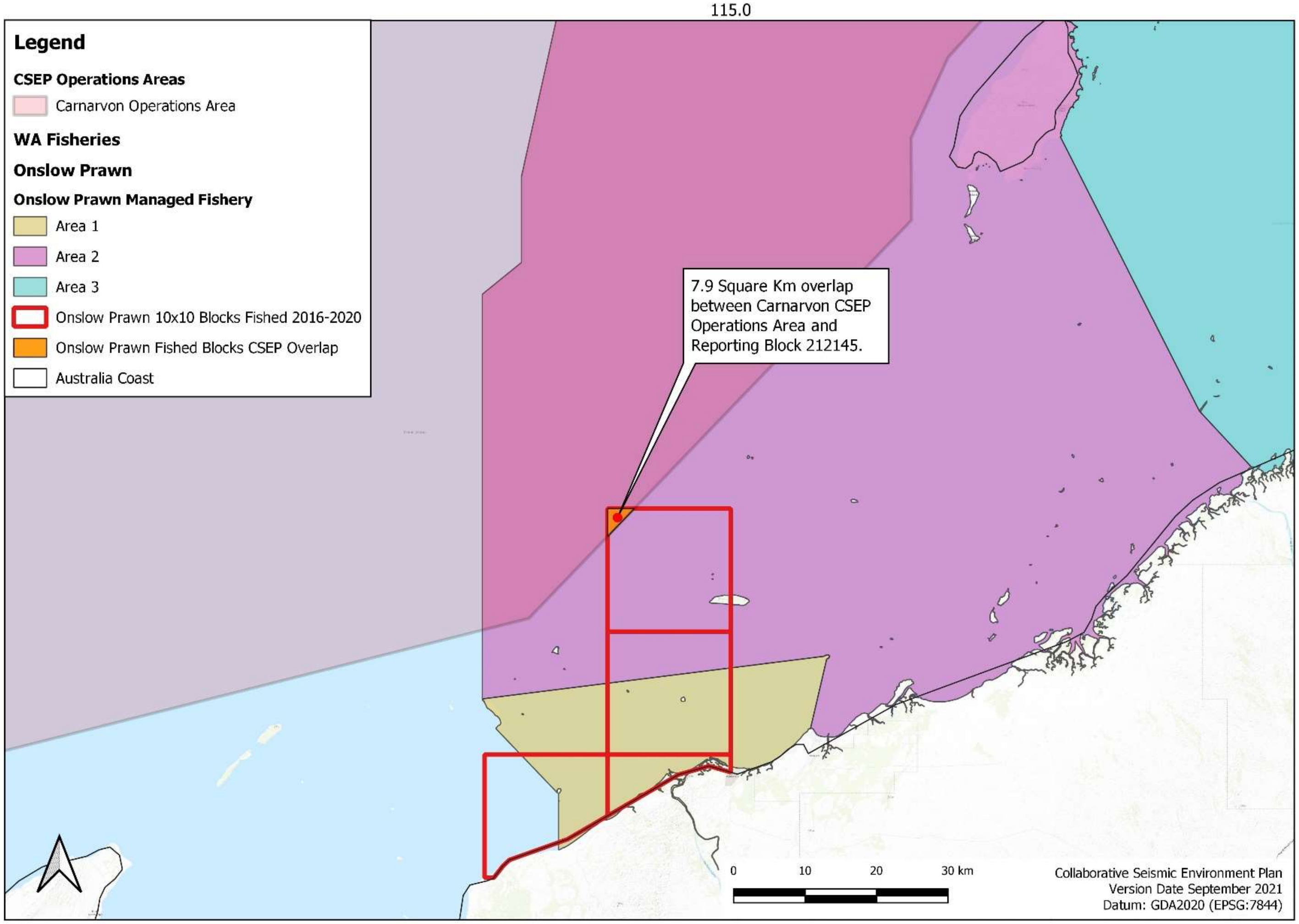


Figure 5-62: CSEP OA overlap with Onslow Prawn Managed Fishery

5.8.2.8 Pearl Oyster Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Pearl Oyster Managed Fishery (POMF) extends from 114° 10' E near Exmouth to the WA/NT border, and out to the edge of the Australian Fishing Zone (200 nm). The licence area is subdivided into four zones.	Drift diving in waters up to 35 m	• Indo-Pacific, silver-lipped pearl oysters (*Pinctada maxima*).	The licence area is subdivided into four zones: Zones 1, 2, 3 and 4 with the CSEP OA within Zones 1, 2 and 3 (Figure 5-63). The principal fishing grounds for pearl oyster collection are located off Eighty Mile Beach within water depths of ~20 m. A deeper water collection site, 'Compass Rose', lies offshore from Eighty Mile Beach in water depths of ~35 m. Holding sites are located near the fishing grounds in water depths up to 30 m (Hart et al. 2016). In 2019, catch was taken in Zone 2 with no fishing in Zones 1 or 3. The number of wild-caught pearl oysters was 611,816. Total effort was 14,022 dive hours, a decrease of 10% from the 2018 effort of 15,637 hours. No fishing has occurred in Zone 1 from 2017 to 2019 with only 4,594 culture shells taken in 2016. Collection usually commences in March/April and ceases in June/July. Seeding of the pearl oysters is undertaken during winter months (June – August). This may occur at holding sites or at pearl farms. The principal fishing grounds, holding sites and pearl farms are in waters off Eighty Mile Beach and Broome. A single approved pearl farm lease is located near North Turtle Island and pearl diving activities have previously occurred in coastal waters near Port Hedland and the De Grey River mouth. Recent Australian Institute of Marine Science (AIMS) research on pearl oyster distribution within the region	The CSEP OA overlaps Zones 1, 2 and 3 of the fishery, however, pearl collection, holding and farming activities are limited to nearshore waters (Figure 5-63). 2016 - 2020 DPIRD FishCube data shows no effort within the CSEP OA, principally due to the safety restriction of pearl diving activities to depths less than 35 m (Table 5-32 and Figure 5-63). The nearest pearl diving activities to the CSEP OA based on 2016 - 2020 DPIRD FishCube data occurred over 25 km south of the Carnarvon and Browse OAs in waters between Port Hedland and Broome between 2014 and 2016 (Figure 5-63). 2016 - 2020 DPIRD FishCube data also shows that since 2017 pearl oyster harvesting has been restricted to shallow (<30 m) waters off Eighty Mile Beach, at least 50 km from the southern boundary of the Browse OA.

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
			located just offshore from the Eighty Mile Beach indicated that "Oysters were found at depths from 28-76 metres, but very few were found deeper than 40 metres." Ref: https://northwestatlas.org/nwa/nws2s-oysters	

Table 5-32: CSEP OA overlap with Pearl Oyster Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Pearl Oyster Managed Fishery	Fishery	-	993,002	993,002	27	10	7,686	-	-	-	-	-	-	-	-
		1	374,352	374,352	3	10	966	-	-	-	-	-	-	-	-
		2	76,912	76,912	22	10	6,096	-	-	-	-	-	-	-	-
		3	427,640	427,640	5	10	1,590	-	-	-	-	-	-	-	-
		4	114,098	114,098	-	10	-	-	-	-	-	-	-	-	-

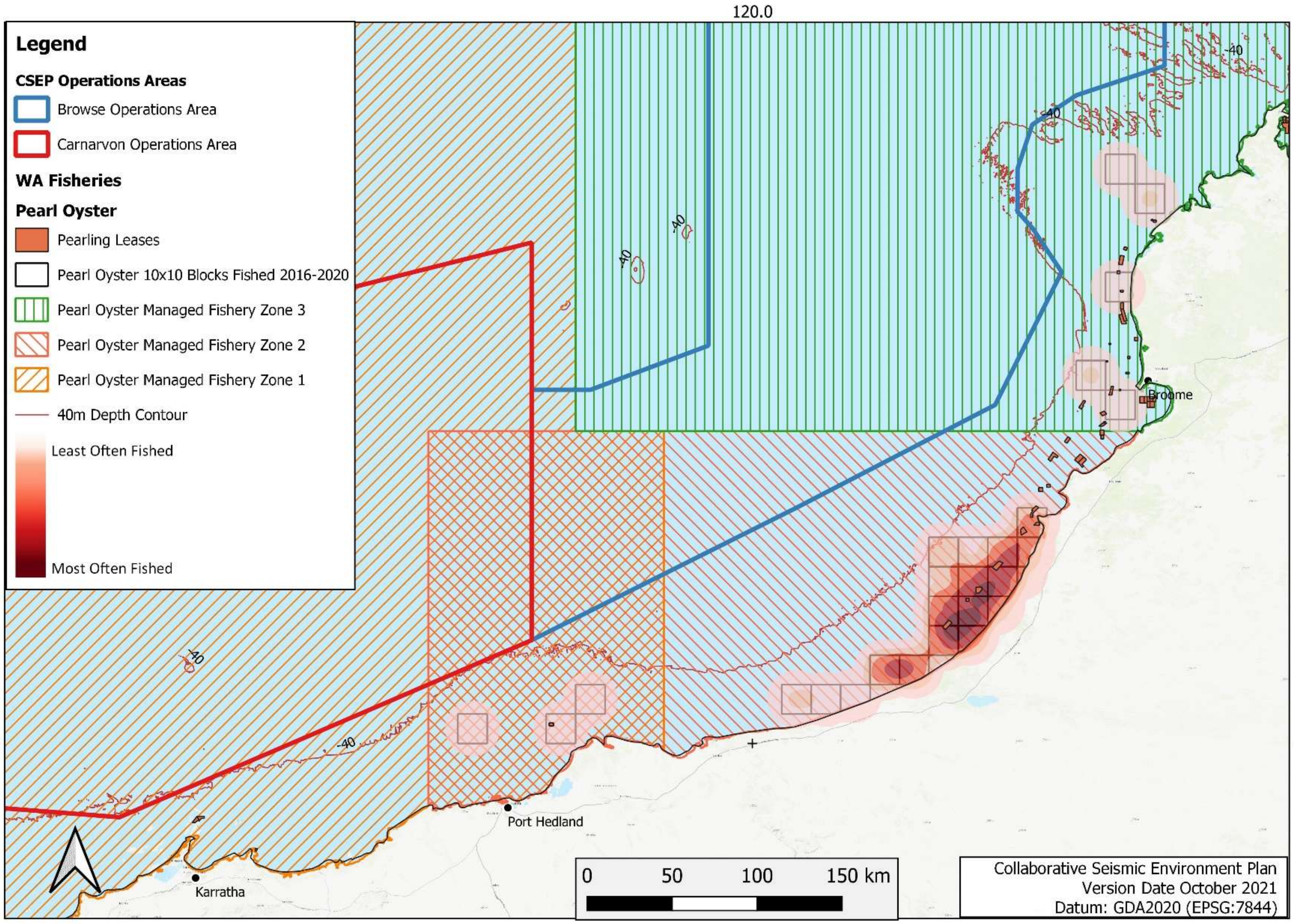


Figure 5-63: CSEP OA overlap with Pearl Oyster Managed Fishery

5.8.2.9 Pilbara Crab Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The boundaries of the Pilbara Crab Managed Fishery (PCMF) are consistent with the boundaries of the NBPMF and OPMF, which includes waters between 114°39.9' E and 120° E, and on the landward side of the 200 m depth isobath.	Traps	• Blue swimmer crab	The fishery is split into two Areas, Area A and Area B (Figure 5-64). The permitted fishing area of the fishery is 360,338 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 25,903 km^2, based on 60 nm^2 reporting blocks (Table 5-33 and Figure 5-64). Crabbing activity along the Pilbara coast is centred largely on the inshore waters from Onslow through to Port Hedland, with most commercial and recreational activity occurring in and around Nickol Bay between April and November. Blue swimmer crabs are targeted by the PCMF within inshore waters around Nickol Bay using hourglass traps. The 2019 North Coast blue swimmer crab catch of 22.1 t accounted for ~3% of the State commercial catch of 660 t for that year, with most of the catch taken from the PCMF. The PCMF is closed to fishing between August 15th and November 15th every year, unless otherwise determined by the DPIRD CEO via notices. Both designated Areas of the fishery are limited to a maximum of 300 crab traps each.	The CSEP OA overlaps the permitted fishing area of Area A by 40% (Carnarvon OA 32%, Browse OA 8%). The Carnarvon OA overlaps with 32% of the fished area within Areas A based on 2016 - 2020 DPIRD FishCube data 60 nm^2 reporting blocks (Table 5-33 and Figure 5-64). There is no overlap with Area B. However, FishCube data for the fishery is based on 60 nmi^2 reporting blocks and consequently covers a far larger spatial extent and into waters deeper than is likely fished for blue swimmer crab. Fishers mostly fish nearshore in less than 50 metres of water but may venture into deeper waters. Target species and fishing activity may therefore occur in the southern portion of the CSEP Carnarvon OA (<50 m depth).

Table 5-33: CSEP OA overlap with Pilbara Crab Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Pilbara Crab	Fishery		648,648	360,338	3	60	25,903	-	-	-	-	-	-	-	-
	Area A		647,889	359,579	3	60	29,538	9,501	-	-	9,501	32%	-	-	32%
	Area B		759	759	2	60	759	-	-	-	-	-	-	-	-

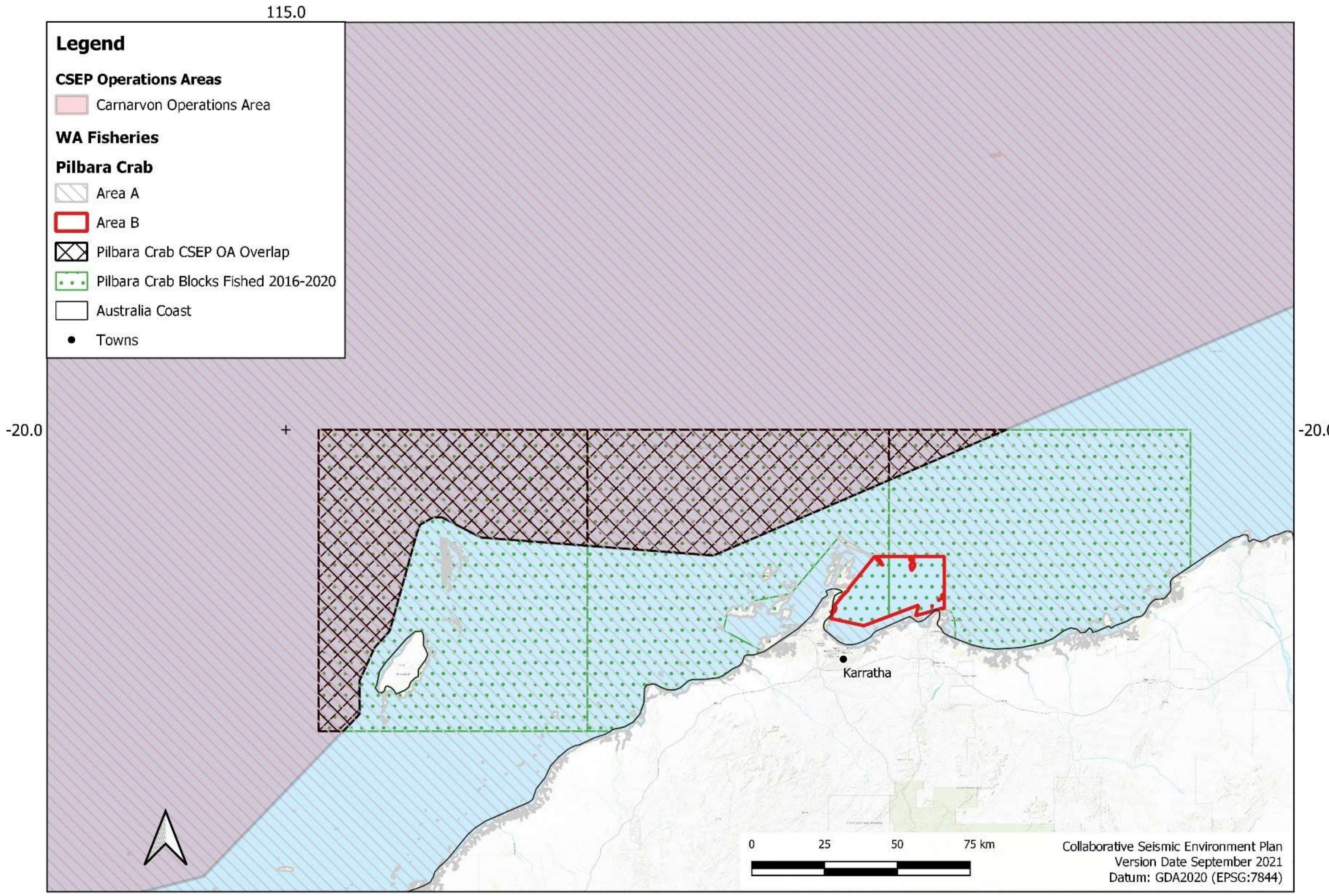


Figure 5-64: CSEP OA overlap with Pilbara Crab Managed Fishery

5.8.2.10 Pilbara Fish Trawl (Interim) Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Pilbara Fish Trawl (Interim) Managed (PFTIMF) is situated in the Pilbara region in the north-west of Australia. It occupies the waters north of latitude 21°35'S and between longitudes 114°9'36'E and 120°E. The fishery is seaward of the 50 m isobath and landward of the 200 m isobath.	Demersal trawl	• Bluespotted emperor (*Lethrinus punctulatus*) • Red emperor (*Lutjanus sebae*) • Rankin cod (*Epinephelus multinotatus*) • Goldband snapper (*Pristipomoides multidens*) • Other demersal snapper, emperor, cod and grouper species are also caught.	The Fishery consists of two zones; Zone 1 in the south-west of the Fishery (which is closed to trawling) and Zone 2 in the north, which consists of six management areas, Areas 1 to 6. Areas 1, 2, 4 and 5 are open to trawl fishing all year round (Figure 5-65). Trawl fishing for the target species occurs widely within the 24,655 km^2 total permitted fishing area of the areas open (1,2,4 & 5). FishCube data (2016 - 2020) shows fishing effort covering an average 93% (15,408 km^2) of Areas 1,2 & 4 and 83% (6,662 km^2) of Area 5 based on 5 nm^2 reporting blocks (Figure 5-65). In 2019, the total catch for the PFTIMF was 2,152 t, making up 72% of the total catch by the Pilbara Demersal Scalefish Fisheries (PDSF), comprising the trawl, trap and line fisheries. It is estimated that ~10 fishers on 2 vessels were directly employed during 2019 in the trawl sector. Fishing occurs year-round.	The Carnarvon and Browse OAs overlap ~96% of the permitted fishing areas and 97% of the fished area based on 2016-2020 DPIRD FishCube data 5 nm^2 reporting blocks (Table 5-34 and Figure 5-65). Of the four permitted fishing areas: • Carnarvon OA overlaps 100% of the fished area in Areas 1,2 & 4 and 7% of Area 5. • Browse OA overlaps 84% of the fished area in Area 5.

Table 5-34: CSEP OA overlap with Pilbara Fish Trawl (Interim) Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Pilbara Fish Trawl (Interim) Managed	Fishery	-	121,433	24,655	332	5	22,071	15,870	5,578	-	21,448	72%	25%	-	97%
	Area 1	2	4,723	4,723	71	5	4,419	4,419	-	-	4,419	100%	-	-	100%
	Area 2	2	6,589	6,589	88	5	6,037	6,037	-	-	6,037	100%	-	-	100%
	Area 4	2	5,274	5,274	83	5	4,953	4,953	-	-	4,953	100%	-	-	100%
	Area 5	2	8,070	8,070	90	5	6,662	461	5,578	-	6,040	7%	84%	-	91%

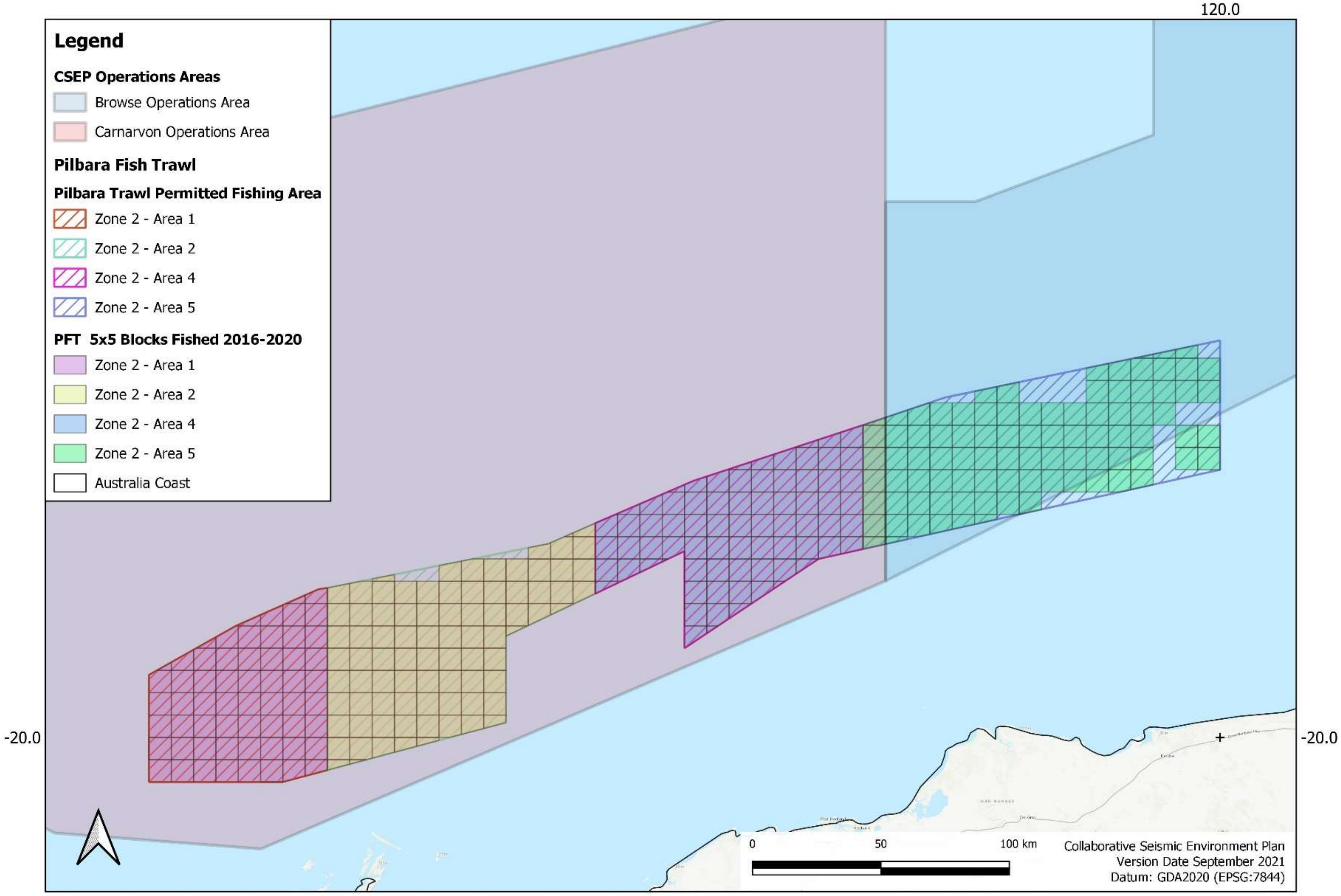


Figure 5-65: CSEP OA overlap with Pilbara Fish Trawl (Interim) Managed Fishery

5.8.2.11 Pilbara Line Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Pilbara Line Fishery (PLF) is permitted to operate anywhere within "Pilbara waters", bounded by a line commencing at the intersection of 21°56'S latitude and the high water mark on the western side of the North West Cape on the mainland of WA; west along the parallel to the intersection of 21°56'S latitude and the boundary of the Australian Fishing Zone and north to longitude 120°E.	Demersal long line	▪ Goldband snapper (*Pristipomoides multidens*) ▪ Ruby snapper (*Etelis carbunculus*) • Other demersal snapper, emperor, cod and grouper species are also caught.	The permitted fishing area of the fishery is 616,602 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 123,877 km^2, based on 60 nm^2 reporting blocks (with mainland and island areas excised) (Figure 5-66). In 2019, the total catch for the PLF was 148 t, making up 5% of the total catch by the PDSF, comprising the trawl, trap and line fisheries. It is estimated that in 2019 at least ~15 fishers on 5 vessels operated in the line sector. Fishing occurs year-round.	The CSEP OA overlaps with 66% of the fished area based on 2016 - 2020 DPIRD FishCube data 60 nm^2 reporting blocks (Table 5-35 and Figure 5-66). Carnarvon OA overlaps 47% of the permitted fishing area, while the Browse OA overlaps 5%. Of the fished 60 nm^2 reporting blocks during the 2016 - 2020 period: • Carnarvon OA overlaps 64% of the fished area. • Browse OA overlaps 2% of the fished area.

Table 5-35: CSEP OA overlap with Pilbara Line Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Pilbara Line	Fishery	-	616,602	616,602	12	60	123,878	78,965	2,009	-	80,974	64%	2%		66%

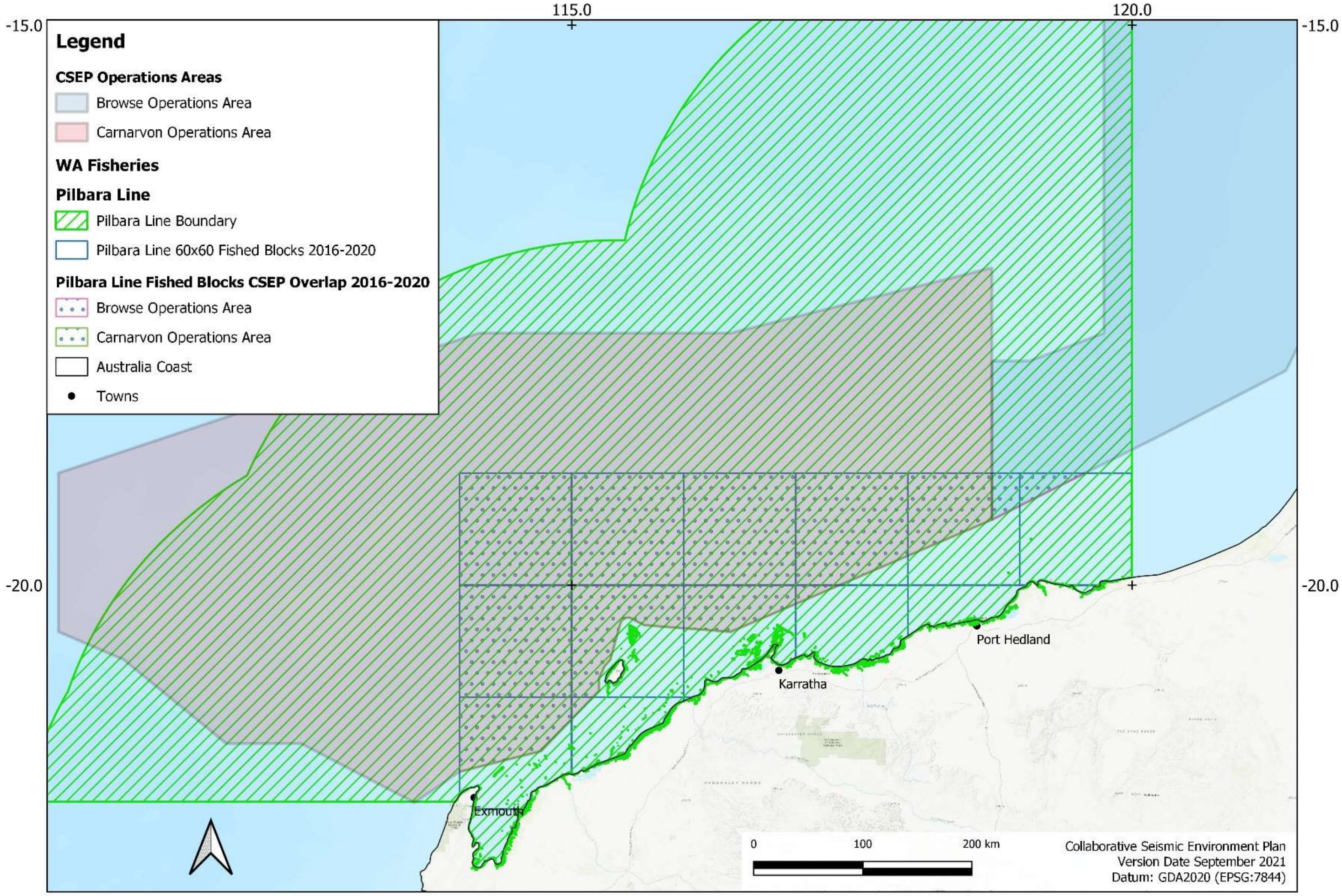


Figure 5-66: CSEP OA overlap with Pilbara Line Fishery

5.8.2.12 Pilbara Trap Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Pilbara Trap Managed Fishery (PTMF) lies north of latitude 21°44'S and between longitudes 114°9.6'E and 120°00'E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath.	Demersal fish traps	• Bluespotted emperor (*Lethrinus punctulatus*) • Red emperor (*Lutjanus sebae*) • Rankin cod (*Epinephelus multinotatus*) • Goldband snapper (*Pristipomoides multidens*) • Other demersal snapper, emperor, cod and grouper species are also caught.	Trap fishing for the target species occurs widely within the 91,771 km^2 permitted fishing area of the PTMF. FishCube data (2016 - 2020) shows fishing effort within 84,060 km^2 of the total permitted fishing area of the PTMF based on 60 nm^2 reporting blocks (excised for land mass overlaps) (Figure 5-67). In 2019, the total catch for the PTMF was 680 t, making up 23% of the total catch by the PDSF, comprising the trawl, trap and line fisheries. In the 2019 season it is estimated there were 8 fishers on 3 vessels in the trap sector. Fishing occurs year-round.	The CSEP OA area overlaps 77% of the fished area based on 2016-2020 DPIRD FishCube data 60 nm^2 reporting blocks (excised for land overlaps) (Table 5-36 and Figure 5-67). Carnarvon OA overlaps 57% of the permitted fishing area, while the Browse OA overlaps 20%. Of the fished 60 nm^2 reporting blocks during the 2016 - 2020 period: • Carnarvon OA overlaps 58% of the fished area. • Browse OA overlaps 19% of the fished area.

Table 5-36: CSEP OA overlap with Pilbara Trap Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Pilbara Trap Managed	Fishery	-	123,006	91,771	15	60	84,060	49,084	15,839	-	64,924	58%	19%	-	77%

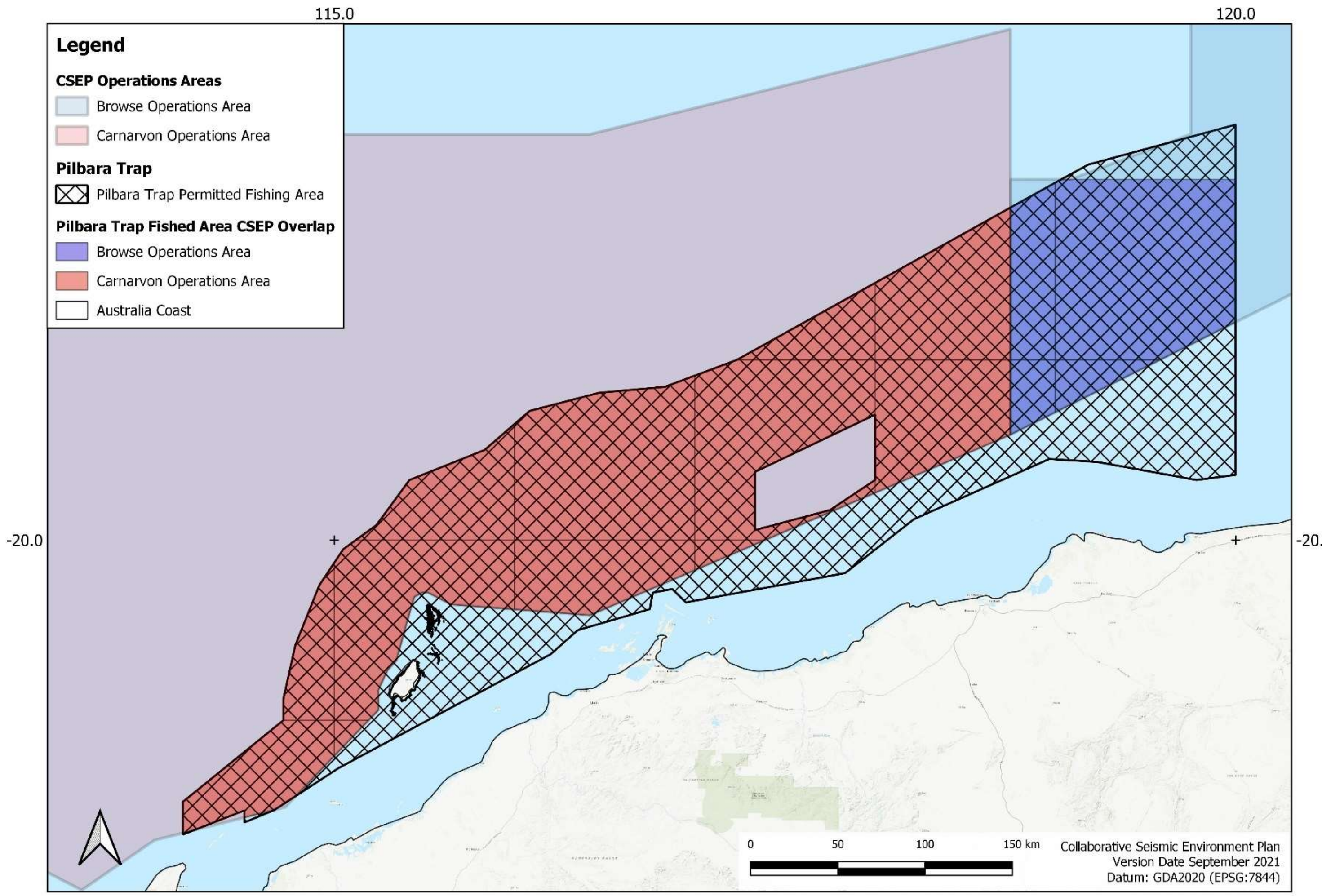


Figure 5-67: CSEP OA overlap with Pilbara Trap Managed Fishery

5.8.2.13 Specimen Shell Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Specimen Shell Managed Fishery (SSMF) area includes all WA waters between the high-water mark and the 200 m isobath.	Hand collection, wading, diving in shallow coastal waters. One licence exemption permits the use of remotely operated vehicle (ROV)	• About 200 species of specimen shell are collected each year, using a variety of methods.	The permitted fishing area of the fishery is 656,929 km^2. FishCube data (2016 - 2020) shows fishing effort within an area of 8,506 km^2, based on 10 nm^2 reporting blocks (with mainland and island areas excised) (Table 5-37 and Figure 5-68). The fishery has 31 licences with a maximum of 4 divers allowed in the water per licence at any one time. Of the 31 licences in the fishery, 17 fished in 2019. Effort in 2019 was 460 days, which was 176 fishing days less than the number of fishing days reported in 2018 (636 days). Over the past five years, there was an annual average of around 598 days fished. In 2019, the total number of specimen shells collected was 7,232 distributed over 241 species. In the past 5 years, more than 450 separate species of molluscs have been collected, with an average of more than 200 species per year – the majority in low numbers per species.	The Carnarvon OA overlaps with 8% of the fished area based on 2016 - 2020 DPIRD FishCube data 10 nm^2 reporting blocks (Table 5-37 and Figure 5-68). The activity within the Carnarvon OA was within two 10 nmi^2 reporting blocks, one was recorded in 2016 and one in 2017. It is probable that these two records in deeper waters were fished from a boat using an ROV. Most of the collection within the fishery occurs in shallower coastal waters (< 40 m) and shallow waters around islands and coral reefs (Figure 5-68).

Table 5-37: CSEP OA overlap with Specimen Shell Managed Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Specimen Shell	Fishery		656,929	656,929	40	10	8,506	640	-	-	640	8%	-	-	8%

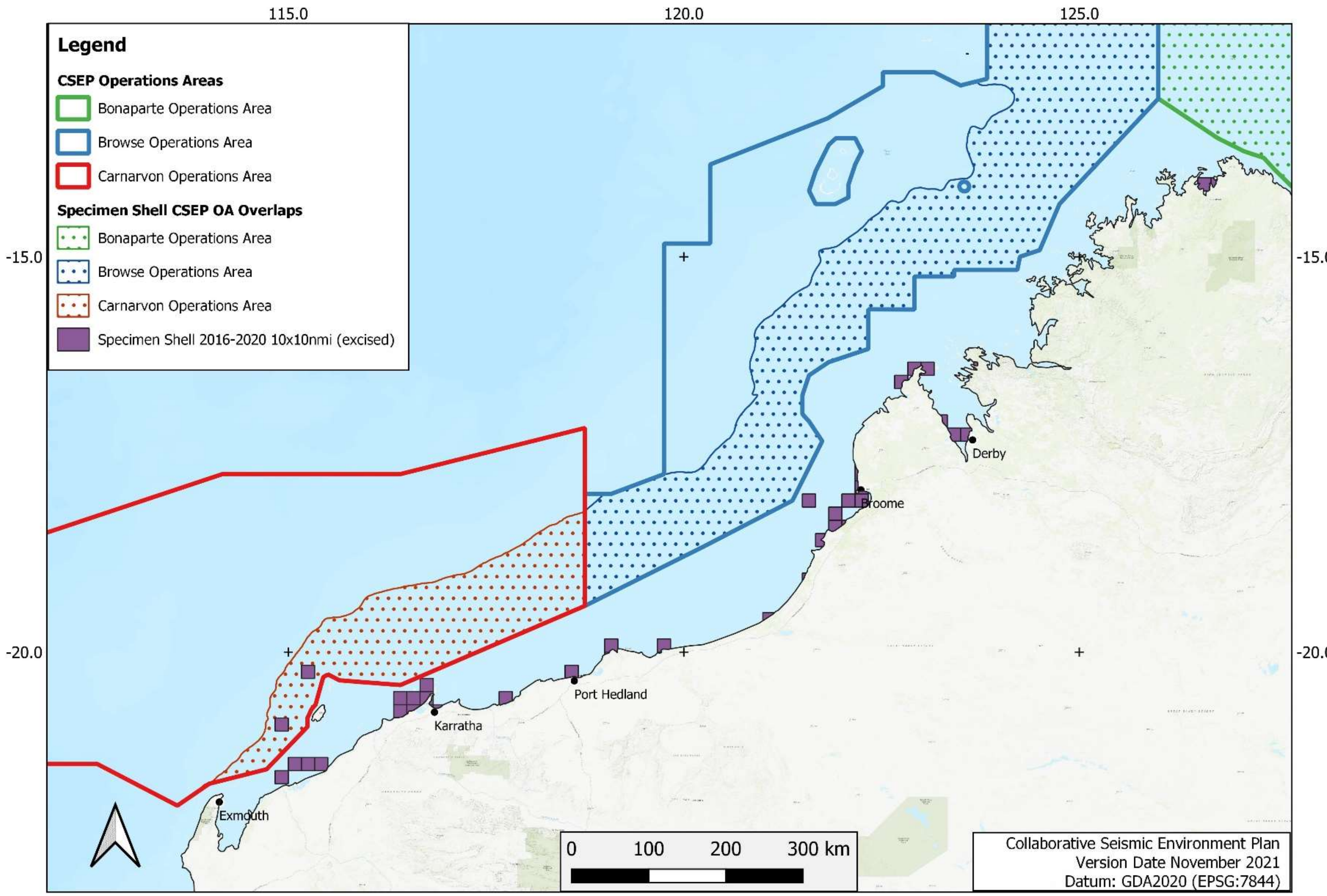


Figure 5-68: CSEP OA overlap with Specimen Shell Managed Fishery

5.8.2.14 West Coast Deep Sea Crustacean Managed Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The boundaries of West Coast Deep Sea Crustacean Managed Fishery (WCDSCMF) include all the waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the NT border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone.	Fish traps	• Crystal crab (*Chaceon albus*) • Champagne (spiny) (*Hypothalassia acerba*) crab • Giant (king) (Pseudocarcinus gigas) crab	The permitted fishing area of the fishery is 1,202,138 km^2 (Table 5-38 and Figure 5-69). The West Coast Deep Sea Crustacean resource is accessed primarily by the commercial WCDSCMF which targets crystal crabs, with the West Coast Rock Lobster Managed Fishery (WCRLMF) retaining a small number of champagne crabs as by-product. The WCDSCMF is a 'pot' fishery using baited pots operated in a long-line formation in the shelf edge waters (>150 m) of the West Coast and Gascoyne Bioregions. The WCDSCMF is open to fishing all year; however, most fishing effort is focused between January and June, when weather conditions are typically more favourable. (How et al. 2015). The crystal crab is a small and tightly controlled fishery with a total allowable commercial catch of 154 t annually.	The permitted fishing area of the WCDSCMF extends from Cape Leeuwin to the WA/NT border in waters great than 150 m. It is overlapped by the CSEP Operations Area by ~30% (Carnarvon OA 19%, Browse OA 11%). No WCDSCMF fishing activity has been recorded in the North Coast Bioregion in the 2016-2020 period, based on FishCube data (2016 - 2020) and as confirmed by email from Research Data Coordinator at DPIRD on November 4th, 2021.

Table 5-38: CSEP OA overlap with West Coast Deep Sea Crustacean Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
West Coast Deep Sea Crustacean	Fishery		1,742,910	1,202,138	-	-	-	-	-	-	-	-	-	-	-

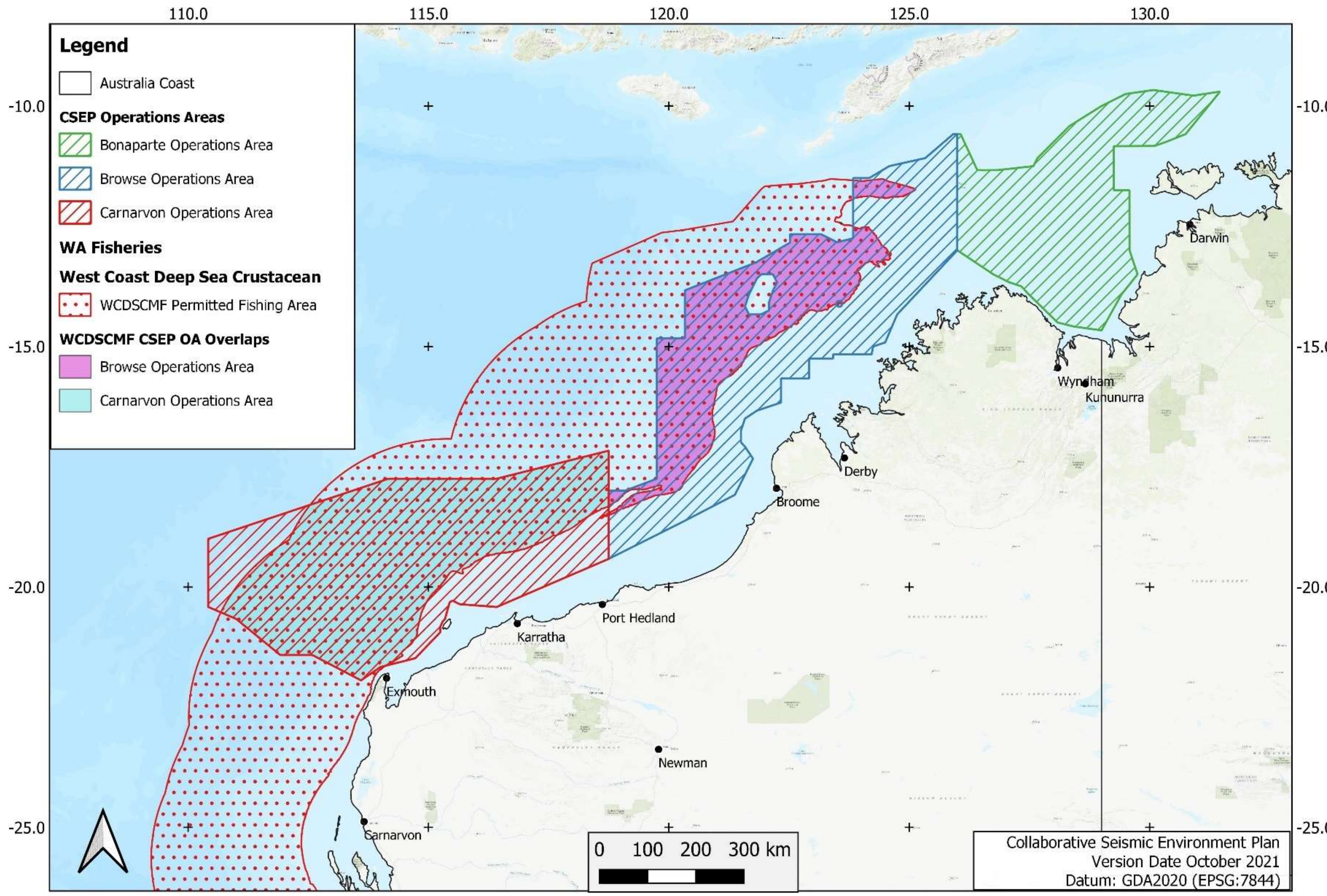


Figure 5-69: CSEP OA overlap with West Coast Deep Sea Crustacean Fishery

5.8.3 Northern Territory Fisheries

The Department of Industry, Tourism and Trade (DITT) manage fisheries that take place predominantly within the offshore waters of Northern Territory (NT) and within 3 nm of the coastline. Wild harvest fisheries are managed under the Fisheries Act 1988 and Fisheries Regulations 1992 and management plans.

To identify NT commercial fishing activities and resources that may be affected by the activity the following was undertaken:

- Review of Northern Territory Government Status of Key Northern Territory Fish Stocks Report 2017 (Northern Territory Government 2017).
- Analysis of DIIT 2016-2020 Fishery presence absence spatial dataset.
- Engagement with DIIT and NT Seafood Council (NTSC).

This information was used to identify those fisheries that fish and/or have spawning areas within the CSEP OAs.

The CSEP OAs overlap the following NT fisheries:

- Aquarium Fish/Display Fishery
- Coast Net Fishery
- Demersal Fishery
- Offshore Net and Line Fishery
- Small Pelagic Developmental Fishery
- Spanish Mackerel Fishery
- Timor Reef Fishery

Based on the DIIT 2016-2020 Fishery presence absence spatial dataset all the fisheries above have fished within the CSEP OA.

5.8.3.1 Aquarium Fish/Display Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Aquarium Fish/Display Fishery operates in both tidal and non-tidal waters of the Top End, to the outer limit of the Australia Fishing Zone. This includes the inland fresh waters of the NT.	Nets, hand pumps, freshwater pots and hand-held instruments to collect specimens.	• Wide range of fishes and invertebrates, as well as coral rubble and substrates covered in encrusting organisms (known as "live rock").	Most of the fishery effort takes place in the waters around the Vernon Islands, between Gunn Point and Melville Island and in the coastal waters near Darwin (Figure 5-70). Aquarium/Display Fishery licensees harvested 2.0 t of product in 2017, valued at about $0.19 million. In 2017 there were 12 licences in the fishery	The permitted fishing area covers 516,156 km^2. During the period 2016-2020 fishing activity was recorded in 1,336 individual point locations, comprising 915 offshore and 412 in tidal and inland waterways (Table 5-39 and Figure 5-70. The Bonaparte OA overlapped 44 collection points, or 5% of all recorded offshore collection events.

Table 5-39: CSEP OA overlap with Aquarium Fish/Display Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Aquarium Fish/Display Fishery	Fishery		516,159	516,159	915	Point Location	915	-	-	44	44	-	-	5%	5%

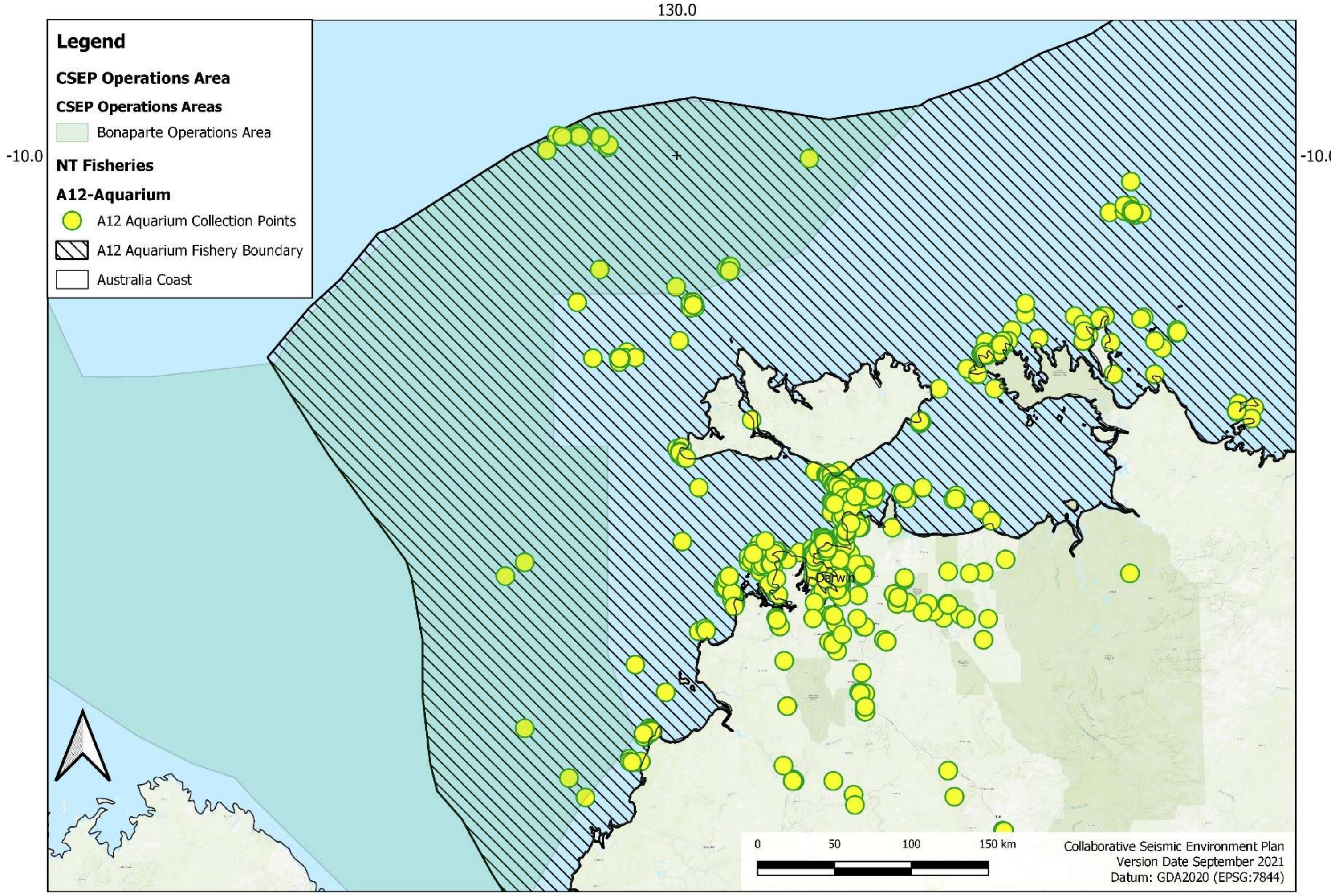


Figure 5-70: CSEP OA overlap with Aquarium Fish/Display Fishery

5.8.3.2 Coastal Line Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Coastal Line Fishery spans the entire NT coastline and is managed as two fishing zones. The Western Zone extends from the WA border to Vashon Head on Cobourg Peninsula at the point of latitude 11° 07.516' South, longitude 131°59.650' East. The Eastern Zone extends from the same point on Vashon Head to the Queensland border.	Rod and line Hand lines Cast nets for bait only Scoop nets or gaffs Drop-lines and a maximum of five fish traps may also be used beyond 2 nm from the coast. Fish traps can only be used in the Eastern Zone of the fishery.	• Black jewfish (*Protonibea diacanthus*) • Golden snapper (*Lutjanus johnii)*	In 2017, the fishery total catch was 172 t with black jewfish and golden snapper forming most of the harvest (98% and 0.45%, respectively). Blue salmon and cods were the main by-product species taken in any significant quantity (0.38% and 0.32% respectively). The total (commercial) value of the catch by this fishery is estimated at $2.1 million. Recreational anglers and fishing tour operators predominantly use rod and line gear to target the same reef associated species as licensees, often at the same location. The harvest by these groups is constrained by personal possession limits. In 2017 there were 14 licences in the fishery.	The permitted fishing area is 41,152 km^2 of which the Bonaparte OA overlaps 3.2% within the Western Zone in the south eastern inshore waters of Joseph Bonaparte Gulf. There is no overlap with the Eastern Zone. NT DITT Fisheries Data (2016 – 2020) shows a total of 87 x 10 nm^2 reporting blocks with fishing activity within the Western Zone totalling 24,113 km^2 (excised to exclude land mass overlaps) (Table 5-40 and Figure 5-71. The Bonaparte OA overlaps the two fished blocks of the Coastal Line Fishery by 166.3 km^2 or 0.7%.

Table 5-40: CSEP OA overlap with Coastal Line Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Coastal Line	Fishery		42,809	41,152	87	10	24,113	-	-	166	166	-	-	0.7%	0.7%

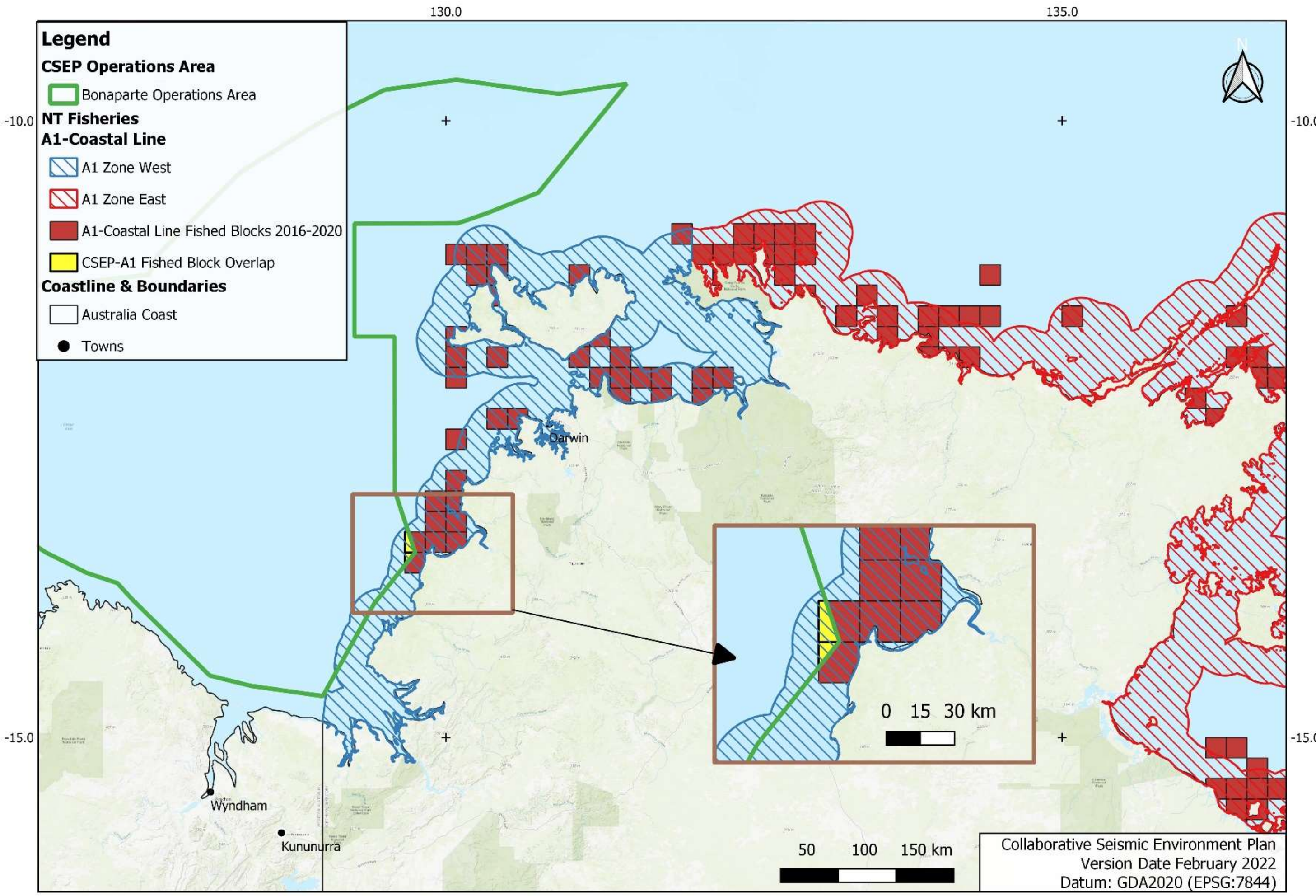


Figure 5-71: CSEP OA overlap with Coastal Line Fishery

5.8.3.3 Demersal Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Demersal Fishery extends from 15 nm from the low water mark to the outer limit of the Australia Fishing Zone (excluding the area of the Timor Reef Fishery). This fishery is managed by the Northern Territory Fisheries Joint Authority (NTFJA)	Fish traps Hand lines Drop-lines Demersal trawl nets permitted in two defined zones.	• Range of tropical snappers (*Lutjanus spp*. and *Pristipomoides spp*.)	The harvest by the fishery is limited through a set of total allowable catches (TACs) applied to goldband snappers (400 t), red snappers (2,500 t) and a "grouped fish" category (915 t). The latter group includes all fish other than barramundi, king threadfin, Spanish mackerel, shark and mud crabs. Licensees harvested 3,388.8 t of fishes in 2017. Red snappers and goldband snappers formed the bulk of the harvest (70.8% and 10.1%, respectively) with painted sweetlip (5.7%), redspot emperor (2.8%) and trevally (2%) being the primary byproduct species. The total value of the catch by this fishery was estimated at $17.9 million in 2017. In 2017 there were eight licences in the fishery.	The permitted fishing area is 353,367 km^2 of which the Bonaparte OA overlaps 15%. NT DITT Fisheries Data (2016 – 2020) shows a total of 653 x 10 nm^2 reporting blocks with fishing activity totalling 218,725 km^2 (excised to exclude land mass overlaps) (Table 5-41 and Figure 5-72). The Bonaparte OA overlaps 12% of the fished area (Table 5-41 and Figure 5-72).

Table 5-41: CSEP OA overlap with Demersal Fishery

Managed Fishery	Area	Zone	Fishery Square km^2	Permitted Fishing Area km^2	No. Blocks Fished	Reporting Block Size (nm^2)	Fished Area km^2	Carnarvon OA overlap km^2	Browse OA overlap km^2	Bonaparte OA overlap km^2	Total OA overlap km^2	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Demersal	Fishery		353,367	353,367	653	10	218,725	-	-	25,771	25,771	-	-	12%	12%

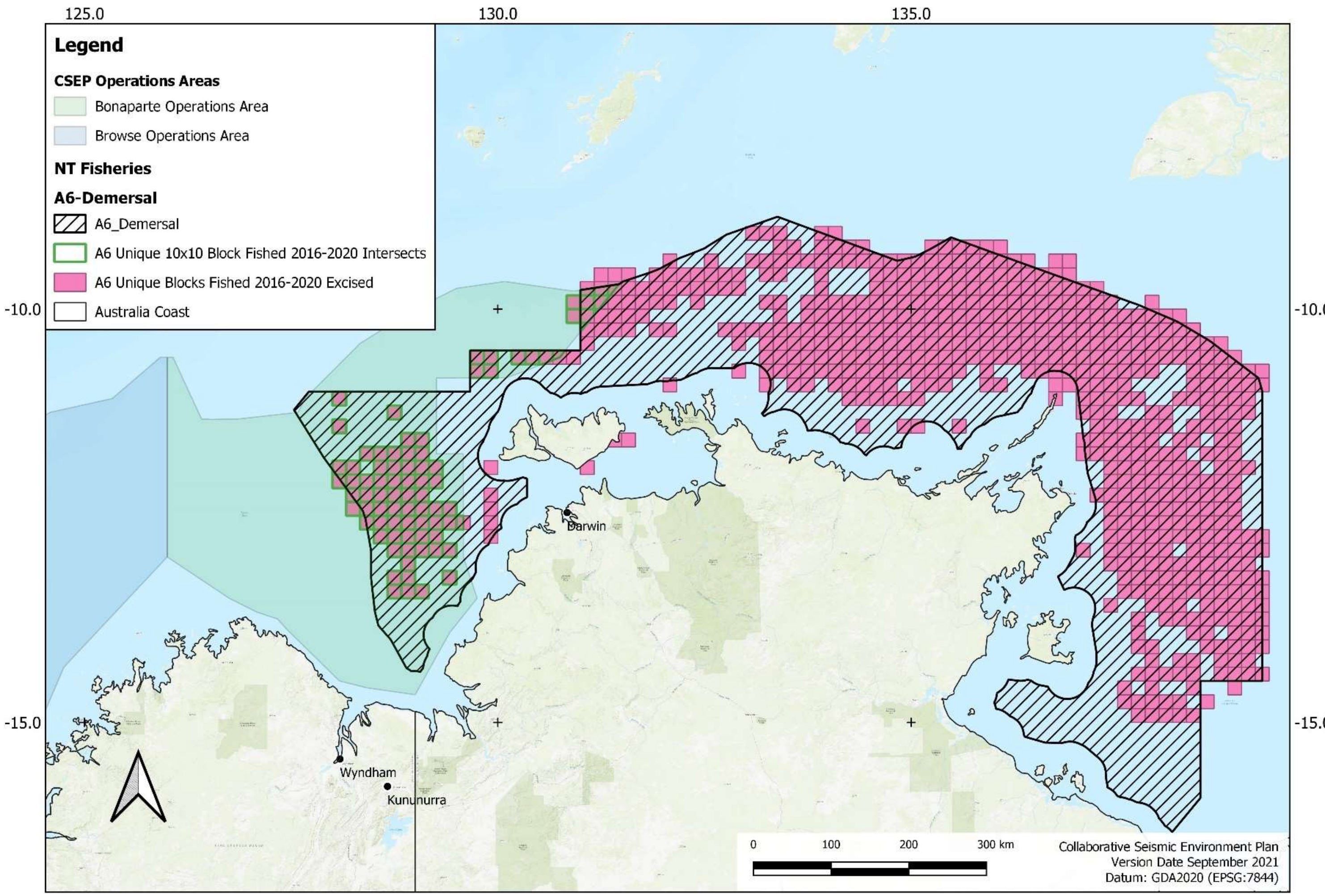


Figure 5-72: CSEP OA overlap with Demersal Fishery

5.8.3.4 Offshore Net and Line Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Offshore Net and Line Fishery (ONLF) operates in NT waters from the low water mark to the boundary of the Australian Fishing Zone. The NT and Commonwealth via the Northern Territory Fisheries Joint Authority (NTFJA) share responsibility for the management of the ONLF.	Pelagic gill-nets Long-lines have not been used in the fishery since 2013	• Australian blacktip sharks (*Carcharhinus tilstoni*) • Common blacktip sharks (C. *limbatus*) • Grey mackerel (*Scomberomorus semifasciatus*) • Black tip shark (*Carcharhinus. limbatus*) • Spottail sharks (*C. sorrah*) • Other retained species include other sharks and finfish.	The fishery harvested 640.8 t of fishes in 2017. Grey mackerel formed the bulk of the harvest (73.2%) followed by the blacktip shark group (11.8%) and Spanish mackerel (3.1%). Other significant by-product species included hammerhead sharks (3%), tuna (2.1%) and queenfish (2%). Bycatch (by weight) was less than 1% of the harvest in 2017. In 2017 there were seven licences in the fishery.	The permitted fishing area is 514,313 km^2 of which the Bonaparte OA overlaps 16% NT DITT Fisheries Data (2016 – 2020) shows a total of 309 x 10 nm^2 reporting blocks with fishing activity totalling 95,512 km^2 (excised to exclude land mass overlaps) (Table 5-42 and Figure 5-73). The Bonaparte OA overlaps 13% of the fished area (Table 5-42 and Figure 5-73).

Table 5-42: CSEP OA overlap with Offshore Net and Line Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Offshore Net and Line Fishery	Fishery		516,159	514,313	309	10	95,512	-	-	12,420	12,420	-	-	13%	13%

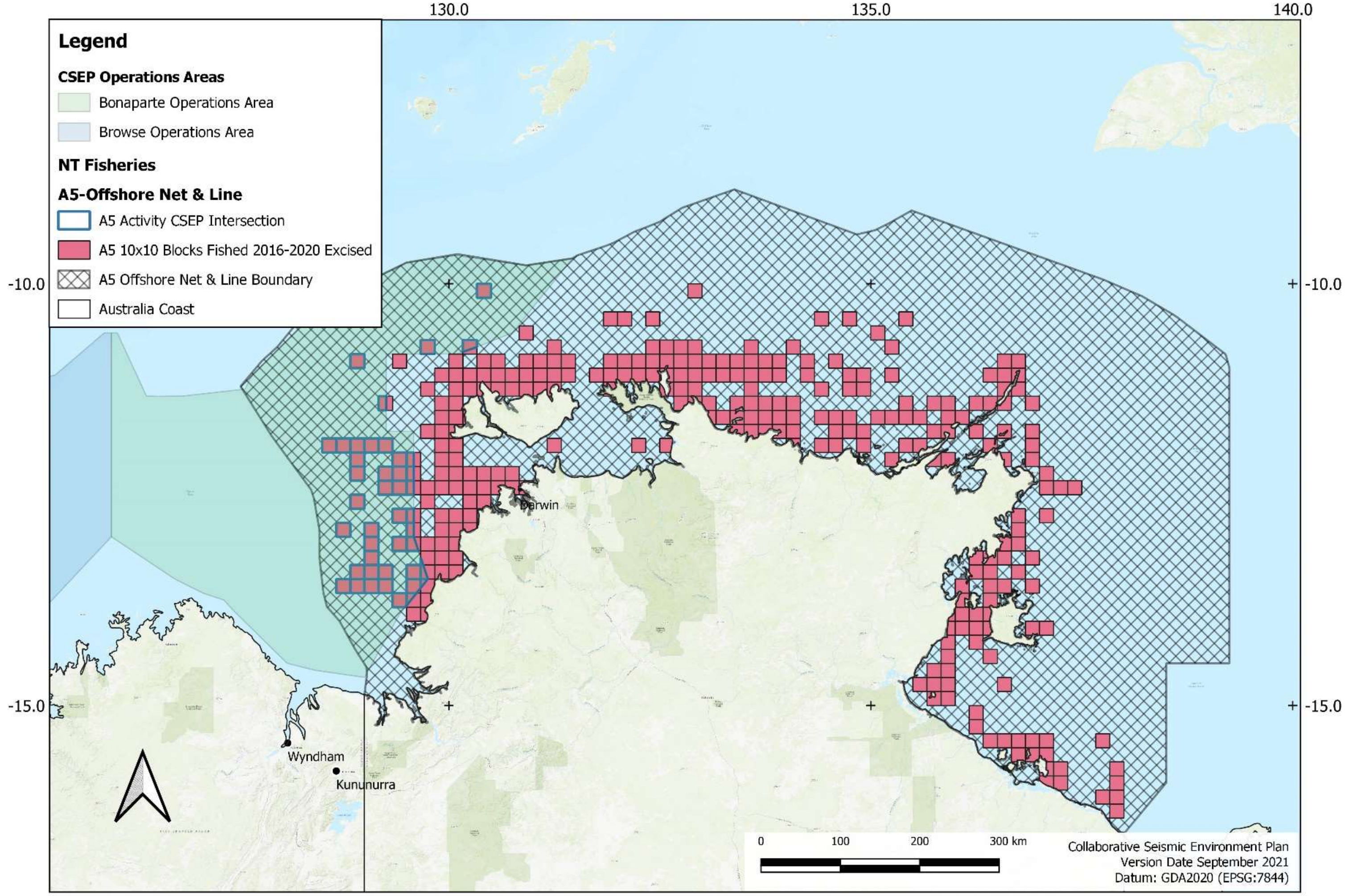


Figure 5-73: CSEP OA overlap with Offshore Net and Line Fishery

5.8.3.5 Small Pelagic Developmental Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence

A research permit has been granted to a proponent to specifically target squid and small pelagic fish species using purse seine and lift net gear. While this permit has been renewed over several years, activity has been sporadic.
The fishery is divided into three zones, West, North and East.
	Lift net
	Purse seine
		• Squid includes only Loligo species.
		• Small pelagic fish includes:
		  ○ Spotted sardine
		  ○ Small spotted herring,
		  ○ Gold stripe sardinella
		  ○ Mouth mackerel
		• Indian anchovy
			Only a single permit holder operates in this fishery, principally targeting sardine.
			There was no fishing activity data directly attributed to the Small Pelagic Development Fishery after 2018 as the development permit had expired. However, it was recorded under a Section 17 permit during 2019 and 2020. *Ref: email Program Leader, Research and Field Operations NT Fisheries 18/10/2021*
				The Western Zone permitted fishing area is 111,632 km^2 of which the Bonaparte OA overlaps 74.3% (Table 5-43 and Figure 5-74.
				NT DITT Fisheries Data (2016 – 2020) shows 48 x 10 nm^2 recording blocks within the Western zone of the fishery with fishing activity totalling 15,359 km^2.
				The Bonaparte OA overlaps the fished area by 21.4%.

Table 5-43: CSEP OA overlap with Small Pelagic Developmental Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Small Pelagic Development Fishery	Fishery	Western	111,632	111,632	48	10	15,359			3,291	3,291	-	-	21%	21%

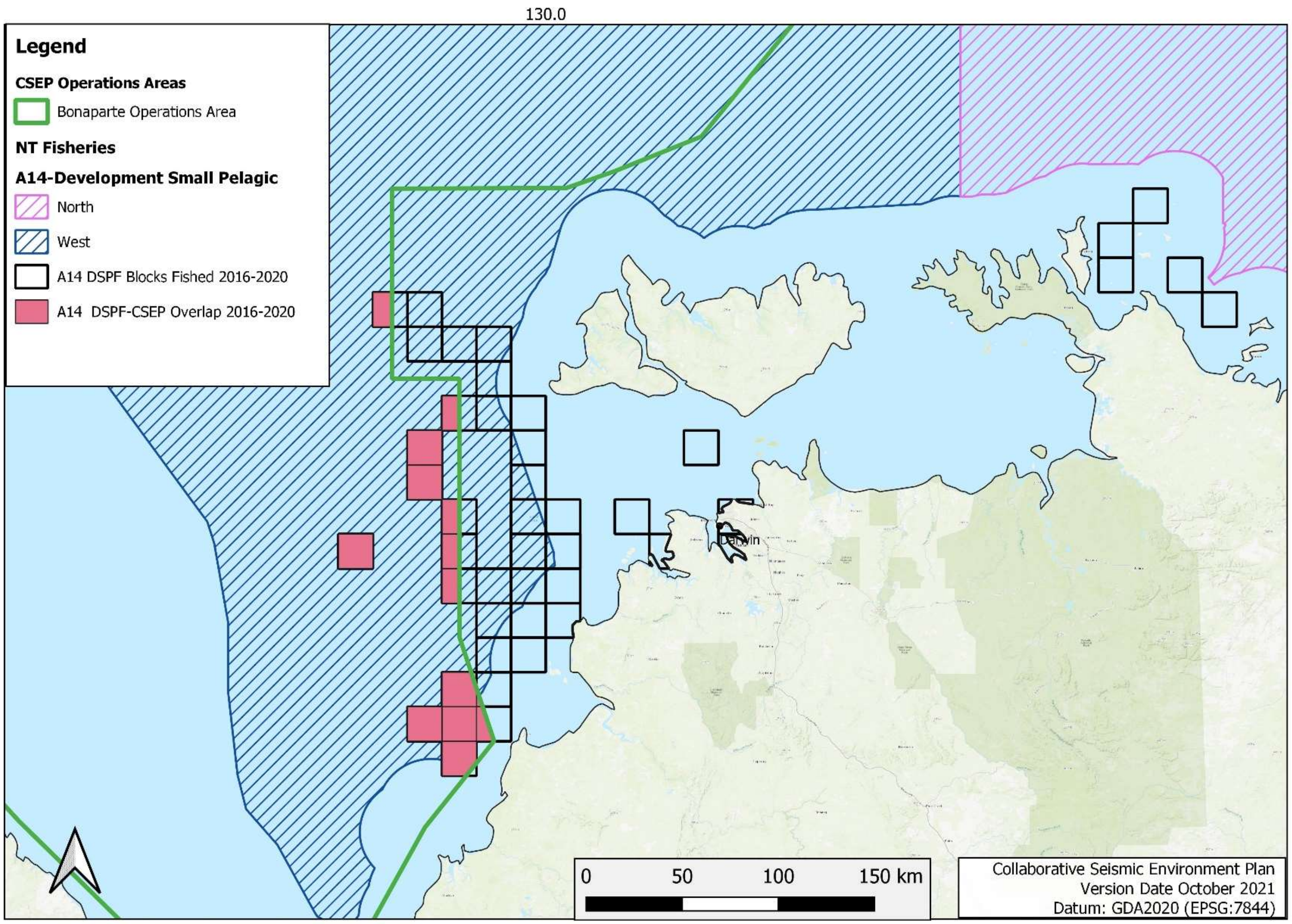


Figure 5-74: CSEP OA overlap with Small Pelagic Developmental Fishery

5.8.3.6 Spanish Mackerel Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence
The Spanish Mackerel Fishery extends seaward from the high-water mark to the outer limit of the Australian Fishing Zone.	Troll lines Floating hand lines Rods	• Spanish Mackerel (*Scomberomorus commerson*)	The primary fishing grounds include waters around Bathurst Island, New Year Island, the Wessel Islands, Groote Eylandt and the Sir Edward Pellew Group of islands. The Spanish Mackerel Fishery is managed through a catch-sharing arrangement between all user groups. This agreement aims to maintain the cumulative harvest of Spanish Mackerel within a precautionary allowable catch of 450 t per annum. Spanish Mackerel Fishery licensees harvested 390.6 t of fish in 2017, with all but 0.7 t of this being Spanish Mackerel. Almost all (>99%) of the by-product of the fishery was Grey Mackerel. Small numbers (<50) of trevallies and sharks were also reported as bycatch in 2017. The total value of the catch by this fishery is estimated at $3.0 million. In 2017 there were 13 licences in the fishery.	The permitted fishing area is 516,159 km^2 of which the Bonaparte OA overlaps 16.6%. NT DITT Fisheries Data (2016 – 2020) shows a total of 350 x 10 nm^2 reporting blocks with fishing activity totalling 113,469 km^2 (excised to exclude land mass overlaps) (Table 5-44 and Figure 5-75). The Bonaparte OA overlaps 28% of the fished area of the Spanish Mackerel Fishery (Table 5-44 and Figure 5-75).

Table 5-44: CSEP OA overlap with Spanish Mackerel Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Spanish Mackerel	Fishery		516,159	516,159	350	10	113,469			31,667	31,667			28%	28%

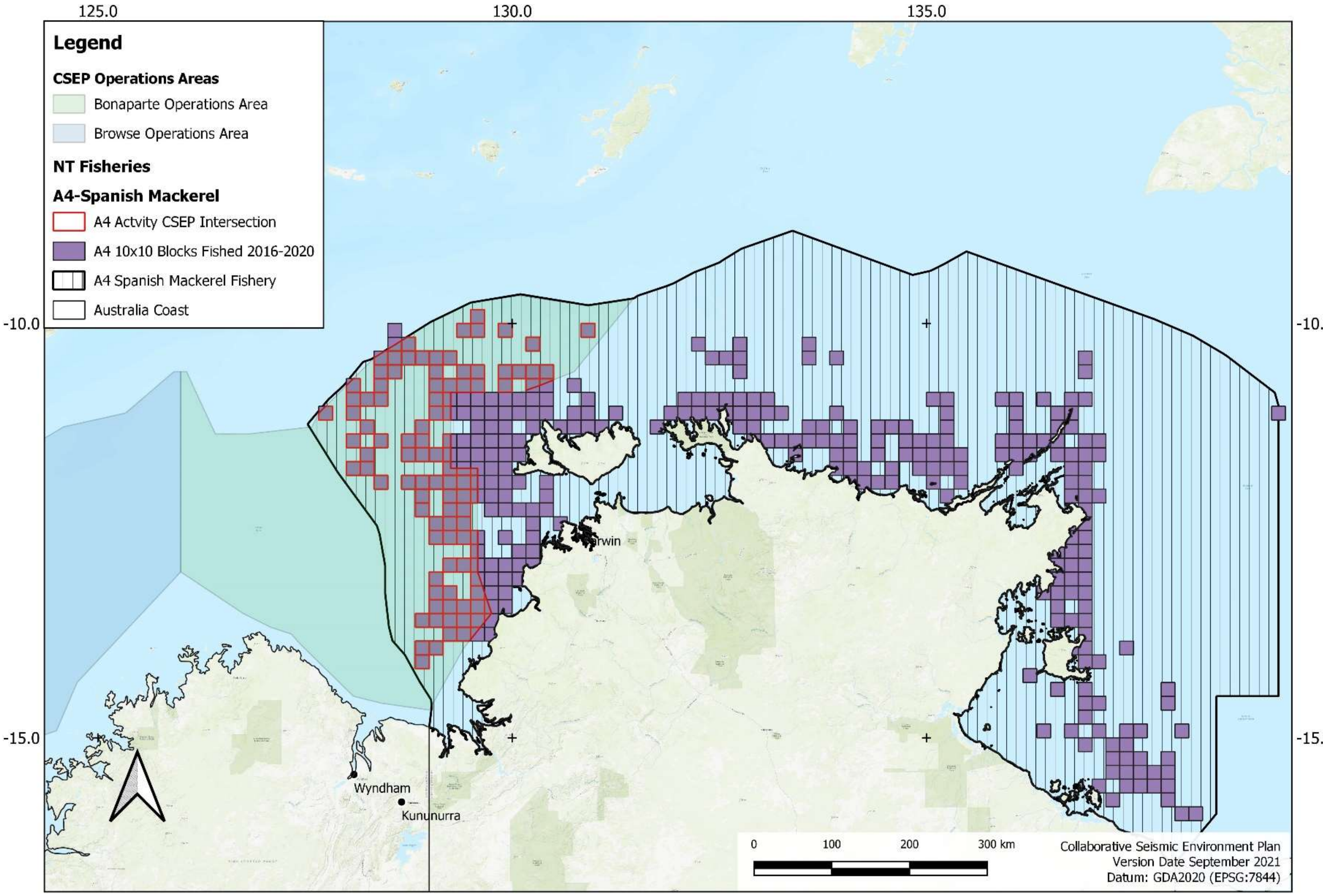


Figure 5-75: CSEP OA overlap with Spanish Mackerel Fishery

5.8.3.7 Timor Reef Fishery

Licence Area Description	Gear Types	Key Target / Indicator Species	Summary of Fishing Activities	Operational Area Presence

The Timor Reef Fishery operates offshore in a zone covering 8,400 nmi^2 to the north-west of Darwin.
This fishery is managed by the Northern Territory Fisheries Joint Authority (NTFJA)
	Drop line, trap and trawl.	• Goldband snappers (*Pristipomoides spp*.)
		• Red snappers (*L. malabaricus and L. erythropterus*) and
		• Grouped fish category includes all fish other than:
		  ○ Barramundi (*Lates calcarifer*)
		  ○ King threadfin (*Polydactylus macrochir*)
		  ○ Spanish mackerel
		  ○ Sharks
		• Mud crabs (*Scyllaspp*.).
			Licensees harvested 837.3 t of fishes in 2017, with red snappers and goldband snappers constituting most of the harvest, 40.2% and 29.7%, respectively.
			Cods (5.3%), trevally (4.1%), red emperor (3.8%), mangrove jack (3.4%) and Robinsons sea bream (2.1%) were the most common by-product species.
			The total value of the catch by this fishery is estimated at $4.9 million.
			Reported bycatch (by weight) in 2017 was less than 1% of the drop-line and trap harvest and the bycatch recorded by observers for trawl gear in 2017 was 16.2%.
			In 2017 there were 5 licences in the fishery.
				The Timor Reef Fishery covers an area of 31,739 km^2. The Bonaparte OA overlaps 96% of the fishery.
				NT DITT Fisheries Data (2016 – 2020) shows a total of 87 x 10 nm^2 reporting blocks with fishing activity totalling 27,968 km^2 (Table 5-45 and Figure 5-76).
				The Bonaparte OA overlaps the fished area by 96% (Table 5-45 and Figure 5-76.

Table 5-45: CSEP OA overlap with Timor Reef Fishery

Managed Fishery	Area	Zone	Fishery Square km²	Permitted Fishing Area km²	No. Blocks Fished	Reporting Block Size (nm²)	Fished Area km²	Carnarvon OA overlap km²	Browse OA overlap km²	Bonaparte OA overlap km²	Total OA overlap km²	Carnarvon OA overlap %	Browse OA overlap %	Bonaparte OA overlap %	Total OA overlap %
Timor Reef Fishery	Fishery		31,739	31,739	94	10	27,968	-	-	26,852	26,852	-	-	96%	96%

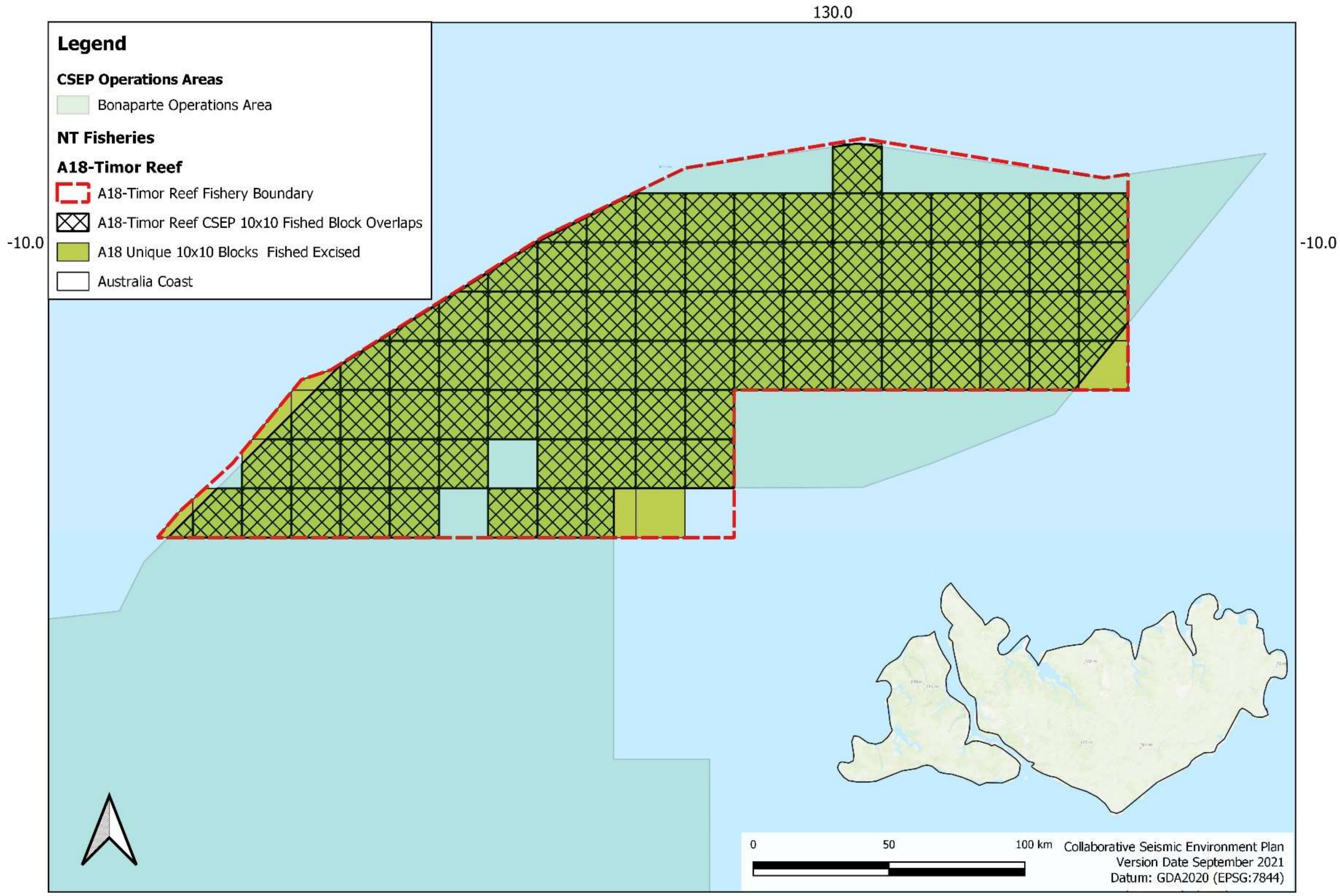


Figure 5-76: CSEP OA overlap with Timor Reef Fishery

5.8.4 Commercial Fisheries Targeted Species

The biology of key commercially targeted species in this region, including the indicator species is summarised in Table 5-47. This includes the distribution, stock structures and spawning characteristics of the various species.

Table 5-46 provides a summary of the indicator species spawning times.

As described for each individual key indicator fish species in the Australian Fisheries Research and Development Corporation (FRDC) Status of Australian Fish Stocks Reports (FRDC 2020), fish stock structures are considered in terms of both their genetic stocks and fishery management units. Biological stocks are discrete populations of a fish species, usually in a given geographical area and with limited interbreeding with other biological stocks of the same species (NT Government 2019). The level of mixing from egg and larval dispersal is influenced by the spatial-temporal patterns of spawning relative to the prevailing oceanographic currents, the duration of the spawning period and the periodicity of spawning. For example, a species that spawns over a large portion of the continental shelf for a protracted period will very likely have a high level of egg and larval dispersal resulting in a wide spatial stock extent (Gaughan et al. 2018).

There is considerable bidirectional mixing of pelagic eggs and larvae in both directions in northern Australia, therefore, for species that are relatively evenly distributed throughout their range and with spawning seasons that extend over several months, there is a high propensity for alongshore mixing over large distances (Gaughan et al. 2018). The eggs and larvae released by spawning adult demersal fish in the region may disperse for several days or weeks and may travel for hundreds of kilometres or more before settling on the seabed (Newman et al. 2000; Mackie et al. 2010; Marriott et al. 2012; Berry et al. 2012; Gaughan et al. 2018). The biological stocks, therefore, represent the area where the exchange of larvae and subsequent recruitment of juvenile fish to the stocks occurs over many years (Martin et al. 2014; Gaughan et al. 2018).

Table 5-46: Commercial Fish and Invertebrate Species Spawning Temporal Information

Species	Fishery	J	F	M	A	M	J	J	A	S	O	N	D	Comment
Black jewfish	NT Coastal Line Fishery								X	X	X	X	X	Saunders et al. (2016, 2020)
Bluespotted emperor Spawns throughout range	Pilbara Trawl and Trap	X	X	X			X	X	X	X	X	X	X	Newman (2020)
Crimson snapper	Timor Reef Fishery (TRF)													Information not found
Goldband snapper Spawns throughout range	Pilbara Trawl, Trap and Line, NDSMF, TRF	X	X	X	X	X	X				X	X	X	Newman (2020)
Golden snapper	NT Coastal Line Fishery	X	X	X	X					X	X	X	X	Saunders et al. (2016)
Grey mackerel Spawns throughout range	Mackerel Managed Fishery NT Spanish Mackerel Fishery	X								X	X	X	X	Saunders et al (2014)
Rankin cod Spawns throughout range	Pilbara Trawl and Trap, NDSMF			X			X	X	X	X	X	X	X	Newman (2020)
Red emperor Spawns throughout range	Pilbara Trawl and Trap, NDSMF	X	X	X	X	X				X	X	X	X	Newman (2020)
Ruby snapper Spawns throughout range	Pilbara Line Fishery Western Deepwater Trawl Fishery	X	X	X	X								X	Newman (2020)
Saddletail snapper	Pilbara Trawl, Trap and Line, NDSMF, TRF, NT Demersal Fishery	X	X	X	X	X	X	X	X	X	X	X	X	Newman (2002)
Southern bluefin tuna	Southern Bluefin Tuna Fishery	X	X	X	X				X	X	X	X	X	AFMA (2021)
Spanish mackerel Form spawning schools	Mackerel Managed Fishery	X								X	X	X	X	Newman (2020)
Australian scampi	North West Slope Trawl Fishery									X	X			AFMA (2021)
Prawns	Prawn fisheries	X	X	X	X	X	X	X	X	X	X	X	x	AFMA (2021)
Pearl Oyster	Pearl Oyster Managed Fishery	X	X	X	X	X				X	X	X	X	Hart et al (2016)

Table 5-47: Commercial Fish and Invertebrate Species Spawning Spatial and Temporal Information

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
Fish					
Black jewfish (*Protonibea diacanthus*)	NT Coastal Line Fishery	Saunders et al. 2016 and Saunders et al. 2020: • Black jewfish is a widespread Indo-Pacific species found from Exmouth Gulf in WA, north and east across Northern Australia, to the east coast of Queensland. • Stock structure for this species has been investigated in the north-western part of its range along the WA and NT and the results indicate that separate stocks exist at the scale of tens of kms. • Seasonal aggregations of black Jewfish occur throughout its distribution, and it has been speculated that these are for spawning. • Histological examination of ovaries indicates multiple batch spawning. • Recent stock assessments in the NT (Saunders et al. 2020) indicates that current biomass has increased significantly to 93 per cent of unfished levels suggesting that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. To protect spawning black and other reef fish, five reef fish protection area have been put in place within NT waters (Figure 5-77).	Up to 100 m	153 days August to December	Sustainable
Bluespotted emperor	Pilbara Fish Trawl Interim Managed Fishery	Newman (2020) • Spawns throughout their range (rather than aggregating at specific locations)	5 – 110 m	274 days Jul-Mar extended	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
(*Lethrinus punctulatus*)	Pilbara Trap Managed Fishery Northern Demersal Scalefish Managed Fishery	• Reproductive mode: Functional gonochorist (individuals male or female) The distribution of bluespotted emperor is restricted primarily to WA waters and extends from around Geraldton in the south to Darwin in the NT, with its greatest relative abundances in the western Pilbara region (Carpenter and Niem 2001, Newman et al. 2020). Bluespotted emperor are exploited primarily in the North Coast Bioregion of Western Australia (Newman et al. 2020). The lack of genetic differentiation among populations of bluespotted emperor across the northwest region of WA indicates that there is gene flow among populations (Johnson et al. 1993, Moran et al. 1993) and in this region comprises one biological stock.		peak spawning period	
Crimson snapper (*Lutjanus erythropterus*)	Timor Reef Fishery	Crimson snapper is a widespread Indo-Pacific species found throughout tropical Australian waters. Research on the biological stock structure of this species in Australian waters has only occurred in northern Australia; including the Timor Sea, the Arafura Sea and the Gulf of Carpentaria (Salini et al. 2006). A single genetic stock was found across this region.	5 – 120 m	Not available	Sustainable
Goldband snapper (*Pristipomoides multidens*)	Pilbara Fish Trawl Interim Managed Fishery Pilbara Trap Managed Fishery Pilbara Line Fishery	Newman (2020) • Spawns throughout their range (rather than aggregating at specific locations) • Reproductive mode: Gonochoristic (individuals male or female) Goldband snapper is widely distributed throughout northern Australia and the tropical Indo–West Pacific. Ovenden et al. (2002) examined the genetic connectivity of Goldband snapper at six Australian locations (four in WA, two in NT and three	50 – 200 m	Gascoyne: 212 days Dec-June (extended peak spawning period) Pilbara: 243 days	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
	Northern Demersal Scalefish Managed Fishery Timor Reef Fishery	south east Asia. The mitochondrial DNA data did not differ genetically among Australian locations, except for the northern Kimberley location that exhibited restricted gene flow. Ovenden et al. (2002) reported that samples taken from locations in Southeast Asia were genetically distinct from those sampled from Australian locations. This study indicated that within the region sampled goldband snapper are likely to form a single biological stock.		Oct-May (extended peak spawning period) Kimberley: 212 days Nov-May (extended peak spawning period)	
Golden snapper (*Lutjanus johnii*)	NT Coastal Line Fishery	Saunders et al. 2016: • Distribution extends from the Pilbara region in WA across northern Australia to the mid-east coast of Queensland. • In estuaries and near-shore embayment's, golden snapper are predominantly juveniles and subadults, while most fish encountered on near-shore reef environment (to 80 m) are larger adult fish. • It has been hypothesised that golden snapper undertake at least two major movements during their life cycle: an inshore migration as post-larvae or early juveniles from offshore spawning grounds and a subsequent offshore migration of sub-adult or mature fish. To protect spawning golden snapper and other reef fish, five reef fish protection area have been put in place within NT waters (Figure 5-77).	Up to 80 m	242 days September to late April.	WA Stock – Sustainable Darwin Region Stock - depleted

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
Grey mackerel (*Scomberomorus semifasciatus*)	Mackerel Managed Fishery NT Spanish Mackerel Fishery	FRDC (2020): Grey mackerel are found in southern Papua New Guinea and northern Australia from Shark Bay, Western Australia, to northern New South Wales. There are at least five Grey Mackerel biological stocks across northern Australia, with a possible additional stock in the north-east Gulf of Carpentaria. Grey mackerel spawn throughout their range in northern Australia between September and January (Bray & Schultz, 2018). Adult female grey mackerel spawn more than 250,000 eggs during each event. Once hatched, larvae mode to coastal bays and estuaries (Saunders et al 2014).	Not available	153 days Between September and January	Sustainable
Rankin cod (*Epinephelus multinotatus*)	Pilbara Fish Trawl Interim Managed Fishery Pilbara Trap Managed Fishery Northern Demersal Scalefish Managed Fishery	Newman (2020) • Spawns throughout their range (rather than aggregating at specific locations) • Reproductive mode: Protogynous (individuals born female and at some point of their life span change sex to males) Rankin Cod are distributed from the Houtman Abrolhos Islands in WA, north to the waters offshore from Darwin in the NT. Rankin cod is exploited primarily in the North Coast Bioregion of WA (Newman et al. 2020). There is no evidence of discrete breeding populations of Rankin cod in WA, indicating that there is one biological stock. Although adults do not mix extensively, they all contribute to the total adult spawning biomass and larval dispersal (Newman et al. 2020).	10 – 150 m	245 days Jun-Dec and March Peak spawning period Aug-Oct	Sustainable
Red emperor (*Lutjanus sebae*)	Pilbara Fish Trawl Interim Managed Fishery	Newman (2020) • Spawns throughout their range (rather than aggregating at specific locations)	10 – 180 m	303 days Sept-June with bimodal	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
	Pilbara Trap Managed Fishery Northern Demersal Scalefish Managed Fishery	• Reproductive mode: Gonochoristic (individuals male or female) Red emperor range from Cape Naturaliste in WA, north and east across northern Australia and down the east coast to Sydney in NSW. Red emperor is exploited primarily in the North Coast Bioregion of Western Australia (Newman et al. 2020). Studies indicate that there are high levels of gene flow among populations (van Herwerden et al. 2009, Johnson et al. 1993) with a single genetic stock between Queensland and Shark Bay in WA		peaks from Sept-Nov and Jan-Mar	
Ruby snapper (*Etelis carbunculus*)	Pilbara Line Fishery Western Deepwater Trawl Fishery	Newman (2020) • Spawns throughout their range (rather than aggregating at specific locations) • Reproductive mode: Gonochoristic (individuals male or female) Ruby snappers are widely distributed throughout northern Australian waters. There are two biological stocks. The Northern Australia stock encompasses all Australian waters west of Torres Strait (i.e., waters off the NT and WA), while the Eastern Australian stock occurs off the east coast of QLD, extending south into NSW. (Newman et al. 2020).	150 – 480 m	151 days Dec-Apr peak spawning period Jan-Mar	Sustainable
Saddletail snapper (*Lutjanus malabaricus*)	Timor Reef Fishery Pilbara Fish Trawl Interim Managed Fishery Pilbara Trap Managed Fishery Pilbara Line Fishery	Saddletail snapper is a widespread Indo-Pacific species found from Shark Bay WA, across northern Australia to the east coast of Queensland (Newman 2002). Genetic studies indicate that three biological stocks occur across the species' Australian range: the North Coast Bioregion biological stock, the Northern Australian biological and the East coast of Queensland biological stock (Elliot 1996, Salini et al. 2006). Recently, Saunders et al. (2018) used otolith microchemistry and	30 – 250 m	212 days Throughout the year, with a peak between September and March	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
	Northern Demersal Scalefish Managed Fishery NT Demersal Fishery	parasitology to identify separate biological saddletail snapper stocks in the Joseph Bonaparte Gulf, Timor and Arafura seas and Gulf of Carpentaria.			
Southern bluefin tuna (*Thunnus maccoyii)*	Southern Bluefin Tuna Fishery	AFMA (2021c): Southern bluefin tuna constitutes a single, highly migratory biological stock that spawns in the north-east Indian Ocean and migrates throughout the temperate southern oceans, supporting a number of international fisheries. Spawning occurs in tropical waters during spring and summer. Only one spawning ground has been identified, in the north-eastern Indian Ocean south of Java (Figure 5-78). Females appear to spawn daily. It is not known whether all mature fish spawn each year, every few years, or even only once in their lifetime. Females produce 14-15 million eggs per spawning season.	Up to 500 m	273 days Spawning occurs from August–April with a peak from October–February	Recovering
Spanish mackerel (*Scomberomorus commerson*)	Mackerel Managed Fishery	Newman (2020) • Form spawning schools around inshore reefs in north coast bioregion. • Reproductive mode: Gonochoristic (individuals male or female)	1 – 50 m	Pilbara: 122 days Sept-Dec (peak spawning period) Kimberley: 153 days Sept-Jan (peak spawning period)	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
Invertebrates					
Australian scampi (*Metanephrops australiensis)*	North West Slope Trawl Fishery	AFMA (2021b): Scampi is a benthic species that inhabits the continental shelf. They can usually be found on *Globigerina* ooze at depths of 420-500 m. Timing of spawning is uncertain but is thought to occur annually. Studies of similar species suggest that spawning occurs in September-October. Females produce 300-1200 eggs per clutch and brood the eggs for 9-10 months before hatching. The larvae settle and adopt a benthic habitat soon after hatching. Scampi typically produce 100-900 larvae per clutch.	420 – 500 m	Annually September-October	Sustainable
Banana prawn - White (*Fenneropenaeus merguiensis)*	Nickol Bay Prawn Managed Fishery Broome Prawn Managed Fishery Kimberley Prawn Managed Fishery Onslow Prawn Managed Fishery Northern Prawn Fishery	AFMA (2021a): Banana prawns inhabit tropical and subtropical coastal waters. They are found over muddy and sandy bottoms in coastal waters and estuaries. Juveniles inhabit small creeks and rivers in sheltered mangrove environments. White banana prawn is mainly caught during the day on the eastern side of the Gulf of Carpentaria (outside the CSEP OA), whereas redleg banana prawn is caught during both day and night, mainly in Joseph Bonaparte Gulf. Spawning occurs in shallow coastal waters throughout the year there are two spawning peaks: the late dry season (September-November) and the late wet season (March-May). Banana prawns are serial spawners, and each female can lay several egg batches each year. Females produce 100,000-450,000 eggs per year depending on their body size. Eggs hatch within 24 hours of fertilisation.	16 – 45 m	Throughout the year with peaks in September-November and March-May	Sustainable
Banana prawn - Red-legged (*Fenneropenaeus indicus)*	Northern Prawn Fishery		35 – 90 m		Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
Endeavour prawn - Blue (*Metapenaeus endeavouri*)	Broome Prawn Managed Fishery Kimberley Prawn Managed Fishery Northern Prawn Fishery	AFMA (2021a): Blue and red endeavour prawns' range across northern Australia waters and parts of the Indo-West Pacific Ocean Spawning occurs throughout the year. Females produce about 296 000 eggs per year depending on their body size. Red endeavour prawns may be more fecund than blue endeavour prawns.	Up to 60 m	Throughout the year with peaks in March and September.	Sustainable
Endeavour prawn - Red (*Metapenaeus ensis*)	Northern Prawn Fishery		Up to 95 m	Throughout the year with peaks in September - December	Undefined
Indo-Pacific, silver-lipped pearl oysters (*Pinctada maxima*).	Pearl Oyster Fishery	The breeding season of pearl oysters starts in the spring months of September or October, extending to the autumn months of April and May. Although there is variability from month to month, the primary spawning occurs from the middle of October to December (Hart et al. 2016). *P. maxima* are broadcast spawners; they release gametes (both sperm and eggs) into the water column during the spawning season (Hart et al. 2016). Spawning in the main fishing areas of the Eighty Mile Beach region is concentrated around broodstock distributed between 8 and 15 m depth, with potential smaller contributions from the north-east (Condie et al. 2006). These spawning events lead to recruitment locally and alongshore to the south-west and also feed larvae into neighbouring shallow coastal environments and deeper waters to the west (~20 m depth). Larval dispersion from known broodstock populations mostly travel less than 30 km, however,	Up to 20 m	119 days Primary spawning occurs from mid-October to December. A smaller secondary spawning occurs in February and March.	Sustainable:

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
		some have been modelled as potentially travelling up to 60 km (Condie et al. 2006).			
Tiger prawn - Grooved (*Penaeus semisulcatus*)	Northern Prawn Fishery	AFMA (2021a): Spawning occurs throughout the year, in both inshore and offshore areas for brown tiger prawns and in offshore areas for grooved tiger prawns. Females produce about 186 000 eggs (brown tiger prawns) and 365 000 eggs (grooved tiger prawns) per year depending on their body size. Eggs hatch within 24 hours of fertilisation.	Up to 200 m	Throughout the year with peak in August-September, with a secondary peak in February	Sustainable
Tiger prawn - Brown (*Penaeus esculentus*)	Nickol Bay Prawn Managed Fishery Broome Prawn Managed Fishery Kimberley Prawn Managed Fishery Onslow Prawn Managed Fishery Northern Prawn Fishery		Up to 200 m	Throughout the year with peak between July and October	Sustainable
Western king prawn (*Penaeus latisulcatus*)	Kimberley Prawn Managed Fishery	FRDC (2020a): Western King Prawn is distributed throughout the Indo–West Pacific (Grey et al. 1983). No research has been conducted into Western King Prawn biological stock structure in Western Australia or Queensland. DPIRD (2021):	Not available	Throughout the year	Sustainable

Key Target / Indicator Species	Fishery	Spatial extent of Stock	Principal stock range	Spawning Period	Stock Status (FRDC 2020)
		A single prawn can spawn more than once in any one year. The female releases hundreds of thousands of eggs. Fertilised eggs hatch within 24 hours and larvae spend time floating in the water, developing through several stages, as they drift shoreward to shallow, hypersaline (highly salty) waters. When they reach these shallow waters, the 'postlarvae', are ready to settle on the bottom, where they develop into juvenile prawns. They remain in the nursery areas for up to six months before they reach a size (near their size at maturity) when physiological changes demand they move back to oceanic waters to mate and spawn, completing their lifecycle.			

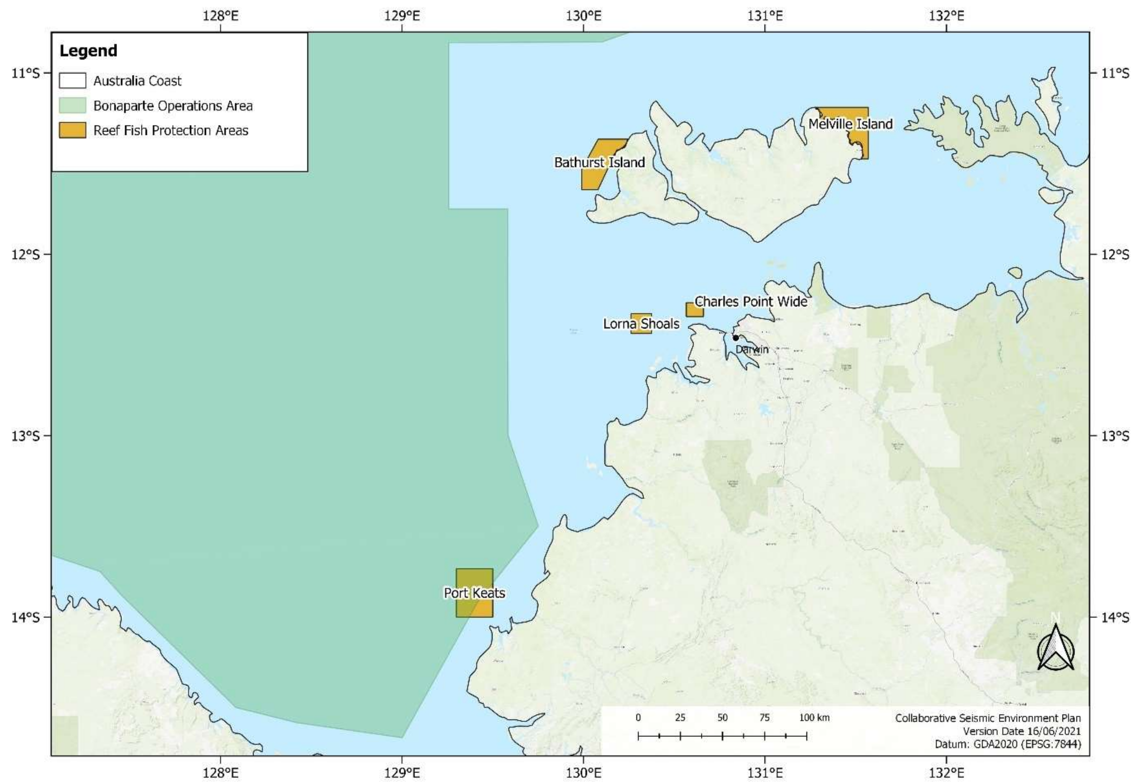


Figure 5-77: CSEP OA overlap with NT Reef Fish Protection Areas

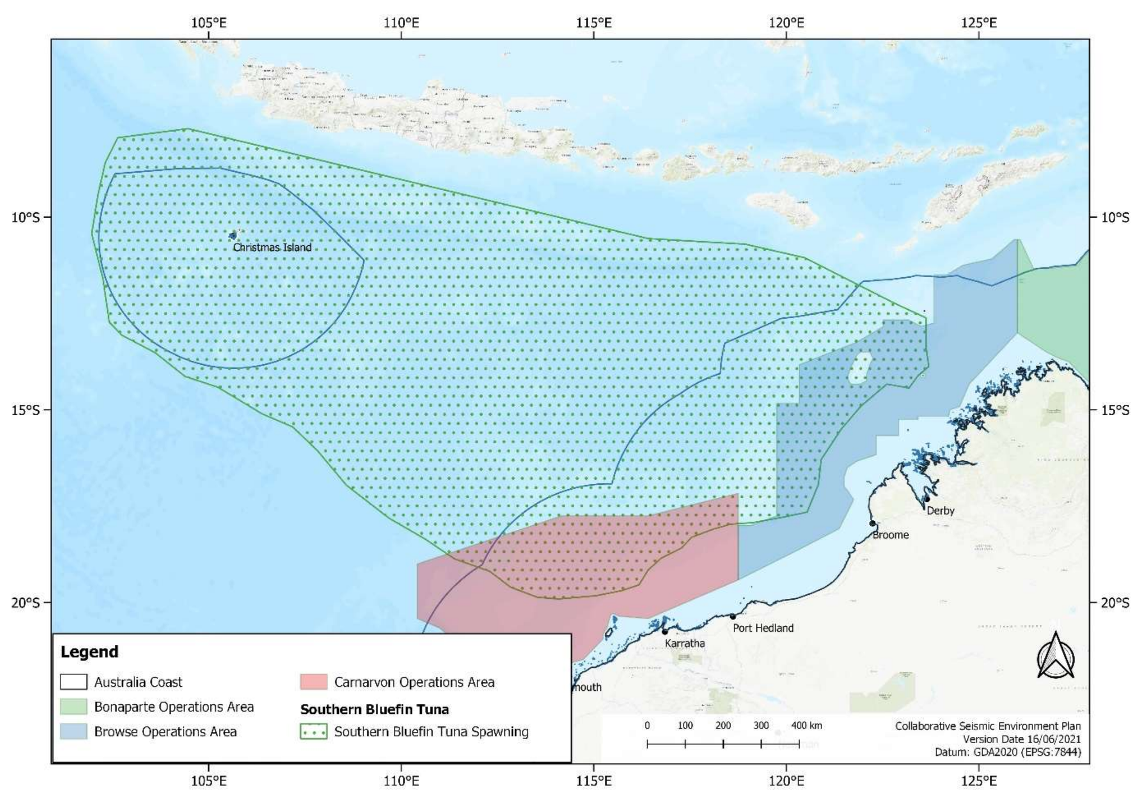


Figure 5-78: CSEP OA overlap with the Southern Bluefin Tuna Spawning Ground

6. Stakeholder Consultation

This section details how the requirements in relation to stakeholder consolation of the OPGGS(E) Regulations have been undertake for the CSEP.

One of the aims of the CSEP was to address long-standing issues affecting stakeholders in relation to stakeholder consultation such as stakeholder fatigue, variation in material provided by titleholders, and clarity on when and where surveys will occur.

Stakeholder engagement was undertaken in two phases:

- Phase 1: Development of the Operational and Adjustment Protocols with the commercial fishing industry.
- Phase 2: Engagement with relevant stakeholders in the development of the CSEP.

6.1 Consultation Approach

The consultation approach the CSEP undertook was:

- Identify stakeholders that may be potentially affected by the activity.
- Determine possible consequences of the activity on each stakeholders' functions, interests or activities from previous knowledge, reviewing any public statements by the stakeholder as to how they want to be engaged by titleholders and/or consulting with stakeholders.
- Provide sufficient information, based on possible consequences and the way the stakeholder would like to be consulted, for the stakeholder to be able to make an informed assessment of the possible consequences of the activity on their functions, interests or activities.
- Allow a reasonable period for the stakeholder to review and respond to any information provided, typically two to four weeks.
- Provide further information either requested by the stakeholder or that became available during the consultation period and allow a reasonable time for the stakeholder to review and respond. Depending on the information provided this may take between one to four weeks.
- Ensure stakeholders are informed about the consultation process and how their feedback, questions and concerns are considered in the EP.

6.2 Stakeholder Identification

The CSEP titleholders have been active in the CSEP OA for numerous years and are familiar with marine users and other stakeholders relevant to the CSEP OA.

Relevant stakeholders were identified by reviewing:

- CSEP titleholder's stakeholder lists.
- Accepted EPs for seismic surveys within the CSEP OA.

- Discussions with identified stakeholders to identify other potentially impacted persons.
- Commonwealth and State fisheries jurisdictions and fishing effort in the region including fishing tour operators. See Section 5.8 for how this was done.
- NOPSEMA Guideline Consultation with Commonwealth Agencies with Responsibilities in the Marine Area.
- Review of Parks Australia authorisations for diving and research activities undertaken within Australian Marine Parks (https://parksaustralia.gov.au/marine/activities/authorisations-issued/2021-22/).

Table 6-1 details the relevant stakeholders identified and groups them by the categories listed under OPGGS(E) Regulations.

Table 6-1: Relevant stakeholders for the activity

Stakeholder	Relevance	Information Category (see
Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant		
Australian Communications Media Authority (ACMA)	Australian Government agency responsible for the regulation of broadcasting the internet, radio communications and telecommunications. Under the OPGGS 2006 companies must manage risk and avoid accidental damage to Australia's submarine telecommunication cables. The CSEP OA overlaps with subsea communication cables.	1
Australian Fisheries Management Authority (AFMA)	Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources. The CSEP OA is within a Commonwealth fishery area. AFMA expects petroleum operators to consult directly with fishing operators or via their fishing association body about all activities and projects which may affect day to day fishing activities.	1
Australian Hydrological Office (AHO)	Australian Government agency responsible for issuing notices to mariners.	2
AMSA Joint Rescue Coordination Centre (JRCC)	Australian Government agency responsible for maritime safety, adherence to advice, protocols, regulations. Issue Auscoast warnings	1
Department of Agriculture, Water and the Environment (DAWE)	As the Department's functions, interests and activities have been incorporated in the requirements of the Program, the Department is not considered a relevant agency for consultation purposes under the Environment Regulations.	NA
DAWE - Biosecurity	DAWE (marine pests) has primary policy and regulatory responsibility for managing biosecurity for incoming goods and conveyances, including biosecurity for marine pests. The Department is the relevant agency where an offshore activity has the potential to transfer marine pests between installations and mainland Australia.	1

Stakeholder	Relevance	Information Category (see
	The CSEP OA is in commonwealth waters.	
DAWE - Fisheries	The Department has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. The CSEP OA overlaps is in commonwealth fisheries	1
Department of Defence (DoD)	The CSEP OA is within Australian Defence Force training areas.	1
Department of Foreign Affairs and Trade (DFAT)	The Department manages Australia's relationships and interaction with the governments of our neighbouring countries. The activity poses an oil spill risk that could result in impacts to other international jurisdictions.	1
Director of National Parks (DNP)	The DNP is the statutory authority responsible for administration, management and control of Australian Marine Parks (AMPs). The DNP is a relevant person for consultation where: • the activity or part of the activity is within the boundaries of a proclaimed AMP. • activities proposed to occur outside a reserve may impact on the values within an AMP. • an environmental incident occurs in Commonwealth waters surrounding an AMP and may impact on the values within the park. The CSEP OA is within the boundaries of a proclaimed AMP.	1
Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP may be relevant		
Department of Biodiversity, Conservation and Attractions (DBCA)	The Department is a responsible for the management of State marine parks and reserves and protected marine fauna and flora. The CSEP OA is not within a State marine park or reserve, but the activity may impact on a State marine park or reserve.	1
NT Aboriginal Areas Protection Authority (APA)	Independent statutory authority established under the Northern Territory Aboriginal Sacred Sites Act. The Authority is responsible for overseeing the protection of Aboriginal sacred sites on land and sea across the whole of Australia's Northern Territory. The CSEP EMBA overlaps Indigenous Protected Areas.	1
NT Department of Chief Minister and Cabinet (CMC) - Oil and Gas Division	Responsible for oil and gas development in NT.	1
NT Department of Environment, Parks and Water Security (DEPWS)	DEPWS is the control agency for marine pollution emergencies in NT waters. The activity poses an oil spill risk to NT waters.	1
NT Department of Industry, Tourism and Trade (DITT) - Fisheries	DITT Fisheries is responsible for managing NT fisheries. The CSEP OA overlaps with NT managed fisheries.	

Stakeholder	Relevance	Information Category (see
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD is responsible for managing West Australian State fisheries. The CSEP OA overlaps with WA managed fisheries.	1
WA Department of Transport (DoT)	DoT is the control agency for marine pollution emergencies in State waters. The activity poses an oil spill risk to WA waters.	1
The Department of the Responsible State or Northern Territory Minister		
WA Department of Mines, Industry Regulation and Safety (DMIRS)	Department responsible for the management of offshore petroleum in the adjacent WA waters.	1
NT Department of Industry, Tourism and Trade (DITT)	Department responsible for the management of offshore petroleum in the adjacent NT waters.	1
A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP		
Australian Institute of Marine Science (AIMS)	Undertake research in the offshore marine environment. The CSEP OA overlaps areas where AIMS undertakes research.	1
Amateur Fishermen's Association of the Northern Territory (AFANT)	AFANT is recognised by both the NT and Commonwealth Governments as the peak body representing recreational fishing interests in the Northern Territory. CSEP OA may overlap recreational fishing areas.	1
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA is the peak body representing Southern Bluefin Tuna ranching companies in Australia. CSEP OA overlaps southern blue fin tuna spawning area.	1
Charter Fishing Operators	The CSEP OA overlaps areas where charter fishing occurs. Charter fishing operators were identified from titleholder's stakeholder lists and EPs, industry website searches, NT DITT and WA DPIRD tour operators lists and DNP authorisations database.	1
Commercial fishing licence holders	The CSEP OA overlaps areas where Commonwealth, NT and WA commercial fishing occurs.	1
Chevron Australia Pty Ltd	Titleholder for the Wheatstone 4D Marine Seismic Survey that may be undertaken within the CSEP OA.	1
Commonwealth Fisheries Association (CFA)	Peak association representing commercial fishing in Commonwealth fisheries. CSEP OA overlaps commonwealth fisheries.	1

Stakeholder	Relevance	Information Category (see
INPEX Browse E&P Pty Ltd	Titleholder for the 2D Seismic Survey WA-532-P, WA-535-P and WA-50-L that maybe undertaken within the CSEP OA. See records in Appendix G CSEP Consultation.	1
Marine Tourism Operators - diving	The CSEP OA overlaps areas or has potential impacts on area where diving via marine tourism operators may occur. Marine Tourism Operators were identified from titleholder's stakeholder lists and EPs, industry website searches and DNP authorisations database.	1
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	Independent advisory committee that provides advice to the Commonwealth and State Environment Ministers on the protection, conservation, presentation, and management of the values of the World Heritage area. The CSEP OA abuts the Ningaloo Coast World Heritage Area.	1
Northern Prawn Fishery Industry Pty Ltd	Industry body for Northern Prawn Fishery. CSEP OA overlaps Northern Prawn Fishery.	
Northern Territory Seafood Council (NTSC)	Industry body for NT WA fisheries including and aquaculture. CSEP OA overlaps NT fisheries.	1
Pearl Producers Association	Industry body for pearl producers. CSEP OA does not overlap any pearl operations, however, impacts to pearl broodstock has been raised previously by pearl producers.	1
Vocus Communications	Vocus Communications is the operator of the North West Cable System which forms a key component to one of Australia's largest nationwide fibre optic networks. The CSEP OA overlaps the North West Cable System.	1
Western Australian Fishing Industry Council (WAFIC)	Industry body for WA fisheries including pearling and aquaculture. CSEP OA overlaps WA fisheries.	1
Woodside Energy	Titleholder for the Galactic Hybrid 2D MSS and Scarborough 4D B1 that maybe undertaken within the CSEP OA.	1
Any other person or organisation that the titleholder considers relevant		
Aboriginal Corporations: Balanggarra Aboriginal Corporation Bardi and Jawi Niimidiman Aboriginal Corporation Dambimangari Aboriginal Corporation	Indigenous groups who have cultural values within marine parks within the CSEP OA or outside the CSEP OA that may be impacted by the seismic surveys.	1

Stakeholder	Relevance	Information Category (see
Australian Institute of Marine Science (AIMS)	Potential for diving and research within CSEP OA and area of impact.	1
Exmouth Game Fishing Club	Undertake game fishing off Exmouth and have previously raised concerns in relation to seismic surveys.	1
Kimberley Land Council	Indigenous body in the Kimberley region working to secure native title recognition, conduct conservation and land management activities.	1
Minderoo Foundation	Potentially undertake marine research in the CSEP OA.	1
Reef Life Survey	Potentially undertake marine research in the CSEP OA.	1
University of Western Australia (UWA)	Potentially undertake marine research in the CSEP OA.	1

The following are not impacted by the CSEP activities but were kept informed of the Operational and Adjustment Protocol	
Australian Petroleum Production & Exploration Association (APPEA)	Commonwealth Department of Industry, Science, Energy and Resources (DISER)
Fisheries Research and Development Corporation (FRDC)	International Association of Geophysical Contractors (IAGC) know called Energeo Alliance
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	South East Trawl Fishing Industry Association (SETFIA)
Western Rick Lobster Council (WRLC)	

6.3 Provisions of Information

The OPGGS(E) Regulations require titleholders to 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.

To determine the type of information to provide to a stakeholder an Information Category was developed and is detailed in Table 6-2.

Table 6-2: Information Category to Determine Information Provided Stakeholder

Information Category	Description	Information Type
1	Organisations or individuals whose functions, interests or activities may be impacted by the activity.	Information Sheet and/or provision of information as per organisations consultation guidance material. Provision of further information where required.

Information Category	Description	Information Type
		Meeting or phone call where required.
2	Organisations who receive activity commencement and cessation notices.	Commencement and cessation notices.
3	Organisations or individuals whose functions, interests or activities will not be impacted by the activity but want to be kept up to date about the with CSEP.	Information Sheet

6.4 Summary of Stakeholder Consultation

Appendix G provides a summary of the stakeholder consultation undertaken as part of the development of the CSEP. The summary provides details of the information sent to stakeholders and any response received. It also details the assessment undertaken of any objection or claims. Where an objection or claim was substantiated via evidence such as publicly available credible information and/or scientific or fishing data, it was assessed as per the impact and risk evaluation process detail in Section 2 and controls applied where appropriate to ensure impacts and risks are managed to ALARP and an acceptable level.

Where an objection or claim was raised by a stakeholder, they were provided feedback as to:

- whether the objection or claim was substantiated.
- how the objection or claim was evaluated.
- if additional controls were required to manage the impact or risk to ALARP and an acceptable level.
- if the objection or claim was not substantiated and the reasons why.

6.5 Ongoing Stakeholder Consultation and Notifications

Titleholders proposing to undertake a seismic survey under the CSEP will identify relevant stakeholders for engagement and undertaken survey notifications as per Table 6-3. The titleholder will retain records of ongoing stakeholder engagement as per Section 8.1.9 Document Management.

Any objections or claims raised from ongoing consultation will be managed as per Section 6.5.2

6.5.1 Ongoing identification of relevant persons

New or changes to relevant persons will be identified through ongoing consultation with stakeholders including peak industry bodies and the environment plan review process detailed in Section 8.2.3. If new relevant persons are identified they will be contacted and provided information about the CSEP and titleholder specific surveys as relevant to their functions, interests or activities. Any objections or claims raised will be managed as per Section 6.5.2.

6.5.2 *Management of objections or claims*

If any objections or claims are raised these will be substantiated via evidence such as publicly available credible information and/or scientific or fishing data. Where the objection or claim is substantiated, it will be assessed as per the risk assessment process detail in Section 2 and controls applied where appropriate to manage impacts and risks to ALARP and an acceptable level.

Stakeholders will be provided with feedback as to whether their objection or claim was substantiated, and if not why, and if it was substantiated how it was assessed and if any controls were put in place to manage the impact or risk to ALARP and an acceptable level. If the objection or claim triggers a revision of the EP this will be managed as per Section 8.3. This will also be communicated to the stakeholder.

Table 6-3: Ongoing stakeholder consultation and notification requirements

Stakeholder	Ongoing Stakeholder Requirement	Timing
Relevant stakeholders	Ongoing engagement including: • Stakeholder communication of information and addressing queries and concerns via email, phone, or meeting. • Updates to online portal for CSEP updates and seismic survey schedules to ensure at any one time, the most recent and correct information is readily available as soon as is practical.	As required
WA DMIRS	Provide a notification to petroleum.environment@dmirs.wa.gov.au when the CSEP has been submitted to NOPSEMA for consideration.	On submission of CSEP to NOPSEMA
WA DoT	Provide a final version of the CSEP OPEP and Oil Spill Response and Monitoring Bridging Plan Template once accepted by NOPSEMA.	On acceptance by NOPSEMA
Commercial Fishers	Annual industry roundtable forum with CSEP consortium members, commercial fishers, and peak bodies, where all publicly releasable plans for seismic surveys proposed to be undertaken under the CSEP will be presented and discussed by CSEP consortium members. Information detailing performance against the controls within this protocol will also be circulated. The forum will encourage commercial fisher input regarding any relevant updated fisheries information for petroleum titleholders and on how each industry can better work together going forward.	Annually
NCWHAC	Annual look-ahead of upcoming seismic surveys proposed to be conducted under the CSEP.	Annually
Relevant Stakeholders: AIMS AMSA Dept. of Defence Reel Teaser NCWHAC	6 monthly look-ahead to identify upcoming seismic surveys proposed to be conducted under the CSEP. This will include a map of the proposed survey locations and proposed timing of surveys.	6 monthly

Stakeholder	Ongoing Stakeholder Requirement	Timing
WA Department of Biodiversity, Conservation and Attractions (DBCA) WA Department of Transport (DoT)		
NT Department of Environment, Parks and Water Security (DEPWS)	The NT Government is currently in a transitional phase with its spill management arrangements. Prior to a seismic survey occurring that has the potential to impact NT waters, the titleholder will contact DEPWS and confirm the NT arrangements.	Prior to a seismic survey occurring that has the potential to impact NT waters
Relevant stakeholders NOPSEMA NCWHAC	"Notification of Intent" to conduct a seismic survey under the CSEP, in a standardised format, as detailed in Operational Protocol. Notification will also be provided as soon as any changes to planned survey details or commencement timing become apparent. Note: NOPSEMA requested they be notified of a proposed seismic survey by the titleholder responsible for that survey 3 months prior to the survey commencing, where possible (NOPSEMA letter dated 14 April 2022).	3 months prior to survey
Dept. of Defence	DoD advised that a Notice to Airmen (NOMAN) was to be raised with Air services Australia when operating within a restricted airspace. Notifications to be provided to nof@airservicesaustralia.com. DoD advised notification would be needed 5 weeks prior to the commencement of activities located within 40 km of an exercise area. Notifications to be provided to Offshore.Petroleum@defence.gov.au.	5 weeks prior to survey
Vocus	If a survey is to be within 5 km of the North West Cable System provide details of the survey, including a shape file, to: vocusom@vocus.com.au noc@vocus.com.au	At least 4 weeks prior to survey
Relevant stakeholders	Stakeholder notification of activity commencement. Notification to include: • location of survey, coordinates and map • timing of survey: expected start and finish date and duration • vessels details including call sign and contact • requested clearance from other vessels • titleholder contact details.	No less than 10 days prior to mobilisations

Stakeholder	Ongoing Stakeholder Requirement	Timing
Relevant stakeholders	During the activity survey vessels will establish and maintain regular on-water communications with any vessels that may be operating within a survey Operations Area, including daily updates regarding survey vessel activities, including proposed movements within the Operations and Adjustment Areas. Vessel to vessel communications will primarily be conducted via VHF marine radio, though alternate viable options, such as mobile phone or emails, are permitted where available.	During activity
AHO	Notification of activity for publication of notice to mariners. Information provided should detail: • type of activity • survey size, location and coordinates • area of operation and requested clearance from other vessels • period that NTM will cover (start and finish date) • vessel details including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), contact details and calls signs • titleholder contact details. Only need to update AHO of changes including if survey start or finish date changes. Do not need to provide cessation notification if NTM covers period of survey.	3 weeks prior to activity commencing
AMSA - JRCC	Notification of activity for publication of Auscoast warning. Information provided should detail: • type of activity • survey size, location, and coordinates • period that warning will cover (start and finish date) • vessel details including vessel name, call-sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), contact details and calls signs • titleholder contact details.	48 – 24 hours prior to activity commencing
NOPSEMA WA DMIRS NT DITT	Regulatory notification of start of activity. A titleholder must notify the Regulator that an activity is to commence at least 10 days before the activity commences. A titleholder must notify the proposed date of commencement to the Department of the responsible State Minister or responsible Northern Territory Minister.	10 days prior to activity commencing
NOPSEMA WA DMIRS NT DITT	Regulatory notification of cessation of activity. A titleholder must notify the Regulator that an activity is completed within 10 days after the completion.	Within 10 days of activity completion
NCWHAC	Provide routine fauna sighting data (whales, whale sharks and turtles) and any non-routine monitoring such as noise applicable to the values of the Ningaloo Coast World Heritage Area.	Within 1 month of titleholder receiving final reports.

7. Environmental Impact and Risk Evaluation

In accordance with Regulation 13(5) and (6) of the OPGGS(E) Regulations, this section details and evaluates the environmental impacts and risks associated with the activity the methodology described in Section 2.

Table 7-1 details the potential impacts (planned) and risks (unplanned) associated with the environmental aspects of the activity.

For the seismic operation impacts and risks associated with the deployment, towing and use of the seismic streamers and source are identified.

For vessel operations impacts and risks associated with the operation of the vessel during the seismic survey are identified.

Table 7-1: Activity and aspect relationship

	Planned							Unplanned			
Operation	**Seabed disturbance**	**Acoustic emissions**	**Atmospheric emissions**	**Light emissions**	**Marine discharges**	**Fauna interaction**	**Displacement of marine users**	**Loss of equipment of waste**	**Introduction of marine pests**	**Deck and refuelling spills**	**Vessel collision**
Seismic		X				X	X	X			
Vessel		X	X	X	X	X	X	X	X	X	X
Helicopter		X	X			X					
Spill response	X	X		X		X	X				

7.1 Impact: Acoustic Emissions

7.1.1 Source of Impact

Continuous underwater acoustic emissions are generated by the survey and support vessels and helicopters. Underwater acoustic emissions from vessels are generated by thrusters, engines, and propellers. Underwater acoustic emissions from helicopters are generated via the engine and rotors.

Impulsive underwater acoustic emissions will result from the seismic source releasing compressed air (seismic pulse) that creates a sound wave that is directed downwards into the seabed.

Underwater acoustic emissions from a seismic source are characterised by high energy pulses of low frequency sound. The frequency of the sound produced from each seismic pulse is primarily less than 2 kHz, with the highest levels at frequencies in the range of 10-500 Hz (McCauley 1994).

The rate of sound attenuation from the seismic source is dependent on local sound propagation characteristics, including seawater temperature and salinity profiles, water depth, bathymetry and the geoacoustic properties of the seabed (McCauley 1994). While the seismic pulses are directed downwards, horizontal propagation may be detected over long distances due to the high intensity and low frequency properties of the sound.

Sound travels as a wave with the amplitude of the wave related to the amount of acoustic energy it carries. Figure 7-1 shows a representative sound wave and the sound measures used in this assessment. Table 7-2 provides definitions of the sound measures and other sound related terms used in this assessment.

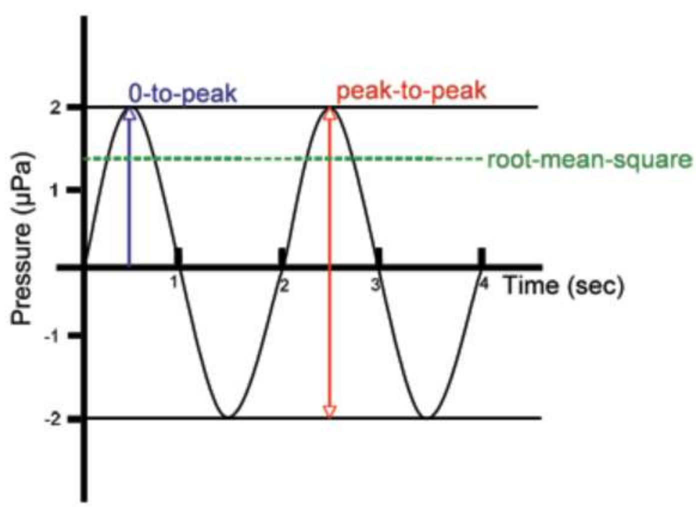


Figure 7-1: Representative Sound Wave and Sound Measures

Table 7-2: Sound Terminology

Team	Definition
0-to-peak or Peak sound pressure level (PK)	The peak pressure, also called the 0-to-peak pressure, is the range in pressure between zero and the greatest pressure of the signal. It is represented by PK and the unit dB re 1 µPa and summarised as dB PK.
Peak-to-peak sound pressure level (PK-PK)	The peak-to-peak pressure is the range in pressure between the most negative pressure and the most positive pressure of the signal. It is represented by PK-PK and the unit dB re 1 µPa or dB re 1 $\mu Pa^2 m^2$ and summarised as dB PK-PK.
Permanent threshold shift (PTS)	Permanent loss of hearing sensitivity caused by excessive sound exposure.
Received sound level	The sound level measured at a receiver.
Root mean square sound pressure level (RMS)	The root-mean-square pressure is the square root of the average of the square of the pressure of the sound signal over a given duration. It is represented by sound pressure level (SPL) and the unit dB re 1 µPa and summarised as dB SPL.
Sound exposure level (SEL)	A measure of the sound energy that considers both received level and duration of exposure. SEL is specified in terms of either single pulse (SEL) or a defined accumulation period (SEL_{cum}). For this assessment 24 hrs is used for the accumulation period and is shown as SEL_{24h}. Units are dB re 1 μPa^2 s or dB re 1 $\mu Pa^2 m^2 s$.
Source sound level	The sound pressure level or sound exposure level measured 1 metre from a theoretical point source that radiates the same total sound power as the actual source.
Temporary threshold shift (TTS)	Temporary loss of hearing sensitivity caused by excessive sound exposure.

7.1.2 Impact Pathway

Marine fauna use sound in a variety of functions, including social interactions, foraging, orientation, and responding to predators. The type and scale of effect of seismic sound emissions on receptors depends on several factors including the level of exposure, the physical environment, the location of the receptor in relation to the seismic source, how long the receptor is exposed to the sound, the exposure history, how often the sound repeats (repetition period) and the ambient sound level.

Seismic sound emissions can potentially affect marine fauna in three main ways:

- Impairment to hearing or other organs. Impacts may be temporary or permanent and may result in injury, physiological impacts, or mortality.
- Disturbance leading to temporary behavioural changes or displacement of fauna. The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation.
- Masking or interfering with other biologically important sounds including vocal communication, echolocation, signals, and sounds produced by predators or prey.

Receptors with the potential to be impacted by underwater sound from the seismic source are:

- Plankton including fish and invertebrate eggs and larvae
- Invertebrates including commercial species
- Fish including commercial species
- Sharks including whale sharks
- Turtles
- Marine mammals
- Divers
- Subsea cables

The levels of acoustic exposure that may result in injury or behavioural changes in marine fauna is an area of increasing research. Due to differences in experimental design, methodology and units of measure, comparison of studies to determine likely sound exposure thresholds can be difficult. On assessment of the available science, thresholds have been defined to inform the impact assessment, and interpretation of the numerical noise modelling results. A summary of relevant studies in relation to seismic acoustic emission impacts to receptors is provided in Appendix A.

7.1.3 Acoustic Modelling

For seismic surveys underwater acoustic modelling is typically commissioned as part of the preparation of an EP to understand the extent and magnitude of underwater sound emissions that may results from a seismic survey. It is best practice for seismic survey impact assessments to use underwater acoustic modelling to assess potential impacts to identified environmental and social receptors. The assessment is conducted by comparing modelled received underwater sound levels to defined noise effect criteria, as determined by scientific research and academic papers (refer to Appendix A), for the identified environmental and social receptors.

As the CSEP will allow for seismic surveys to be undertaken with the CSEP OAs; Bonaparte, Browse and Carnarvon (Figure 4-2), it is not specifically known where seismic surveys may be undertaken within these areas. On review of the acoustic modelling commissioned to date it was identified that there had been a significant amount of modelling undertaken in a variety of water depths, geomorphological features (shelf, slope, plateau) and seabed types (Figure 7-4). Thus, to determine the distances to the defined noise effect criteria the existing acoustic modelling data was used.

The selection criteria used to identify the acoustic modelling that could be used were:

- Acoustic modelling was undertaken using a validated seismic source model.
- Acoustic modelling results formed part of an accepted EP.
- Modelling locations were within the CSEP OA.
- Most recent sound effect criteria used.

On review of 49 seismic surveys EPs from 2013 to 2022, 19 acoustic modelling studies met the selection criteria. The modelling locations from these studies are shown in Figure 7-4 and show that the coverage of modelling is broad within the CSEP OAs. Water depths for the modelling locations ranged from 38 m to 969 m (Figure 7-2 and Figure 7-5). Seismic source size used for the modelling ranged from 2,360 cubic inch (cui) to 4,130 cui (Figure 7-3). As detailed in Section 4.6 the maximum seismic source size for the CSEP will be 4,130 cui (See Control Measure #3).

Once it was determined that the acoustic modelling that met the selection criteria covered a range of water depths, geomorphological features, and seabed types, which are the main criteria for noise propagation within the acoustic model, the data was collated for each sound effect criteria to determine an appropriate distance to the criteria to use in the impact assessment. The acoustic modelling data for sound effect criteria relevant to each receptor is in the following sections.

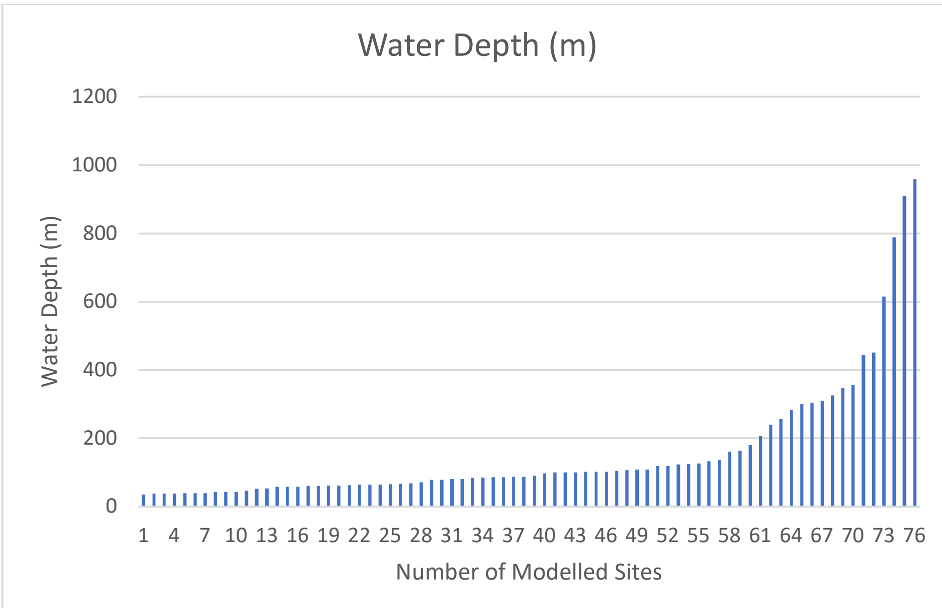


Figure 7-2: Acoustic Modelling Sites and Water Depth (m)

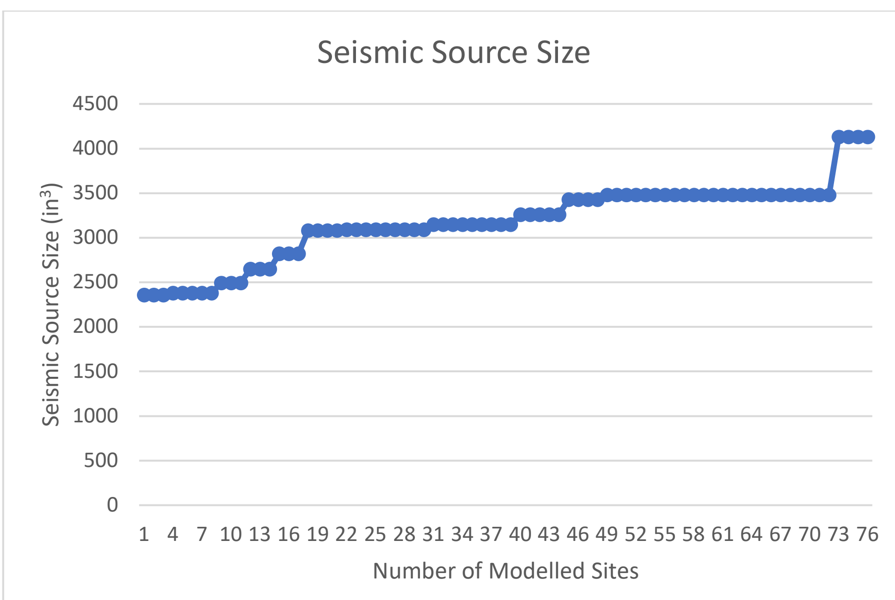


Figure 7-3: Acoustic Modelling Sites and Seismic Source Size (in^3)

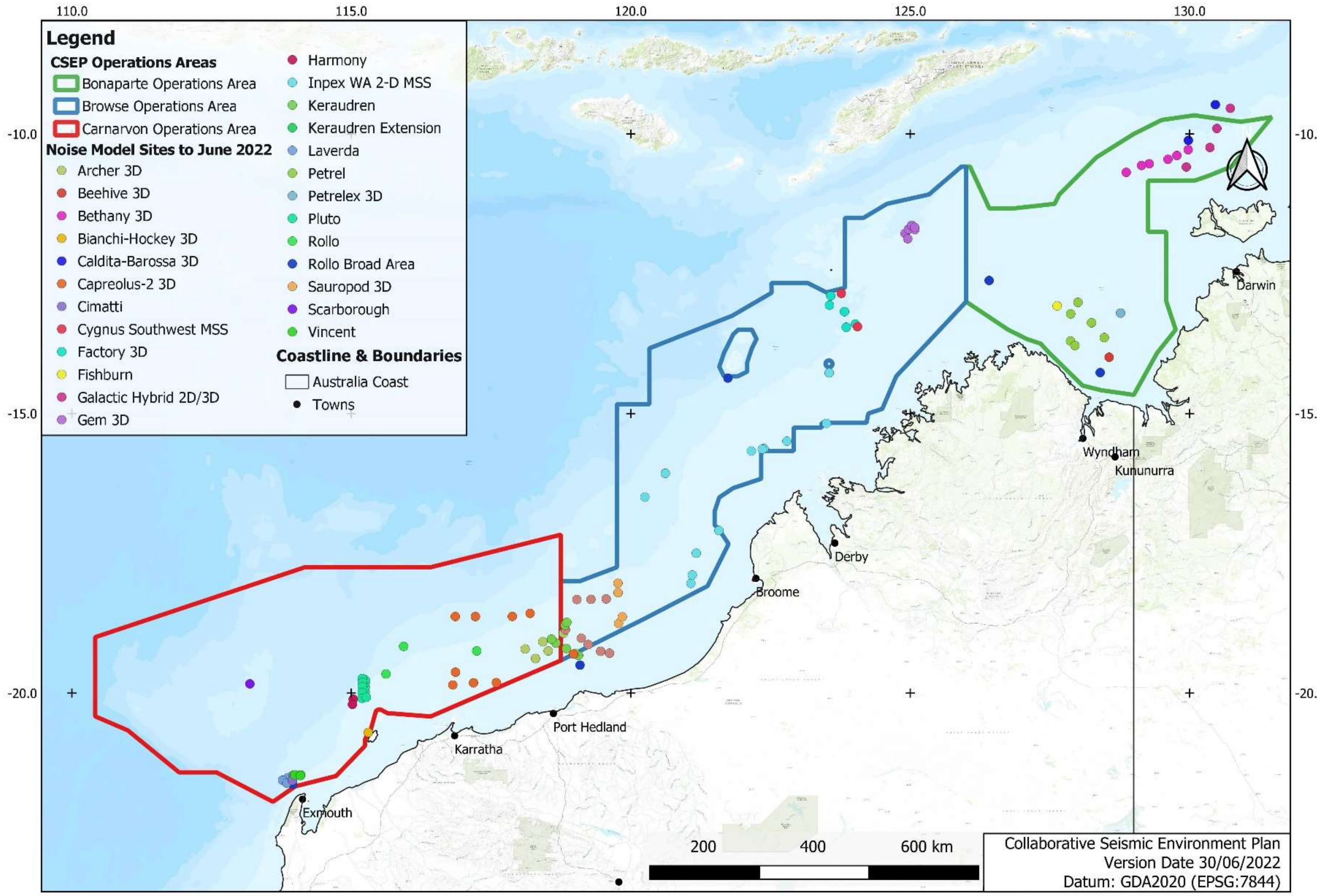


Figure 7-4: CSEP Operational Area and Acoustic Modelling Locations

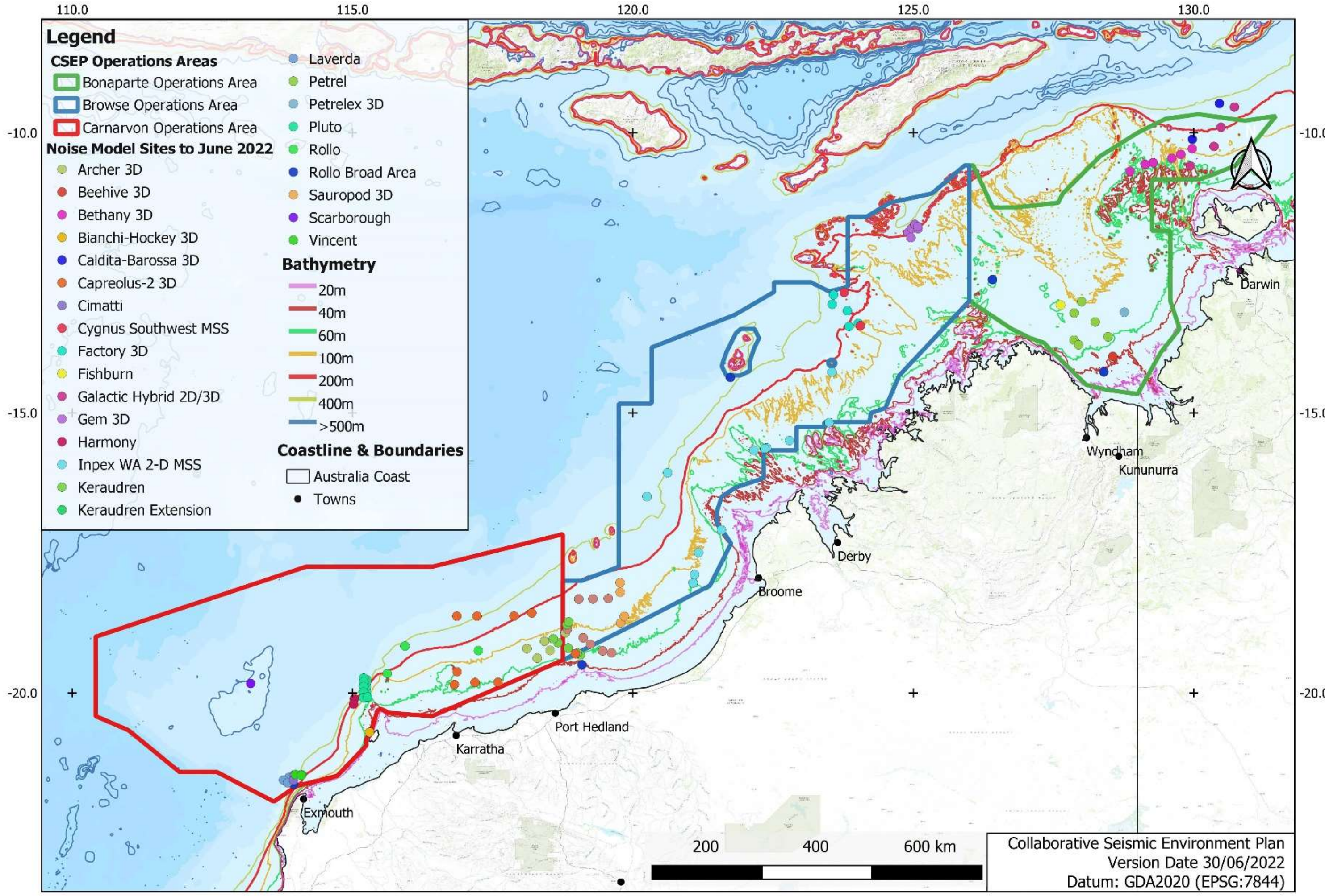


Figure 7-5: CSEP Operational Area and Acoustic Modelling Locations with Water Depth

7.1.4 Plankton including Fish and Invertebrate Eggs and Larvae

Plankton is a collective term for all marine organisms that are unable to swim against a current. This group is diverse and includes phytoplankton (plants) and zooplankton (animals), as well as fish and invertebrate eggs and larvae which includes coral spawn.

A summary of relevant studies in relation to seismic acoustic emission impacts to plankton including fish and invertebrate eggs and larvae is provided in Appendix A.

7.1.4.1 Sound Effect Criteria

Sound exposure guidelines for plankton have been established by the American National Standards Institute (ANSI) accredited report of Sound Exposure Guidelines for Fishes and Sea Turtles (Popper et al. 2014). The sound exposure guidelines from Popper et al. (2014) though based on pile-driving are comparable to other seismic sound studies such as Day et al. (2016a, 2016b) for embryonic lobsters and Fields et al. (2019) for copepods.

For plankton, the sound exposure guidelines provide sound exposure metrics for:

- Mortality and potential mortal injury.

Within these sound exposure guidelines, there was insufficient data to make a quantitative guideline for:

- Recoverable injury
- Temporary threshold shift (TTS) in hearing
- Behaviour
- Masking

For these impacts, a subjective approach of 'relative risk' (low, moderate, and high) is used to assess risk at three distances from the seismic source (near - tens of metres, intermediate - hundreds of metres, and far - thousands of metres) as detailed in Table 7-3.

The sound exposure guidelines and predicted maximum distances from the acoustic modelling are detailed in Table 7-3 for mortality and potential mortal injury.

Figure 7-6, Figure 7-7, Figure 7-8 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound exposure guidelines. For the per pulse sound exposure guidelines the data is shown relative to water depth (Figure 7-6) and seismic source size (Figure 7-7) as the modelling for the per pulse criteria is at a specific location. For the cumulative sound exposure guideline, the modelling is done over a 24 hr period within a range of water depths thus the data is shown relative to seismic source size (Figure 7-8).

Table 7-3: Sound Exposure Guidelines and Predicted Maximum Distance for Plankton

	Mortality/Potential Mortal Injury		**Recoverable Injury and TTS**		**Behavioural**	
Threshold Criteria	Few studies to base criteria on, however, Popper et al. (2014) provides acoustic criteria extrapolated from simulated pile driving signals which have a more rapid rise time and greater potential for trauma than pulses from a seismic source. Popper et al. (2014) does not recommend a timeframe for cumulative sound exposure levels and thus 24 hrs has been used as is current industry practice.		There are currently no acoustic criteria for plankton, fish and invertebrate eggs or larvae, however, a scale of relative risk is provided in Popper et al. (2014). The scale assumes that larvae have similar sensitivity to sound as juvenile and adult fish, and that recoverable injury and TTS are possible.		There are currently no acoustic criteria for plankton, fish and invertebrate eggs or larvae, however, a scale of relative risk is provided in Popper et al. (2014). The scale assumes that a behavioural response is possible.	
Relevance of thresholds adopted	Popper et al. (2014) has been used as this cites many of the current references and studies on potential impacts of noise emissions on fish eggs and larvae, and when compared to other studies the threshold levels are similar to those proposed, e.g., Day et al. (2016a and 2016b); Fields et al. (2019). Popper et al. (2014) suggest that injury to larvae resulting from seismic impulses may occur for sound exposures above 207 dB PK or above 210 dB SELcum. However, Popper et al. (2014) suggest that recoverable injury and TTS is likely within tens of metres of a seismic source, which is generally less than the distance associated with their proposed mortal injury threshold, hence there is some discrepancy. The threshold proposed for mortal injury is derived from pile driving impacts to fish and is likely to be conservative. The body of literature indicates that mortality and sub-lethal injury are limited to within tens of metres of seismic sources. Masking is identified as low at near, intermediate and far distances.					
Sound exposure guideline	**Per pulse**	**SELcum**	**Proximity to sound source**	**Relative risk**	**Proximity to sound source**	**Relative risk**
	207 dB PK	210 dB SELcum	Near – tens of metres	Moderate	Near (tens of metres)	Moderate
			Intermediate – hundreds of metres Far – thousands of metres	Low	Intermediate – hundreds of metres Far – thousands of metres	Low
Modelled Distance	250 m	100 m	NA	NA	NA	NA

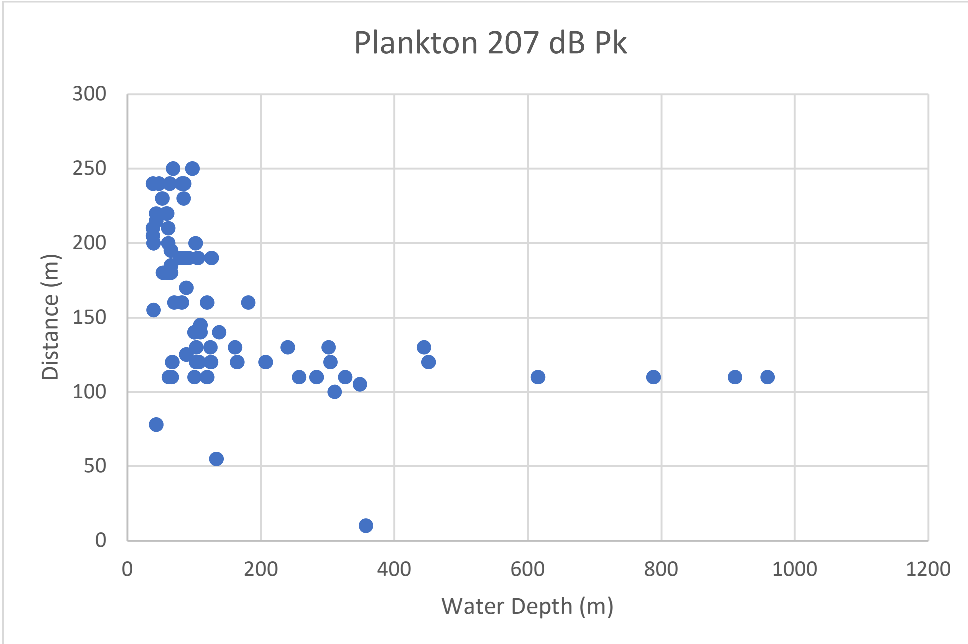


Figure 7-6: Distance to Plankton 207 dB PK Sound Effect Criteria against Water Depth

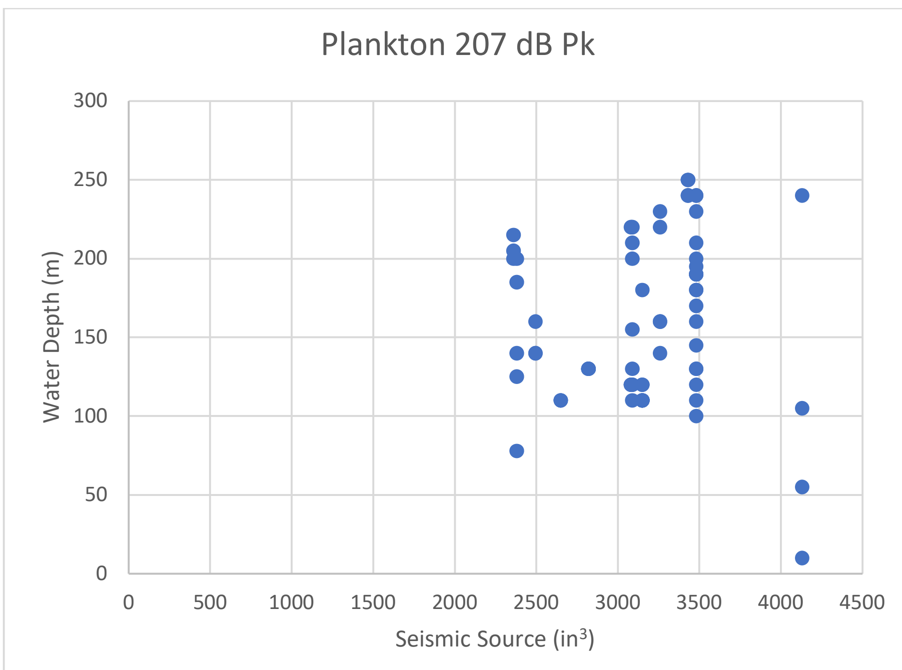


Figure 7-7: Distance to Plankton 207 dB PK Sound Effect Criteria against Seismic Source

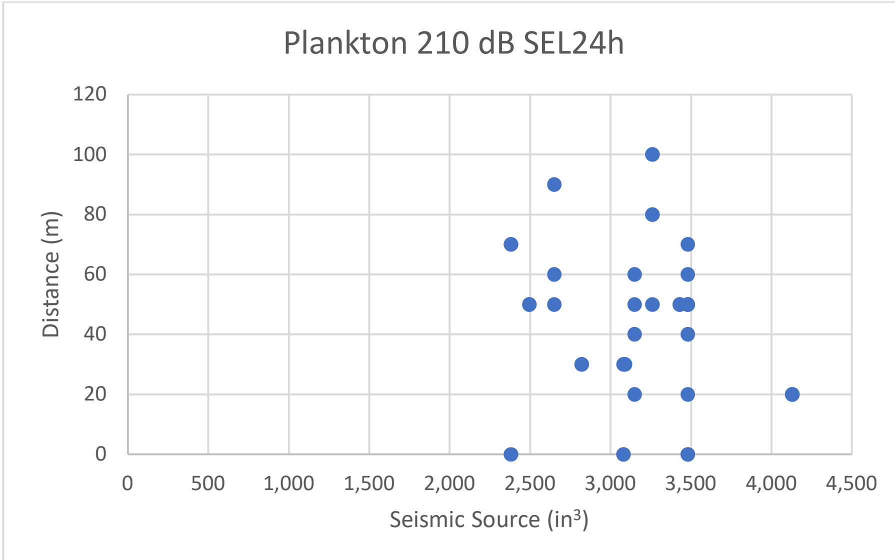


Figure 7-8: Distance to Plankton 210 dB SEL24h Sound Effect Criteria against Seismic Source

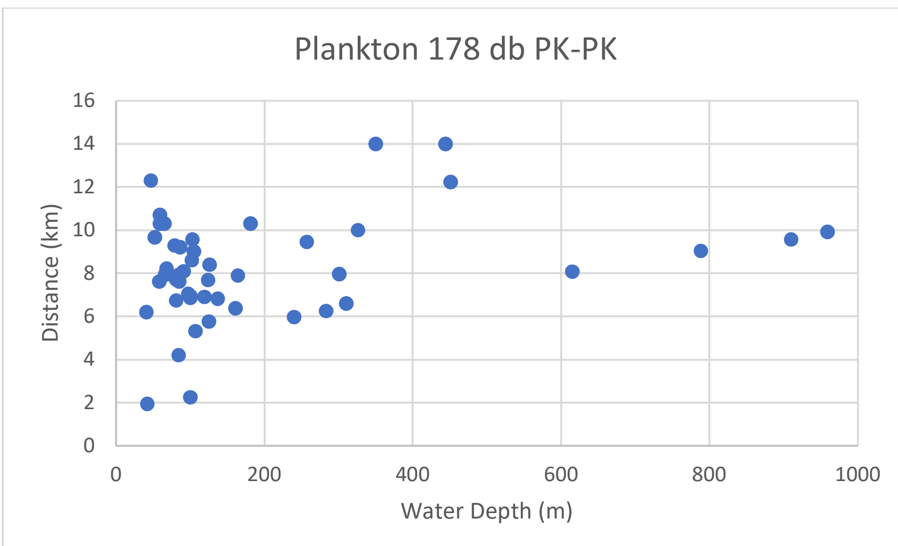


Figure 7-9: Distance to McCauley et al. (2017) Zooplankton 178 dB PK-PK against Water Depth

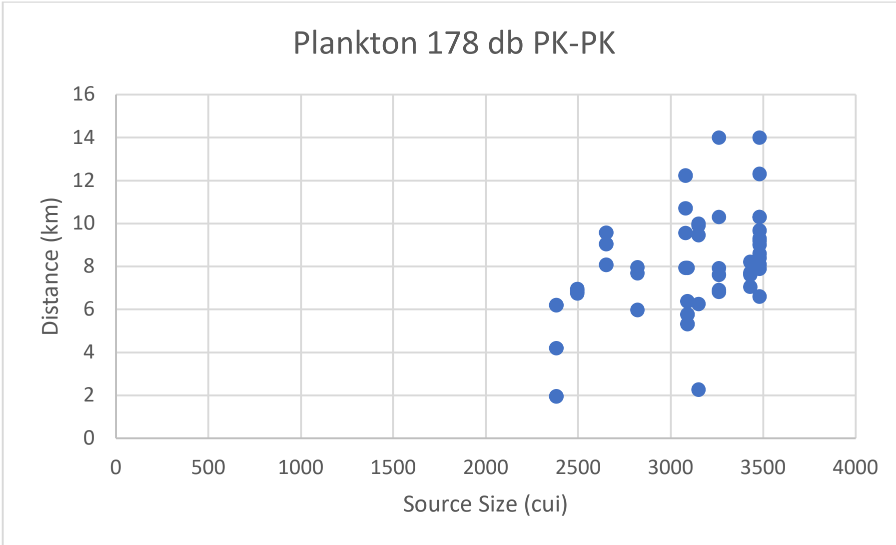


Figure 7-10: Distance to McCauley et al. (2017) Zooplankton 178 dB PK-PK against Seismic Source

7.1.4.2 Impact Pathway

Plankton is a key component in oceanic food chains and supports nearly all marine life and is the dominant biomass of marine ecosystems (CSIRO 2015).

To identify the values and sensitivities associated with plankton a review was undertaken of the existing environment within the CSEP OA and out to 250 m of the CSEP OA to identify those receptors associated with plankton. This review identified the following values and sensitivities:

- Fish and invertebrate eggs and larvae including coral spawning
- Commercial fish and invertebrate species eggs and larvae
- Whale shark foraging
- Pygmy blue whale foraging

7.1.4.3 Predicted Level of Impact

As detailed from the studies discussed in Appendix A, mortality and injury to plankton has been identified from seismic source sound emissions within close proximity to the seismic source. This can have direct impacts to plankton including fish and invertebrate larvae and indirect impacts to receptors that feed on plankton and recruitment of fish and invertebrate species.

The extent of the area of impact is predicted to be a maximum of 250 m from the sound source during survey acquisition (Table 7-3, Figure 7-6, Figure 7-7, Figure 7-8).

The severity is assessed as Minor (2) based on impacts to zooplankton are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- The Working Group on the Effects of Sound on Fish and Turtles Popper et al. (2014) detail there is a low relative risk of plankton experiencing masking impacts at all distances from the seismic source and a moderate risk of recoverable injury, TTS, behavioural impacts near (tens of metres) from the seismic source. At distances greater than near (tens of metres) the risk is low (Table 7-3).

- Phytoplankton and zooplankton biomass in the oceans can vary significantly at spatial scales ranging from hundreds of metres to hundreds of kilometres and temporal scales of hours, days, seasons and inter-annually, due to tidal and large-scale currents, bathymetry, temperature, salinity, water chemistry parameters and other environmental factors (Gibbons & Hutchings 1996; Holliday et al. 2011; McKinnon et al. 2008; Pearce et al. 2000; Sutton & Beckley 2017). Thus, plankton will be spatially and temporally variable throughout a seismic survey.
- Any potential mortality or mortal injury effects to plankton must be assessed in the context of natural mortality rates. Mortality or mortal injury impacts to plankton (including fish eggs and larvae) resulting from seismic surveys are likely to be inconsequential compared to natural mortality rates, which are very high, exceeding 50% per day in some species and commonly exceeding 10% per day (Tang et al. 2014). In a review of mortality estimates (Houde and Zastrow 1993) the mean mortality rate for marine fish larvae was equivalent to a loss of 21.3% per day. In the experiment undertaken by McCauley et al. (2017) zooplankton mortality rate background levels were 19%. Thus, predicted impacts to zooplankton from the seismic survey are likely to be within natural mortality rates. Sætre and Ona (1996) calculated that under the 'worst-case' scenario, the number of larvae killed during a typical seismic survey was 0.45% of the total population, and they concluded that mortality rates caused by exposure to the seismic source are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant.
- Considering the McCauley et al. (2017) effect criteria of 178 dB re 1 μPa PK-PK (which has been recognised as providing a highly conservative, precautionary approach not considered to be rigorous or represent the best available science), this equates to a modelled minimum distance of 1.95 km and a maximum distance of 14 km (Figure 7-9 and Figure 7-10). Richardson et al. (2017) modelled the results from McCauley et al. (2017) in the context of ocean ecosystem dynamic and zooplankton population dynamic. They determined that zooplankton abundance would not be adversely affected as the extensive movement of water masses carrying plankton through seismic survey area, and the rapid reproductive cycle and high reproductive potential characteristics of planktonic organisms. The study showed that it would take approximately three days after the end of a typical 4000 cubic inch seismic survey for the zooplankton to recover to original levels and that zooplankton communities can begin to recover during the seismic survey such that a continuous decline in zooplankton throughout the duration of the seismic survey is not anticipated and parts of the survey area would be replenished as the survey progressed.
- Predicted impacts to plankton do not remove them from the food web and as such the nutrients and energy they contain are retained within the ecosystem. Even after plankton die, their carcasses remain in the water column for several days where they are scavenged before any remaining carcasses sink to the seafloor to be consumed by opportunistic benthic organisms (Kirillin et al. 2012; Tang et al. 2014; Dubovskaya et al. 2015).

- The area of predicted impact does not overlap the whale shark high density foraging BIA off Ningaloo but does overlap the whale shark foraging BIA (Figure 5-21). Whale sharks seasonally aggregate in coastal waters off Ningaloo Reef between March and July, at Christmas Island between December and January, and in the Coral Sea between November and December. These seasonal aggregations are thought to be linked to localised seasonal 'pulses' of food productivity (TSSC 2015a). If whale sharks are moving between these areas to feed, it could be assumed that they are not reliant on feeding while migrating and that feeding is opportunistic. Mortality or mortal injury effects to plankton does not impact on whale sharks being able to feed on them as the plankton will still be available within the water column. In addition, any impacts are likely to be within natural mortalities rates thus not effecting the availability of plankton available for foraging.
- The area of predicted impact overlaps the pygmy blue whale possible foraging BIAs off Exmouth and Scott Reef. Evidence for feeding off the north-west of Australia is based on limited direct observations or through indirect evidence, such as the occurrence of krill in proximity of whales, or satellite tagged whales showing circling tracks (DoE 2015). Pygmy blue whales feed on krill a type of planktonic crustacean (McCauley et al. 2004, Rennie et al. 2009). Mortality or mortal injury effects to krill does not impact on pygmy blue whale being able to feed on them as the krill will still be available within the water column. In addition, any impacts to krill are likely to be within natural mortalities rates thus not effecting the availability of krill available for foraging.
- The area of impact does not overlap coral reefs where spawning may occur, typically between March and April in northern Australia. However, coral spawn may be present in the water column within a survey area from being transported by currents. As there have been no studies on impacts to coral spawning from seismic surveys this evaluation applies the information for zooplankton detailed in this section. As for plankton, coral spawn will be spatially and temporally variable throughout a seismic survey and potential mortality or mortal injury effects to coral spawn must be assessed in the context of natural mortality rates which as per plankton is high and thus mortality rates caused by exposure to the seismic source would be low compared to natural mortality and unlikely to result in the lack of replenishment of coral populations.

Commercial fish and invertebrate spawning and recruitment

As detailed from the studies discussed in Appendix A, mortality and injury to fish and invertebrate eggs and larvae have been identified from seismic source sound emissions within close proximity to the seismic source. This can have direct impacts to fish and invertebrate eggs and larvae and indirect impacts to recruitment of fish and invertebrate species.

From stakeholder consultation commercial fishers have raised concerns in relation to impacts to commercial fish spawning and recruitment as this can lead to a reduction in fish biomass available for commercial fishers.

The extent of the area of impact is predicted to be a maximum of 250 m from the sound source during survey acquisition (Table 7-3, Figure 7-6, Figure 7-7, Figure 7-8).

Commercial fish eggs and larvae

To evaluate the consequence to commercial fish spawning and potentially recruitment success and the sustainability of fish species the assessment considers:

- Spatial-temporal information to identify spawning areas and timing.
- Natural variability in fish distribution, spawning biomass and recruitment.
- Sustainability status of the fish stocks and fisheries.

This information is detailed in Table 5-46 and Table 5-47, and in summary:

There are no specific aggregation areas for spawning within the CSEP OA for bluespotted emperor, goldband snapper, grey mackerel, Rankin cod, red emperor, and ruby snapper. These species are widely distributed and spawn throughout their range rather than aggregating at specific locations (Newman 2020). They have extended spawning periods ranging from 151 to 303 days and the fishery biomass is sustainable. Bluespotted emperor, goldband snapper, Rankin cod and red emperor are each comprised of one biological stock while ruby snapper are comprised of two biological stocks (NT and WA, and east coast) and grey mackerel comprise two biological stocks (WA and north west NT) within the CSEP OA.

There is limited information on crimson snapper and saddletail snapper. Both are widespread Indo-Pacific species found throughout tropical Australian waters and as such it is likely that they spawn throughout their range rather than aggregating at specific locations, as per other commercially fished snapper species. Their stock status is sustainable, and the crimson snapper was found to be a single genetic stock in northern Australia; including the Timor Sea, the Arafura Sea and the Gulf of Carpentaria (Salini et al. 2006). Saunders et al. (2018) used otolith microchemistry and parasitology to identify separate biological saddletail snapper stocks in the Joseph Bonaparte Gulf, Timor and Arafura seas and Gulf of Carpentaria.

Seasonal aggregations of black jewfish occur throughout its distribution, and it has been speculated that these are for spawning (Saunders et al. 2016). A 2014 stock assessment indicated that black jewfish were overfished (Saunders et al. 2016). However, the most recent assessment using data up to 2019, indicates that current biomass has increased significantly to 93 per cent of unfished levels (FRDC 2020) suggesting that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. To protect spawning black jewfish and other reef fish, five reef fish protection area have been put in place within NT waters (Figure 5-77).

It has been hypothesised that golden snapper undertake at least two major movements during their life cycle: an inshore migration as post-larvae or early juveniles from offshore spawning grounds and a subsequent offshore migration of sub-adult or mature fish (Saunders et al. 2016). To protect spawning golden snapper and other reef fish, five reef fish protection area have been put in place within NT waters (Figure 5-77).

Spanish mackerel form spawning schools around inshore reefs in north coast bioregion in water depths up to 50 m (Newman (2020). They have extended spawning periods ranging from 122 to 153 days and the fishery biomass is sustainable.

Southern bluefin tuna spawn in tropical waters during spring and summer with only one spawning ground identified, in the north-eastern Indian Ocean south of Java. Females appear to spawn daily producing 14-15 million eggs per spawning season. The CSEP OA overlaps a part of the identified spawning ground (Figure 5-78) and the spawning stock biomass on a global basis is assessed as recovering.

The consequence rating for impacts to commercial fish species eggs and larvae is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- Any potential impacts to commercial fish species eggs and larvae have to be assessed in the context of natural mortality which for zooplankton, including fish species eggs and larvae, are very high exceeding 50% per day in some species and commonly exceeding 10% per day (Tang et al. 2014). In a review of mortality estimates (Houde and Zastrow 1993), the mean mortality rate for marine fish larvae was M = 0.24, a rate equivalent to a loss of 21.3% per day. In the experiment undertaken by McCauley et al. (2017) zooplankton mortality rate background levels were 19%. Sætre and Ona (1996) calculated that under the 'worst-case' scenario, the number of larvae killed during a typical seismic survey was 0.45% of the total population, and they concluded that mortality rates caused by exposure to seismic source sounds are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant.
- Impacts to commercial fish species eggs and larvae over the distances and timeframes associated with spawning events are not expected to be significant at a regional level. Some localised mortality to eggs and larvae may occur during a seismic survey, but this is unlikely to be discernible from the natural variability in mortality rates, such as from predation and other environmental factors. Though some species have separate biological stocks, the range and genetic connectivity of these species occur over many tens or hundreds of thousands of square kilometres, disturbances to individual groups of spawning fishes would represent a small proportion of the spawning biomass available in each stock during each spawning event.
- The key commercial fish species have multiple, broadcast spawning behaviours which offset potentially high natural embryo and larval mortality because of predation or other environmental factors that may occur at a regional scale, and thereby spreads the risk or potential opportunity for larval settlement over large areas and long timeframes.
- Fish spawning is not evenly distributed through their range or within a survey area with only a small area within a survey area potentially impacted at a time as the survey vessel moves through the survey area.
- The serial, broadcast spawning strategies of the key fish species, by their very nature, offsets potential high natural embryo and larval mortality because of predation or other environmental factors and thereby spreads the risk or potential opportunity for larval settlement over large areas and long timeframes. Subsequent recruitment of fishes to the adult stock also occurs over extended timeframes and is ongoing. Slow-growing and long-lived species such as goldband snapper are less likely to be affected by short-duration environmental changes (of one or a few years), because adult stocks comprise fish that are recruited over many years (Martin et al. 2014). Therefore, in comparison, the short-term and localised impacts to spawning as a result of a seismic survey would have impacts many orders of magnitude smaller than regional scale environmental/climatic events that would affect entire stocks.

Commercial prawn and scampi eggs and larvae

To evaluate the consequence to commercial prawn and scampi spawning and potentially recruitment success and the sustainability of species the assessment considers:

- Spatial-temporal information to identify spawning areas and timing.
- Natural variability in distribution, spawning biomass, and recruitment.
- Sustainability status of the fish stocks and fisheries.

This information is detailed in Table 5-46 and Table 5-47 and in summary:

Scampi spawn annually over a short period of time (September and October) and produce small clutches of larvae (100 - 900 per clutch) that settle and adopt a benthic habitat soon after hatching.

Banana, endeavour, tiger, and Western king prawns are widely distributed and spawn throughout their range rather than aggregating at specific locations. Spawning occurs throughout the year and the fishery biomass is sustainable.

The severity of impacts to scampi and prawn eggs and larvae is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- Impacts to prawn eggs and larvae over the distances and timeframes associated with spawning events are not expected to be significant at a regional level. Some localised mortality to eggs and larvae may occur as the seismic source undertakes a seismic survey, but this is unlikely to be discernible from the natural variability in mortality rates, such as from predation and other environmental factors. The range of these species occur over many tens or hundreds of thousands of square kilometres, thus disturbances to individual groups of spawning prawns would represent a small proportion of the spawning biomass available in each stock during each spawning event.
- As scampi spawn annually and produce smaller clutches of larvae than serial spawners localised mortality to larvae may represent a larger proportion of the spawning biomass available in each stock during each spawning event. Scampi is present in water depths of 420 – 500 m and as the spawned larvae settle and adopt a benthic habitat soon after hatching, impacts are not predicted to larvae once they have settled on the seabed as the extent of the area of impact is predicted to be a maximum of 250 m from the sound source during survey acquisition.

Pearl Oysters Spawn

The consequence rating for impacts to pearl oyster spawn is assessed as Slight (Localised, temporary effects) based on the following information that identifies that pearl oyster broodstock responsible for stock recruitment into the fishery is typically in water depths less than 20 m which is outside the area of the CSEP OA.

- Spawning of pearl oysters occurs all year round, with primary spawning from mid-October to December and a smaller secondary spawning in February and March (Daume et al. 2016). Following spawning the pearl oysters then metamorphose, settling into a benthic, filter feeder within 3 to 4 weeks. Pearl oysters are therefore less likely to be impacted by seismic surveys once they have settled on the seabed. Losses in the water column during the planktonic stage are extremely high under natural conditions, and <1% of the fertilised eggs survive the veliger stage (Southgate and Lucas 2008).

- Published information on pearl oyster broodstock by Daume et al. (2016) and Condie et al. 2006, indicates that:
  - Spawning in the main fishing areas of Eighty Mile Beach region is concentrated around broodstock distributed between 8 and 15 m water depth. This is outside the CSEP OA and predicted area of impact from seismic sound.
  - Broodstock responsible for stock recruitment into the fishery is in water depths less than 20 m, while oysters in deeper water depths do not contribute to recruitment in shallow waters. This CSEP OA and predicted area of impact from seismic sound is outside the area of water depths less than 20 m.
  - Pearl oyster inshore stock appears to be self-sustaining and may even be providing larvae to deeper stock in irregular recruitment events. As the CSEP OA and predicted area of impact from seismic sound does not overlap with the inshore stock areas impacts are not predicted.
- Towed video footage in water depths of 40 – 60 m in the vicinity of the Keraudren Extension 3D MSS survey area indicated that significant numbers of pearl oysters are not likely to occur at these water depths (RPS 2019). The findings of this study are consistent with preliminary survey results from the Australian Institute of Marine Science (AIMS)-led North West Shoals to Shore research program, which has surveyed for pearl oysters and pearl oyster habitat in waters of Eighty Mile Beach. Preliminary data from the study indicates that pearl oysters are more common in water depths less than 40 m. Only a few individual pearl oysters have been found in water depths between 40 and 70 m (Miller 2019).

7.1.4.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-4: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature. For commercial fish and invertebrate eggs and larvae, there is some scientific uncertainty especially where a stock species biomass is not at a sustainable level. Via commercial fishery workshops an additional control was identified to undertake an annual review of the relevant fisheries to identify change in spawning biomass and recruitment (See Control Measure #1).	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	They are no relevant legislative requirements in relation to seismic surveys and plankton. The development of the Operational Protocol (Control Measure #2) with the commercial fishing industry is best practice.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within the Adjustment Protocol developed with the commercial fishing industry and the controls identified within this section of the EP.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Commercial fishers have raised concerns in relation to impacts to fish and invertebrate eggs and larvae from seismic surveys and the sustainability of impacted fisheries in relation to biomass. This resulted in the development of the Operational Protocol which details spatial and temporal controls to minimise impacts to fish and invertebrate eggs and larvae. Via commercial fishery workshops an additional control was	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		identified to undertake an annual review of the relevant fisheries to identify change in spawning biomass and recruitment (See Control Measure #1).	

7.1.4.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-5 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-5: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#1: Annual Fisheries Review	An annual review of the sustainability of fisheries will be undertaken to identify changes to stock status. The review will be undertaken within 1 month of the public release of the any of the following reports: • Status of Australian Fish Stock Report. • Status of Key Northern Territory Fish Stocks Report. • Status Reports of the Fisheries and Aquatic Resources of Western Australia. Where changes are identified consultation will be undertaken with the relevant fishery manager, licence holders and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant fishery fished area. In addition, where changes to a commercial fishing licence holder’s catch are reported to a CSEP titleholder in connection with a seismic survey conducted under the CSEP, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to discuss and evaluate the available information.	Yes
CM#2: Operational Protocol	The Operational Protocol has been developed in consultation with the commercial fishing industry. The protocol establishes spatial and temporal controls to limit the size, location and frequency of seismic surveys conducted under the CSEP. Spatial and temporal controls are typically used to minimise impacts to commercial fish eggs and larvae. The operational protocol has the following commitments that will minimise potential impacts to commercial fish eggs and larvae: • Wherever possible and operationally feasible, and taking into consideration other critical timing factors, Petroleum Titleholders will work with commercial fishers to avoid seismic survey activities during the most active fishing and spawning periods of any directly affected managed fishery.	Yes

Control Measure	Justification	Adopted
	• The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP will not exceed 40,000 km^2 in any calendar year. This equates to 6% of the CSEP OAs per year. • The Acquisition Area of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP will not exceed 10,000 km^2. This equates to 1.5% of the CSEP OAs. • The Active Source Area of any 3D or 4D seismic surveys conducted under the CSEP will not overlap other previously acquired 3D seismic survey Active Source Areas within the same Regulated Fishing Season of any surveys conducted under the CSEP. This will allow a minimum of one year between surveys over the same survey area which would allow for recovery of any impacts to commercial fish eggs and larvae especially for broadcast spawners with extended spawning periods throughout the year.	
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes
CM#4: Reef Fish Protection Areas	Reef Fish Protection Areas are put in place to protect spawning reef fish where known spawning aggregations occur. Seismic surveys will not be undertaken within Reef Fish Protection Areas during spawning periods.	Yes
Time surveys to avoid spawning periods	As detailed in CM#2 Operational Protocol spawning periods will be avoided where possible. Commercial fish and invertebrate species in the CSEP OA are typically broadcast spawners with extended spawning periods throughout the year (Table 5-46 and Table 5-47). Therefore, it is not feasible to avoid some spawning period.	**Partial**

7.1.5 Invertebrates

Marine invertebrates consist of:

- Crustaceans such as prawn, scampi, and crab.
- Molluscs such as bivalves (scallops, pearl oysters, mussels, and clams) and gastropods (sea snails/trochus, sea slugs and nudibranchs).
- Hard and soft corals.

A summary of relevant studies in relation to seismic acoustic emission impacts to invertebrates is provided in Appendix A.

Research is ongoing into the relationship between sound and its effects on benthic invertebrates, including the relevant metrics for both effect and impact. Marine invertebrates lack a gas-filled bladder and are unable to detect the pressure component of sound waves (Parry and Gason 2006, Carroll et al. 2017) or "hear" sound in the way that mammals and fish can. Instead, invertebrates detect sound by sensing the particle motion component of sound in water and seabed sediments through physiological structures such as sensory hairs, statocysts and muscles, and therefore detect sound at close range (McCauley 1994, Parry and Gason 2006, André et al. 2016, Roberts et al. 2016, Edmonds et al. 2016, Carroll et al. 2017, Popper and Hawkins 2018).

Statocysts, found in a wide range of invertebrates, are utilised by animals to maintain their orientation, direct their movements through the water and may play a key role in controlling the behaviour responses of invertebrates to a wide range of stimuli. Although directly sensitive to particle motion and not to sound pressure, most available research on seismic impacts to invertebrates characterises received sound levels in terms of the sound pressure. Therefore, available literature suggests particle motion, rather than sound pressure, is a more important factor for benthic invertebrates such as crustacean and molluscs. Water depth and seismic source size are related to the particle motion levels at the seafloor, with larger arrays and shallower water being related to higher particle motion levels, thus more relevant to effects on crustaceans and molluscs (including bivalves) (Quijano and McPherson 2020).

A range of physiological responses have been identified in some studies, however, the received sound levels are typically at levels that would be received within tens or a few hundred metres from the sound source or have been from repeated exposure at the same sound levels, which is not typical of an actual seismic survey (Carroll et al. 2017, Edmonds et al. 2016, Salgado Kent et al. 2016, Webster et al. 2018).

The most recent critical review of the potential impacts of marine seismic surveys on fish and invertebrates by Carroll et al. (2017) summarised the impacts of seismic sound emissions on marine invertebrates based on a literature review of 70 studies, which comprised a total of 68 species of fish and 35 species of invertebrates, including several studies that were not differentiated. Carroll et al. (2017) conclude that:

"Our review has identified scientific evidence for high-intensity and low-frequency sound-induced physical trauma and other negative effects on some fish and invertebrates; however, the sound exposure scenarios in some cases are not realistic to those encountered by marine organisms during routine seismic operations."

7.1.5.1 Sound Effect Criteria

No published sound effect criteria currently exist to enable an evaluation of potential impacts to invertebrates. The sound effect criteria adopted for the assessment of noise impacts to invertebrates are based on the studies described in Appendix A. The sound effect criteria and predicted maximum distances from the acoustic modelling are detailed in Table 7-6.

Table 7-6: Sound Effect Criteria and Predicted Maximum Distance for Invertebrates

	Crustaceans – Recoverable Injury
Threshold Criteria	Crustaceans were the most studied group in terms of the range of metrics investigated, including catch rates and physical, behavioural, and physiological effects (Carroll et al. 2017). No threshold criteria currently exist for acoustic impacts from seismic exposure to crustaceans. Though particle motion is likely the mechanism of impacts for invertebrates rather than sound pressure it is not clear what level of particle motion relates to an effect. Thus, for this assessment sound pressure metrics are used to be able to compare to published study results that use the sound pressure metrics of PK-PK. As Payne et al. (2007) identified no effects on righting time in lobster at 202 dB re 1 µPa (PK-PK), and Day et al. (2016a) found effects at 209 dB re 1 µPa (PK-PK), the level of 202 dB re 1 µPa (PK-PK) has been applied in this assessment as a precautionary threshold to determine potential impacts. To inform the assessment of potential effects on crustaceans the PK-PK sound level at the seafloor was estimated at all modelled sites and compared to assessment criteria of 202 dB re 1 µPa (PK-PK).
Sound exposure guideline	202 dB PK-PK
Modelled Distance	763 m Figure 7-11 and Figure 7-12 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound effect criteria.
	Molluscs – Mortality/Mortal Injury
Threshold Criteria	No threshold criteria currently exist for acoustic impacts from seismic exposure to molluscs. Particle motion is likely the mechanism of impacts for molluscs rather than sound pressure though it is not clear what level of particle motion relates to an effect. Particle motion is seen as a more relevant criteria for assessment of molluscs as they spend most of the time in the seabed sediments rather than the water column. To assess the potential impacts associated with the seismic survey, particle motion has been assessed, specifically particle acceleration and velocity, and the results compared to those presented in Day et al. (2016b). The maximum particle acceleration assessed for scallops was 37.57 ms^{-2}.
Sound exposure guideline	37.57 ms^{-2}
Modelled Distance	80 m Figure 7-13 and Figure 7-14 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound effect criteria.
	Coral - Mortality/Mortal Injury
Threshold Criteria	There are currently no peer-reviewed acoustic criteria for noise impacts and hence the 226 dB PK received levels at which no impacts to coral were identified (Heyward et al. 2018) are typically used.
Sound effect criteria	226 dB PK
Modelled Distance	20 m Figure 7-15 details the collated acoustic modelling data used to determine the predicted maximum distances to the sound effect criteria.

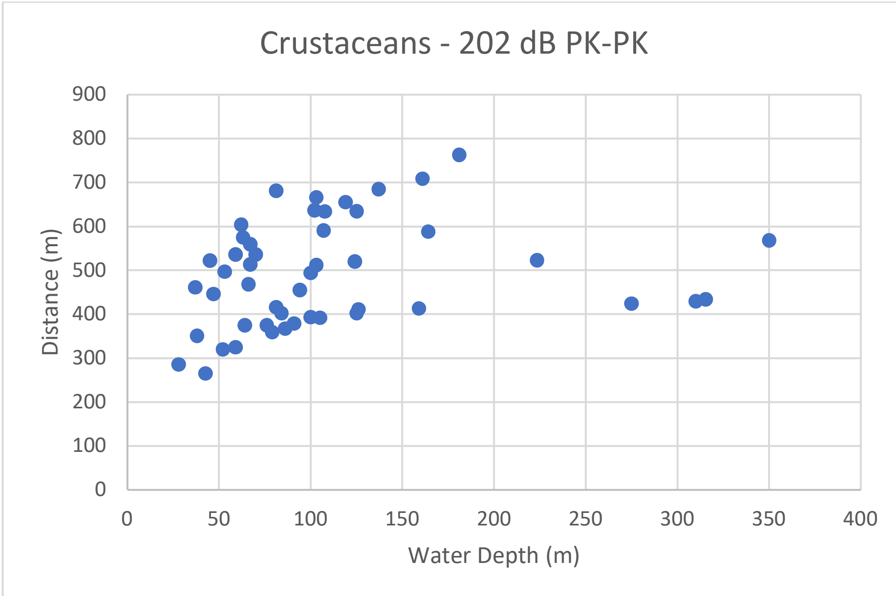


Figure 7-11: Distance to Crustacean 202 dB Pk-Pk Sound Effect Criteria against Water Depth

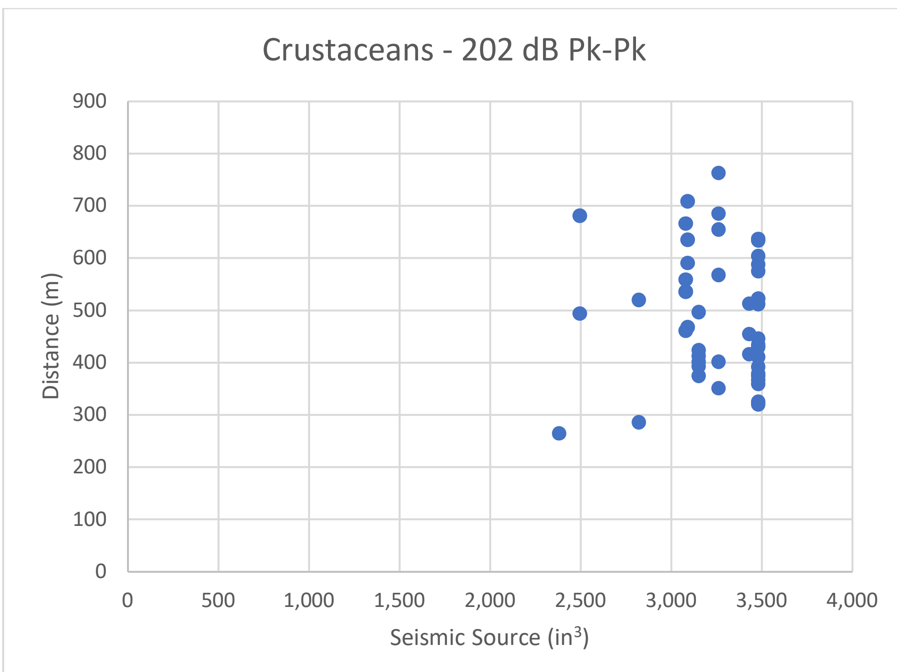


Figure 7-12: Distance to Crustacean 202 dB Pk-Pk Sound Effect Criteria against Seismic Source

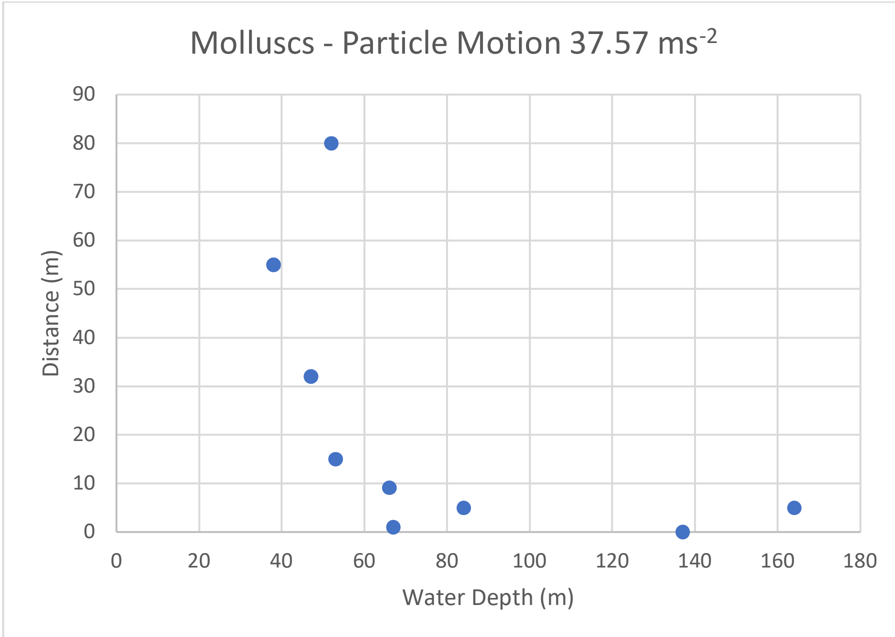


Figure 7-13: Distance to Mollusc Particle Motion Sound Effect Criteria against Water Depth

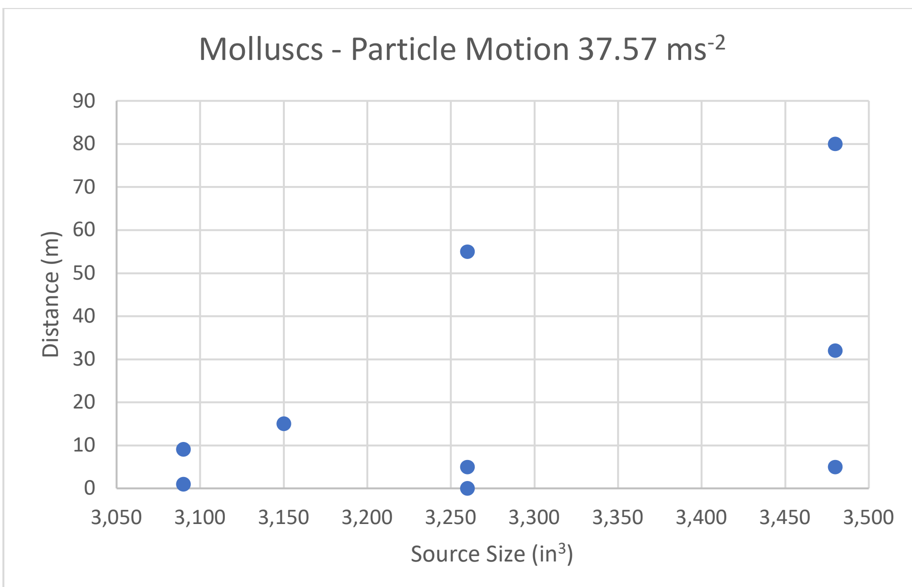


Figure 7-14: Distance to Mollusc Particle Motion Sound Effect Criteria against Seismic Source

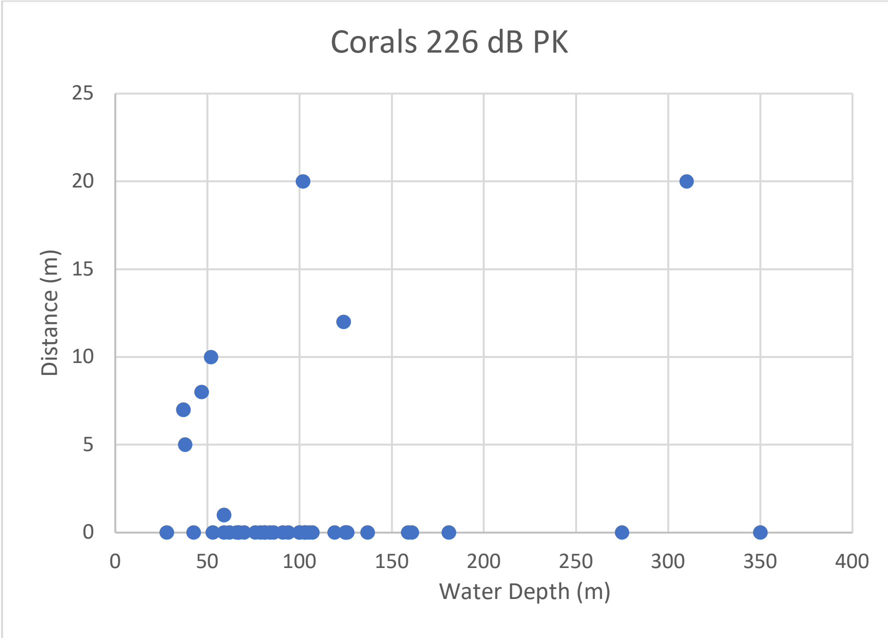


Figure 7-15: Distance to Coral 226 dB Pk Sound Effect Criteria against Water Depth

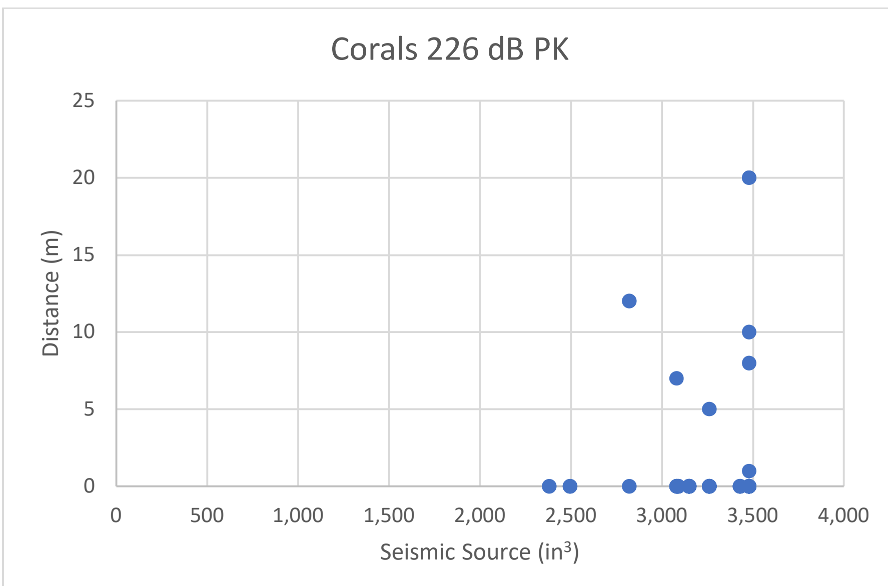


Figure 7-16: Distance to Coral 226 dB Pk Sound Effect Criteria against Seismic Source

7.1.5.2 Impact Pathway

To identify the values and sensitivities associated with invertebrates a review was undertaken of the existing environment within the CSEP OA and out to 800 m of the CSEP OA to identify those receptors associated with invertebrates. A distance of 800 m was used as this is the furthers distance to the sound effect criteria as detailed in Table 7-6. This review identified the following values and sensitivities:

- Crustacean species including commercial species such as scampi, prawns, and crabs.
- Molluscs such as:
  - Specimen shells – bivalves and gastropods
  - Pearl oysters
- Soft and hard corals

7.1.5.3 Predicted Level of Impact - Crustaceans

Crustaceans including commercial species such as scampi, prawns and crabs are likely to be present throughout the CSEP OA.

As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for crustaceans is 763 m.

The consequence rating for impacts to crustaceans is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following

- Lethal effects in studies have not been observed (Payne et al. 2007, Day et al. 2016a).
- Sub-lethal effects, relating to impairment of reflexes, damage to the statocysts and reduction in numbers of haemocytes are documented at received levels of 209 dB re 1 μPa (PK-PK) (Day et al. 2016a). Based on the distances from the seismic source that these levels would be reached it is possible that some individuals will incur a reduction in fitness. However, it is unlikely that this would occur to the majority of individuals present within the Active Source Area, therefore, impacts at a population level due to reduced fitness would be unlikely as there would be sufficient unaffected crustaceans to maintain the population.
- At higher received noise levels of 209 dB re 1 μPa (PK-PK) (Day et al. 2016a) impacts to embryonic development were not observed with hatched larvae found to be unaffected in terms of egg development, the number of hatch larvae, larval dry mass and energy content and larval competency (i.e., survival in adverse conditions) thus recruitment should be unaffected (Day et al. 2016a). Therefore, impacts at a population level due to reduced recruitment would be unlikely as impacts to larvae and eggs were not observed.
- Indirect impacts on higher trophic level species that target benthic invertebrates as a food source are also not expected. For example, benthic organisms are a key food source for demersal fish species; following the passing of the seismic source, invertebrates are still available to be foraged and any chronic mortality that occurs over the weeks or months following exposure is expected to be negligible in the context or natural mortality and recruitment. However, as this will only occur to a small proportion of individuals present within the Active Source Area, impacts at a population level due to

reduced fitness would be unlikely as there would be sufficient unaffected crustaceans to maintain the population.

- During the survey, there may be times when the seismic source is shutdown (e.g., as mitigation for marine fauna sightings). Should this occur, the seismic vessel may return later in the survey to complete infill of sections of acquisition lines that were missed. This may result in the operation of the seismic source over a small stretch of seabed that has been previously exposed to the seismic source. It is possible that repeat exposures could result in a small increase in the proportion of organisms that experience sub-lethal effects.
- A range of studies have exposed female crustaceans bearing eggs to sound pressures of approximately 196–237 dB re 1 µPa PK-PK, with no reports of acute or chronic mortality in the adult lobsters and no mortality of embryos (Christian et al. 2003; DFO 2004). Day et al. (2016a, 2016b) also reported that exposures equivalent to approximately 205 dB re 1 µPa (PK) did not impact the condition or development of eggs carried by female lobsters, or the size or morphology of the larvae once hatched. Therefore, potential exposure of berried females to the seismic source is unlikely to result in any mortalities to adult females in addition to natural or fishing mortalities and, therefore, no reduction in the adult spawning biomass.
- The physical structure, ecosystem functioning and integrity of habitat where crustaceans may be present are not predicted to be altered.

7.1.5.4 Predicted Level of Impact - Molluscs

Molluscs including commercial species such as specimen shells are likely to be present throughout the CSEP OA. Pearl Oysters may be present in the CSEP OA.

As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for molluscs is 80 m.

The consequence rating for impacts to molluscs is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- If mortality impacts do occur to molluscs, it would be within natural mortality rates and unlikely to have long term or population effects based on the findings of the study by Day et al. (2016a).
- If mortality, injury, or behavioural impairments did occur to molluscs during the weeks and months following exposure, it would not occur to all molluscs thus, significant impacts at a population level would be unlikely, as there would be sufficient unaffected molluscs and recruitment from adjacent unaffected areas to maintain the population.
- Using the particle motion threshold (the most relevant metric given that molluscs live in or on the seabed), physiological impacts in the form of increased stress levels and therefore a low risk of mortality in the long-term, but no mass mortality, are restricted to a distance of no greater than 80 m from each seismic pulse location at the seabed.
- Indirect impacts on higher trophic level species that target benthic invertebrates as a food source are also not expected. For example, benthic organisms are a key food source for demersal fish species; following the passing of the seismic source, molluscs are still

available to be foraged and any chronic mortality that occurs over the weeks or months following exposure is expected to be negligible in the context or natural mortality and recruitment.

- During the survey, there may be times when the seismic source is shutdown (e.g. as mitigation for marine fauna sightings). Should this occur, the seismic vessel may return later in the survey to complete infill of sections of acquisition lines that were missed. This may result in the operation of the seismic source over a small stretch of seabed that has been previously exposed to the seismic source. It is possible that repeat exposures could result in a small increase in the proportion of organisms that experience sub-lethal effects or chronic mortality. For example, Day et al. (2016b, 2017) observed 9.4-11.3% mortality in scallops exposed to a single pass of the seismic source, 11.3-16.1% mortality in scallops exposed to two passes of the seismic source, and 14.8-17.5% mortality in scallops exposed to four passes of the seismic source. The mortality rates were at the low end of the range of naturally occurring mortality rates documented in the wild, which range from 11-51% with a 6-year mean of 38% (Day et al. 2017). Day et al. (2017) acknowledged that the changes observed are likely within the range of variation that can occur from other common natural and anthropogenic stressors. The ecological implications of such impacts on benthic invertebrate communities are not expected to be significant or long-term.
- Impact to the Specimen Shell Managed Fishery is not predicted based on the only activity within the Carnarvon OA was within two 10 nmi^2 reporting blocks with one recorded in 2016 and one in 2017.
- Pearl collection, holding and farming activities are limited to nearshore waters (Figure 5-63) with the 2016 - 2020 DPIRD FishCube data showing no effort within the CSEP OA (Table 5-32 and Figure 5-63). The nearest pearl diving activities to the CSEP OA based on 2016 - 2020 DPIRD FishCube data occurred over 25 km south of the Carnarvon and Browse OAs in waters between Port Hedland and Broome between 2014 and 2016 (Figure 5-63). 2016 - 2020 DPIRD FishCube data also shows that since 2017 pearl oyster harvesting has been restricted to shallow (<30 m) waters off Eighty Mile Beach, at least 50 km from the southern boundary of the Browse OA. Thus, no impacts to commercial pearl oysters in these harvesting grounds are predicted.
- Whalan et al. (2021) looked at the distribution of pearl oyster in water depths up to 100 m off Eighty Mile Beach and detailed that pearl oysters were found in water depths from 28 to 76 m, with 92% in depths shallower than 40 m consistent with the Department of Fisheries (2016) statement that in Western Australia, silver-lipped oysters are found in waters between 8 and 40 metres deep, northward from Dirk Hartog Island in Shark Bay. As shown in Figure 5-63 the CSEP overlaps a very small area of water depths 40 m or less off Karratha and Broome, thus impacts could occur to a small proportion of pearly oysters within the waters < 40 m and waters > 40 m where pearl oysters are found but at much lower numbers. If impacts did occur to a small proportion of pearl oyster, significant impacts at a population level would be unlikely, as the majority of the population would be unaffected and able to maintain the population.
- The physical structure, ecosystem functioning and integrity of habitat where molluscs including pearl oysters may be present are not predicted to be altered.

- The seismic source will not be operated within 500 m horizontal distance of the 60 m depth contour (isobath) of banks and shoals (CM#8 for fish Table 7-12) therefore, potential impacts to benthic invertebrates will be avoided in shallow water areas where benthic invertebrate communities are likely to be more diverse than in deeper waters.

7.1.5.5 Predicted Level of Impact - Corals

As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m as detailed in the Seismic Survey Parameters (Table 4-2).

7.1.5.6 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-7: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature. However, there is some scientific uncertainty especially where a stock species biomass is not at a sustainable level. Via commercial fishery workshops an additional control was identified to undertake an annual review of the relevant fisheries to identify change in spawning biomass and recruitment (See Control Measure #1).	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	They are no relevant legislative requirements in relation to seismic surveys and invertebrates. The development of the Operational Protocol (Control Measure #2) with the commercial fishing industry is best practice.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within the Adjustment Protocol (Control Measure #5) and the Operational Protocol (Control Measure #2) developed with the commercial fishing industry, and the controls identified within this section of the EP.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Commercial fishers have raised concerns in relation to direct impacts to commercial species and indirect impacts to catch rates. This resulted in the development of the Operational Protocol (Control Measure #2) which details spatial and temporal controls to minimise impacts to commercial species and the Adjustment Protocol (Control Measure #5) developed to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage where these impacts cannot be avoided. Via commercial fishery workshops an additional control was identified to undertake an annual review of the relevant fisheries to identify change in the sustainability of the stock to identify any long term impacts to the fishery and commercial fishers catch rates (See Control Measure #1).	Yes

7.1.5.7 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-8 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-8: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#1: Annual Fisheries Review	An annual review of the sustainability of fisheries will be undertaken to identify changes to stock status. The review will be undertaken within 1 month of the public release of the any of the following reports: • Status of Australian Fish Stock Report. • Status of Key Northern Territory Fish Stocks Report. • Status Reports of the Fisheries and Aquatic Resources of Western Australia. Where changes are identified consultation will be undertaken with the relevant fishery manager, licence holders and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant fishery fished area. In addition, where changes to a commercial fishing licence holder's catch are reported to a CSEP titleholder in connection with a seismic survey conducted under the CSEP, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to discuss and evaluate the available information.	Yes
CM#2: Operational Protocol	The Operational Protocol has been developed in consultation with the commercial fishing industry. The protocol establishes spatial and temporal controls to limit the size, location and frequency of seismic surveys conducted under the CSEP. Spatial and temporal controls are typically used to minimise impacts to commercial invertebrate eggs and larvae. The operational protocol has the following commitments that will minimise potential impacts to commercial invertebrate species: • Wherever possible and operationally feasible, and taking into consideration other critical timing factors, Petroleum Titleholders will work with commercial fishers to avoid seismic survey activities during the most active fishing and spawning periods of any directly affected managed fishery. • The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP will not exceed 40,000 km^2 in any calendar year. This equates to 6% of the CSEP OAs per year. • The Acquisition Area of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP will not exceed 10,000 km^2. This equates to 1.5% of the CSEP OAs. • The Active Source Area of any 3D or 4D seismic surveys conducted under the CSEP will not overlap other previously acquired 3D seismic survey Active Source Areas within the same Regulated Fishing Season of any surveys conducted under the CSEP. This will allow a minimum of one year between surveys	Yes

Control Measure	Justification	Adopted
	over the same survey area which would allow for recovery of any impacts to commercial fish species.	
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes
CM#5: Adjustment Protocol	The Adjustment Protocol has been developed in consultation with the commercial fishing industry. The CSEP titleholders commit to minimising potential impacts on commercial fishing and the fish stocks that support the industry primarily through avoidance of fishing activities. However, the titleholders recognise that their activities may, from time-to-time, take place in the same area and at the same time as commercial fishing. The purpose of the adjustment protocol is to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage.	

7.1.6 Fish

Although hearing ranges and sensitivities vary substantially between species (e.g., Ladich and Fay 2013), all fish species tested to date can detect sound and vibration to some degree (Dale et al. 2015). Fishes have developed two sensory mechanisms for detecting, localising, and interpreting underwater sounds and vibrations: the inner ear, which is tuned to sound pressure detection, and the lateral line system, which allows a fish to detect vibration and water flow. Inter-specific variations in hearing range and sensitivity result from the different adaptations in these systems for perceiving sound pressure and particle motion information (Popper and Fay 2011).

Based on their morphology, Popper et al. (2014) classified fishes into three categories comprising:

- Fishes with swim bladders whose hearing does not directly involve the swim bladder or other gas volumes.
- Fishes whose hearing does directly involve a swim bladder or other gas volume.
- Fishes without a swim bladder that can sink and settle on the substrate when inactive.

The Popper et al. (2014) classifications can be assigned to the following families or species of commercial fish species common in Australian waters:

- Fishes with swim bladders or other gas volumes, but whose hearing does not directly involve the swim bladder, e.g. snappers, emperors, groupers and rock cods (Lutjanids and Lethrinids such as *Pristipomoides* spp., *Lethrinus* spp., *Lutjanus* spp., and family Serranidae), and some species of tuna (*Thunnus* sp.) (Tavolga and Wodinsky 1963; Higgs et al. 2006; Braun and Grande 2008; Engineering-Environmental Management, Inc. 2008; United States Department of the Navy 2008; Caiger et al. 2012; Bertrand and Josse 2000; Song et al. 2006).
- Fishes whose hearing does directly involve a swim bladder or other gas volume e.g., family Clupeidae (herrings, sardines, pilchards and shads) and some Haemulidae (grunters and sweetlips) (Nedwell et al. 2004; Braun and Grande 2008; Popper et al. 2014).
- Fishes without a swim bladder (e.g., mackerel, Scomberomorus spp., some species of tuna, Thunnus sp. and sharks) (Casper et al. 2012, Popper et al. 2014, Carroll et al. 2017).

The most relevant metric for perceiving underwater sound for most fish species is particle motion (Popper and Hawkins 2019; Popper et al. 2019) but, except for few species (Popper and Fay 2011; Popper et al. 2014), there is an almost complete lack of relevant data on particle motion sensitivity in fishes (Popper and Hawkins 2019).

Most fish species detect sounds from below 50 Hz up to 500-1500 Hz. A smaller number of species can detect sounds to over 3 kHz, while a very few species can detect sounds to well over 100 kHz. The critical issue for understanding whether an anthropogenic sound affects hearing is whether it is within the hearing frequency range of a fish and loud enough to be detectable above threshold. For this impact assessment, it is assumed that all fishes can detect signals below 500 Hz and therefore can 'hear' the seismic source.

The potential impacts to commercial fish species identified from DPIRD's Risk Assessment of the Potential Impacts of Seismic Air Gun Surveys on Marine Finfish and Invertebrates in Western Australia (Webster et al. 2018) and Popper et al. (2014) are summarised in Table 7-9.

A summary of relevant studies in relation to seismic acoustic emission impacts to fish is provided in Appendix A.

Table 7-9: Impact Pathway for Commercial Fish Species

Impact Type (Webster et al. 2018)	Impact Pathway (Popper et al. 2014)	Summary
Mortality	Mortality and potential mortal injury	Immediate or delayed death.
Physical Impacts		Damage to lateral line and internal organs that may result in death or decrease in fitness leading to death.
Physical Impacts	Recoverable injury	Injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries are likely to result in direct mortality.
Physiological impacts	TTS	As per Popper *et al*. (2014): *"Temporary threshold shift (TTS) is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS has been demonstrated in some fishes, and its extent is of variable duration and magnitude. TTS results from temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves innervating the ear (Smith et al. 2006; Liberman 2015). However, sensory hair cells are constantly added in fishes (e.g., Corwin 1981, 1983; Popper and Hoxter 1984; Lombarte and Popper 1994) and also replaced when damaged (Lombarte et al. 1993; Smith et al. 2006; Schuck and Smith 2009), unlike in the auditory receptors of mammals. When sound-induced hair cell death occurs in fishes, its effects may be mitigated over time by the addition of new hair cells (Smith et al. 2006, 2011; Smith 2012, 2015).* *After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure (e.g., Popper and Clarke 1976; Scholik and Yan2001, 2002a, b; Amoser and Ladich 2003; Smith et al. 2004a, b, 2006, 2011; Popper et al. 2005, 2007). While experiencing TTS, fishes may have a decrease in fitness in terms of communication, detecting predators or prey, and/or assessing their environment."*
Behavioural impacts	Masking	Masking is the impairment of hearing sensitivity by greater than 6 dB, including all components of the auditory scene, in the presence of noise. Masking impairs an animal's hearing with respect to the relevant biological sounds normally detected within the environment and can have long lasting effects on survival, reproduction, and population dynamics of fishes. Acoustic masking only occurs while the interfering sound is present, and therefore, masking resulting from a single pulse

Impact Type (Webster et al. 2018)	Impact Pathway (Popper et al. 2014)	Summary
		of sound (such as seismic source impulses) or widely separated pulses would be infrequent and not likely affect an individual's overall fitness and survival. In the absence of any quantitative scientific information, acoustic masking of signals caused by the reception of seismic sounds are assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds.
	Behavioural effects	Substantial change in behaviour for the marine fauna exposed to a sound. This may include changes in behaviour and distribution, such as moving from preferred sites for feeding and reproduction, or alteration of migration patterns. This behavioural criterion does not include effects on single animals, or where animals become habituated to the stimulus, or small changes in behaviour such as a startle response or small movements. It is currently impossible to determine single value thresholds for the onset of behavioural reactions. Popper et al. (2014) propose broad response and effect categories. In the absence of any quantitative scientific information, behavioural response caused by the reception of seismic sounds are assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. The transient nature of a seismic survey and the standard soft start ramp-up practices mean that for all fishes that have a relatively large home range and are mobile the possible effects are predicted to commence with a behavioural effect. As the proximity to the sound source increases the effect is anticipated to increase.
Cumulative impacts and mortality		Cumulative effect of all physical and behavioural impacts on direct and indirect mortality.
Cumulative impacts and catchability		Cumulative effect of all physical and behavioural impacts on catchability of fish (e.g., reduction in catch rates due to migration out of the area).

7.1.6.1 Sound Effect Criteria

Sound exposure guidelines for fish have been established by the American National Standards Institute (ANSI) accredited report of Sound Exposure Guidelines for Fishes and Sea Turtles (Popper et al. 2014). The sound exposure guidelines from Popper et al. (2014) are based on the presence or absence of a swim bladder and ancillary structures which determines the level of susceptibility of fishes to injurious effects from exposure to intense sound. Accordingly, different exposure guidelines were developed for fishes without a swim bladder, fishes with a swim bladder not involved in perception of acoustic signals and fishes that use their swim bladders for hearing. Examples of the commercial fish species common in Australian waters for each category are provided in Section 7.1.6.

For fish, the sound exposure guidelines provide sound exposure metrics for:

- Mortality and potential mortal injury
- Recoverable injury
- Temporary threshold shift (TTS) in hearing

Within these sound exposure guidelines, there were insufficient data to make a quantitative guideline for:

- Behaviour
- Masking

For these impacts, a subjective approach of 'relative risk' (low, moderate, and high) is used to assess risk at three distances from the seismic source (near - tens of metres, intermediate - hundreds of metres, and far - thousands of metres) as detailed in Table 7-10.

The sound exposure guidelines and predicted maximum distances from the acoustic modelling are detailed in Table 7-10.

Figure 7-17 to Figure 7-34 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound exposure guidelines. For the per pulse sound exposure guidelines the data is shown relative to water depth and seismic source size (Figure 7-17 to Figure 7-24) as the modelling for the per pulse criteria is at a specific location. For the cumulative sound exposure guideline, the modelling is done over a 24 hr period and thus over a range of water depths thus the data are shown relative to seismic source size (Figure 7-25 to Figure 7-34).

Table 7-10: Sound Exposure Guidelines and Predicted Maximum Distance for Fish

	Mortality/Potential Mortal Injury	Recoverable Injury	TTS
Threshold Criteria	No studies to date have demonstrated direct mortality of adult fish in response to seismic emissions, even at close proximity (within 1–7 m; DFO 2004; Boeger et al. 2006 as cited in NSW DPI 2014; Popper et al. 2014). Carroll et al. (2017) conclude that "*For fish, there are few data on the physical effects of seismic airguns (e.g., mortality, barotrauma), and of these none have shown mortality*." Though mortality or mortal injury of fish from seismic sources has not been demonstrated it is industry practice to apply the Popper et al. (2014) exposure guidelines as part of the impact assessment process.	The effects of change in pressure (barotrauma – resulting in tissue injury) can result in injury. Recoverable injuries include fin hematomas, capillary dilation, and loss of sensory hair cells. Full recovery from these injuries is possible (Popper et al. 2014).	TTS is a temporary reduction in hearing sensitivity caused by exposure to intense sound. After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure (Popper et al. 2014). Sound exposure guidelines proposed in Popper et al. (2014) use a cumulative sound exposure level (SELcum) for TTS. Popper et al. (2014) summarises that in all TTS studies considered, fish that showed TTS recovered to normal hearing levels within 18–24 hours. Due to this, a period of accumulation of 24 hours has been applied in this assessment for SEL, which is the same to that applied for marine mammals in Southall et al. (2007) and NMFS (2016).
	Popper et al. (2014) propose a dual criterion of PK and SEL24hr for mortality or potential mortal injury and recoverable injury. For the impact assessment the furthest distance to the criteria is be used. For this impact assessment, the period of 24 hrs is applied to the SELcum metric.		
Relevance of thresholds adopted	Based on the literature review presented in Appendix A, and the indicator commercial species that are present within the CSEP OA (pelagic and demersal fish), Popper et al. (2014) has been adopted as relevant to set the threshold criteria. This American National Standards Institute (ANSI) accredited report by the Working Group on the Effects of Sound on Fish and Turtles undertook a review of experimental findings of sound on fishes, presenting thresholds for mortality, recoverable injury, and TTS in 2014, and is adopted by industry in Australia for the basis of impact assessment.		

	Mortality/Potential Mortal Injury		Recoverable Injury		TTS	
Group I: Fish with no swim bladder - mackerel, Scomberomorus spp., some species of tuna, Thunnus sp. and sharks						
Sound exposure guideline	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**
	213 dB PK	219 dB SELcum	213 dB PK	216 dB SELcum	NA	186 dB SELcum
Modelled Distance	Water column -145 m Seafloor – 145 m	Water column -100 m Seafloor – not reached	Water column -145 m Seafloor – 145 m	Water column -100 m Seafloor – 20 m		Water column -14 km Seafloor – 7.5 km
Group II: Fish with swim bladder not involved in hearing - snappers, emperors, groupers and rock cods and some species of tuna						
Sound exposure guideline	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**
	207 dB PK	210 dB SELcum	207 dB PK	203 dB SELcum	NA	186 dB SELcum
Modelled Distance	Water column -250 m Seafloor – 240 m	Water column -100 m Seafloor – 80 m	Water column -250 m Seafloor – 240 m	Water column -310 m Seafloor – 310 m		Water column -14 km Seafloor – 7.5 km
Group: III Fish with swim bladder involved in hearing - herrings, sardines, pilchards, grunters, sweetlips						
Sound exposure guideline	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**	**Per pulse**	**SELcum**
	207 dB PK	207 dB SELcum	207 dB PK	203 dB SELcum	NA	186 dB SELcum
Modelled Distance	Water column -250 m Seafloor – 240 m	Water column -150 m Seafloor – 150 m	Water column -250 m Seafloor – 240 m	Water column -310 m Seafloor – 310 m		Water column -14 km Seafloor – 7.5 km

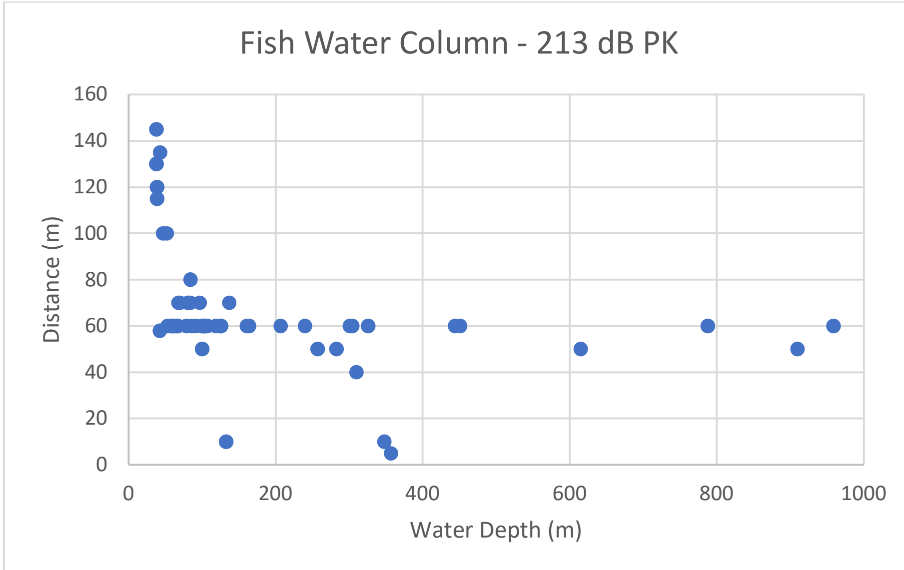


Figure 7-17: Distance to Fish 213 dB PK Sound Effect Criteria (Water Column) against Water Depth

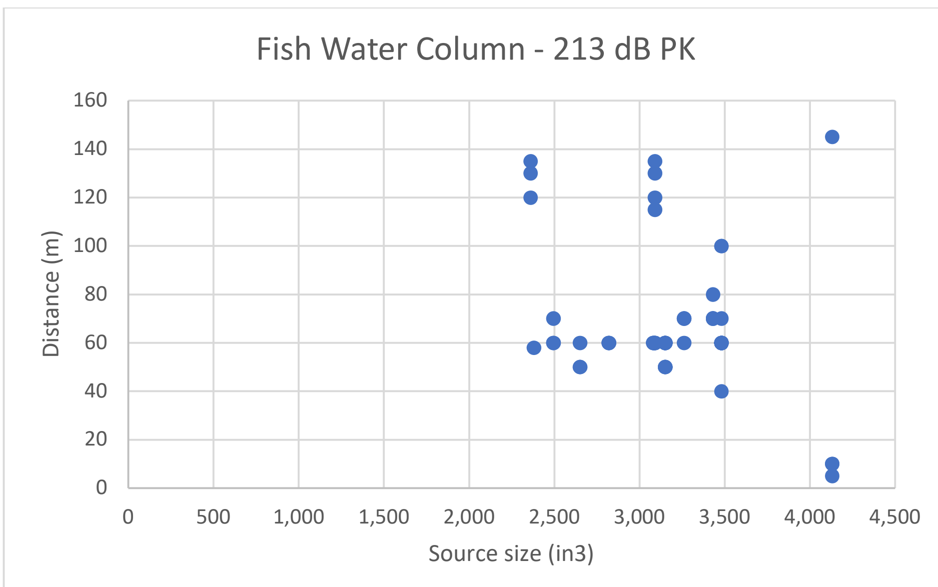


Figure 7-18: Distance to Fish 213 dB PK Sound Effect Criteria (Water Column) against Seismic Source

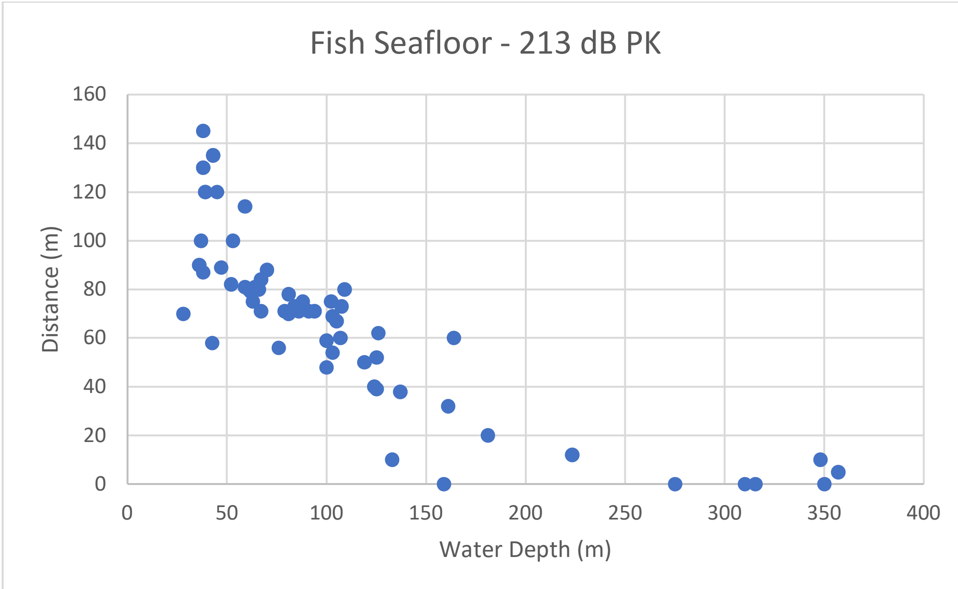


Figure 7-19: Distance to Fish 213 dB PK Sound Effect Criteria (Seafloor) against Water Depth

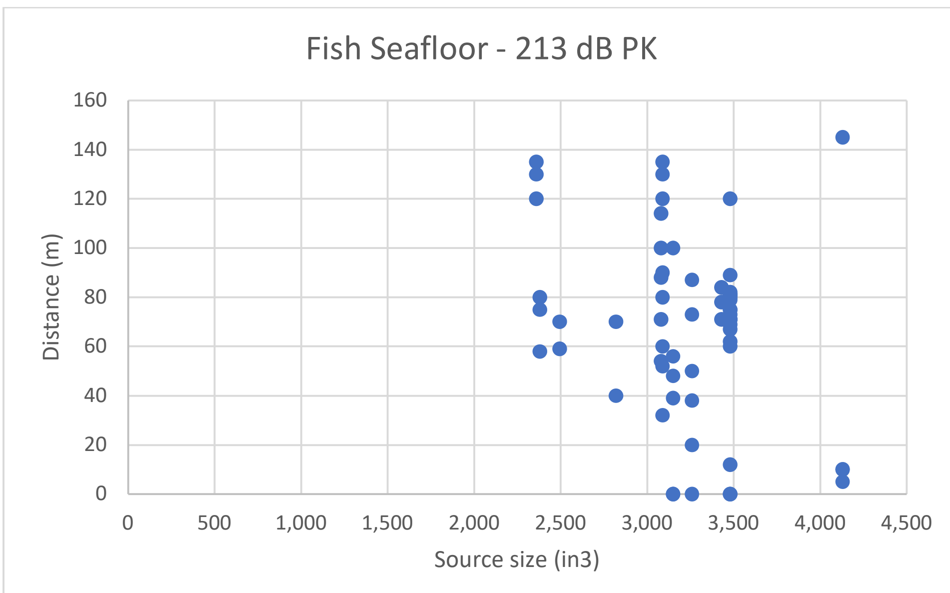


Figure 7-20: Distance to Fish 213 dB PK Sound Effect Criteria (Seafloor) against Seismic Source

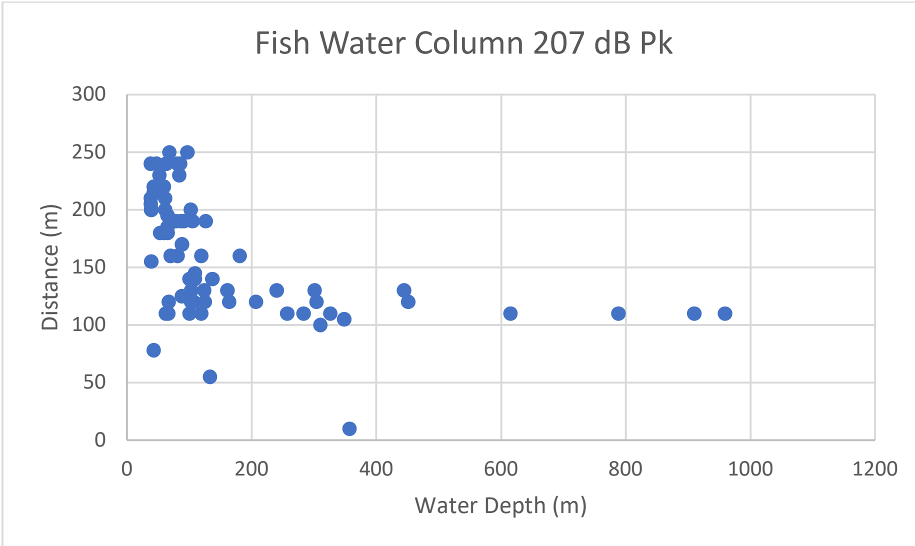


Figure 7-21: Distance to Fish 207 dB PK Sound Effect Criteria (Water Column) against Water Depth

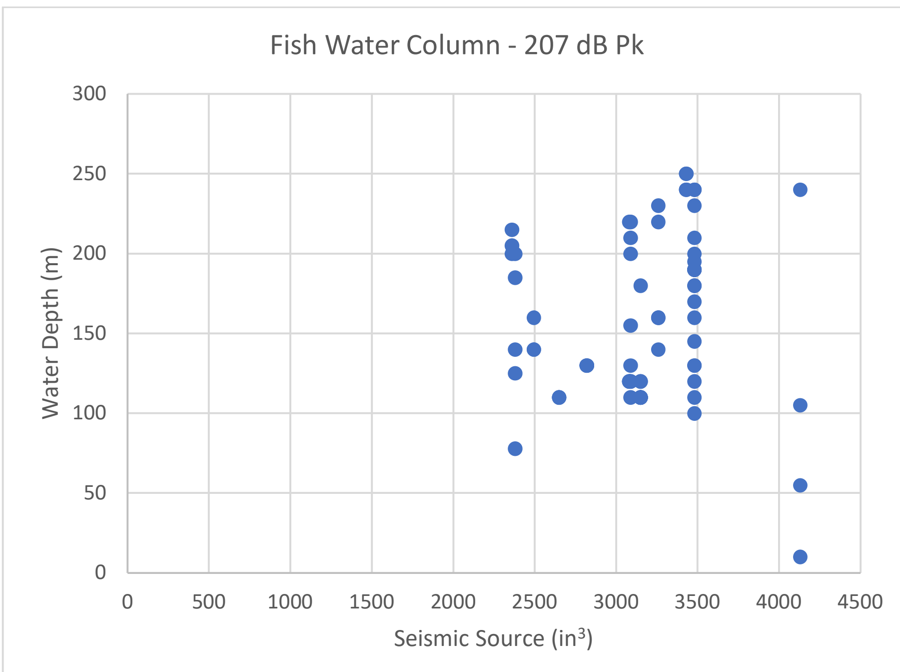


Figure 7-22: Distance to Fish 207 dB PK Sound Effect Criteria (Water Column) against Seismic Source

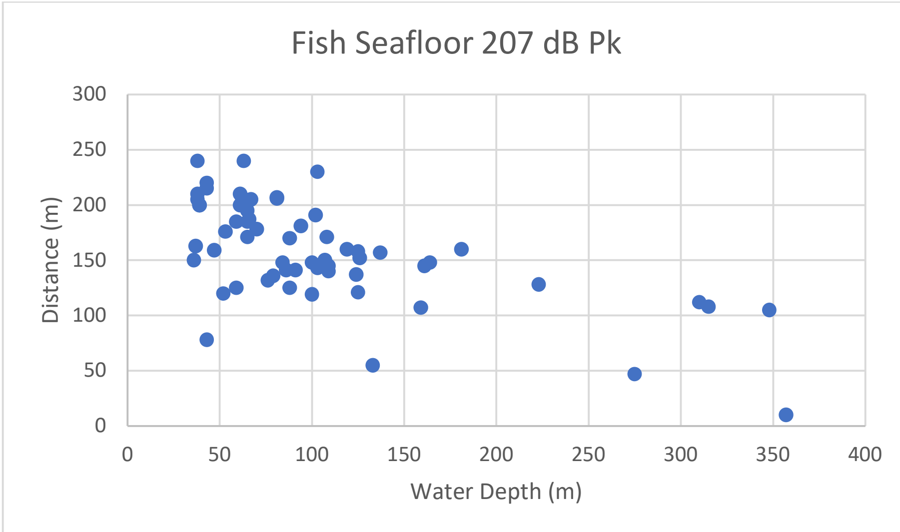


Figure 7-23: Distance to Fish 207 dB PK Sound Effect Criteria (Seafloor) against Water Depth

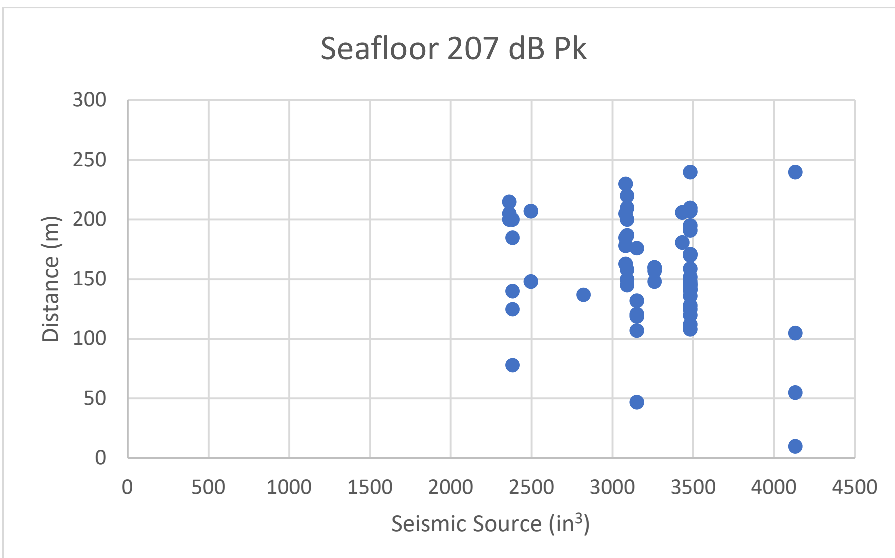


Figure 7-24: Distance to Fish 207 dB PK Sound Effect Criteria (Seafloor) against Seismic Source

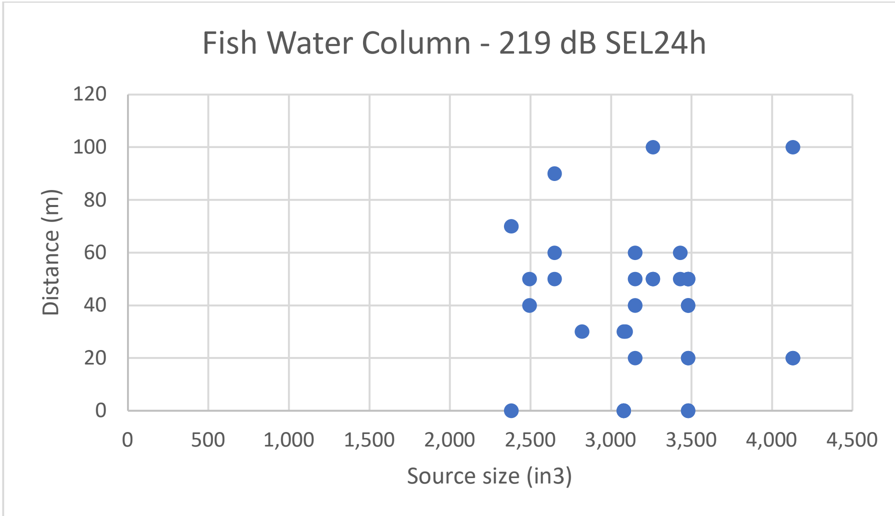


Figure 7-25: Distance to Fish 219 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

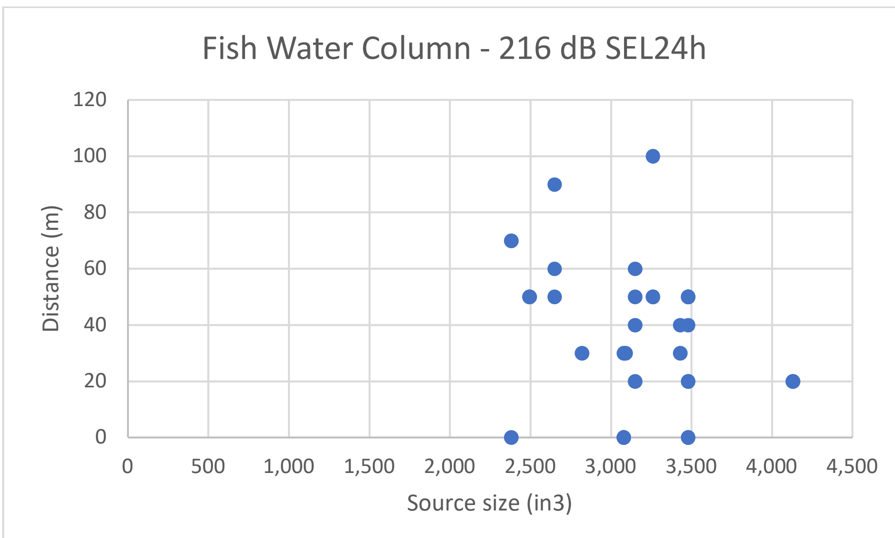


Figure 7-26: Distance to Fish 216 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

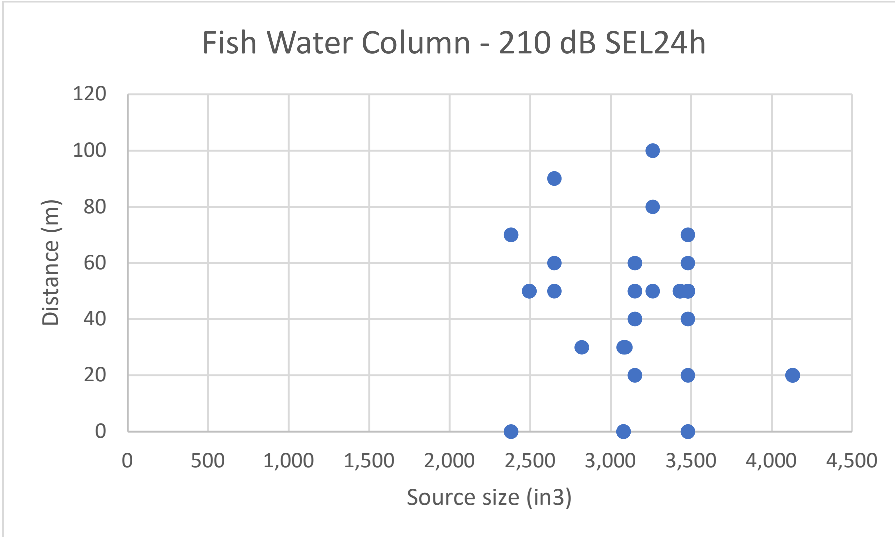


Figure 7-27: Distance to Fish 210 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

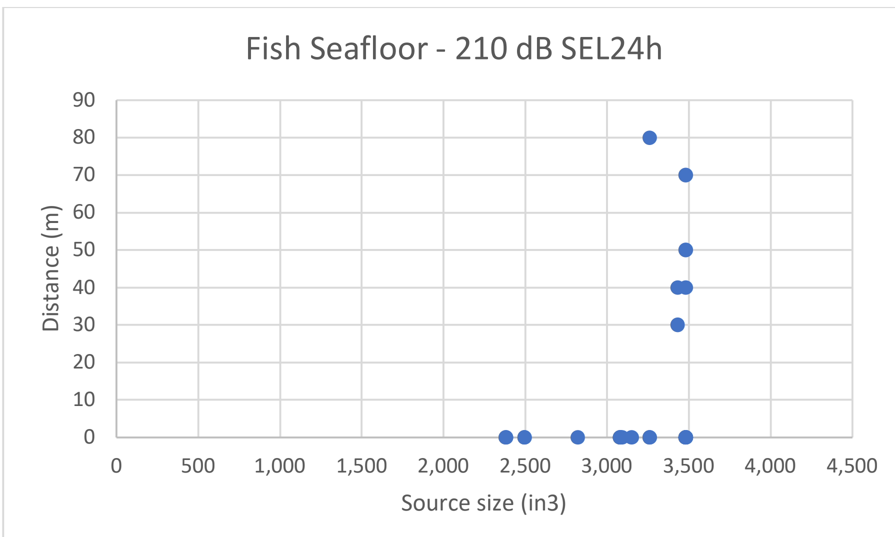


Figure 7-28: Distance to Fish 210 dB SEL24h Sound Effect Criteria (Seafloor) against Seismic Source

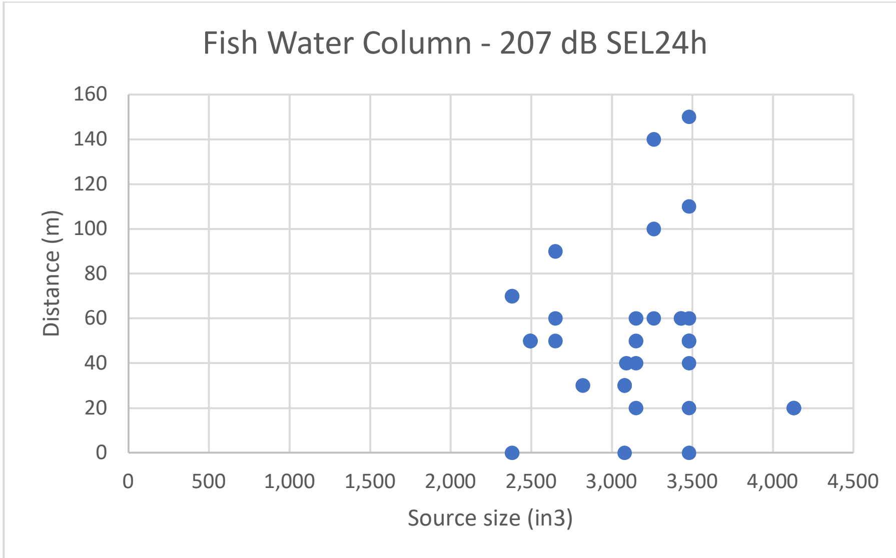


Figure 7-29: Distance to Fish 207 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

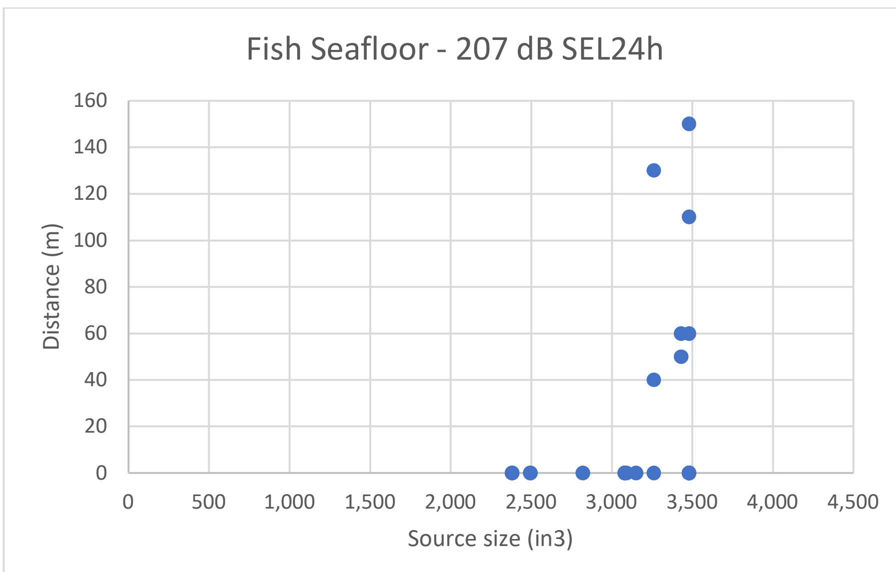


Figure 7-30: Distance to Fish 207 dB SEL24h Sound Effect Criteria (Seafloor) against Seismic Source

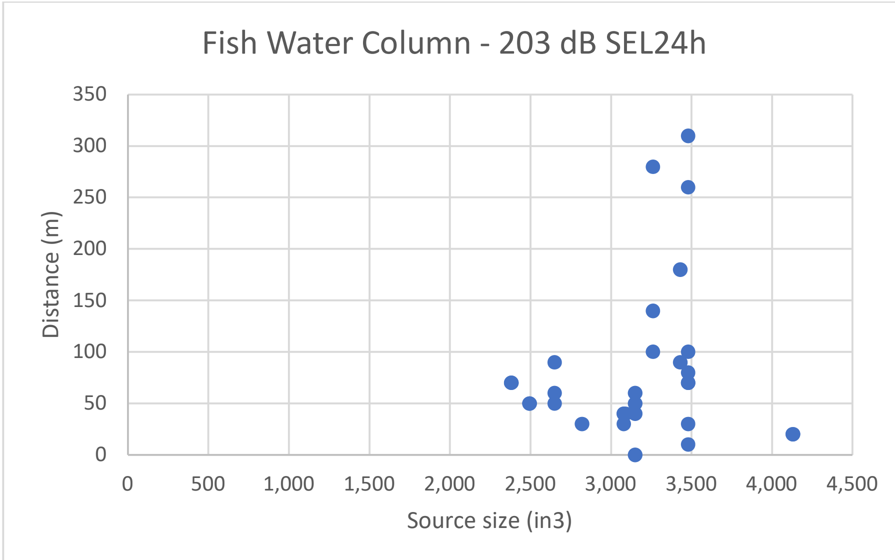


Figure 7-31: Distance to Fish 203 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

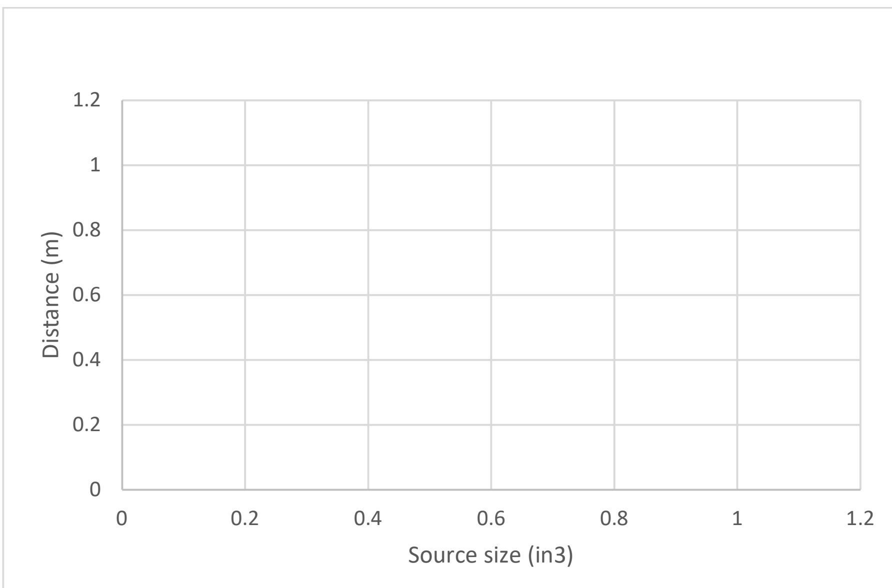


Figure 7-32: Distance to Fish 203 dB SEL24h Sound Effect Criteria (Seafloor) against Seismic Source

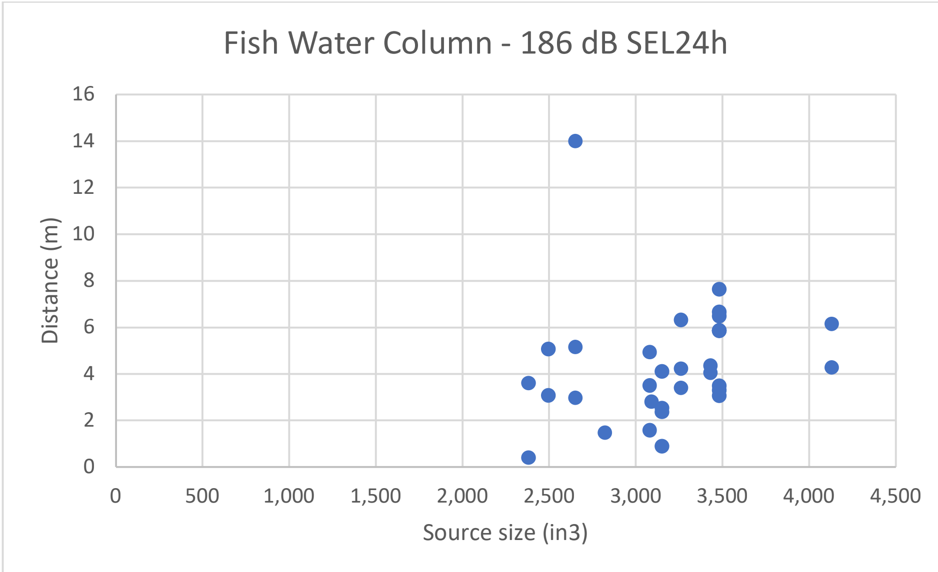


Figure 7-33: Distance to Fish 186 dB SEL24h Sound Effect Criteria (Water Column) against Seismic Source

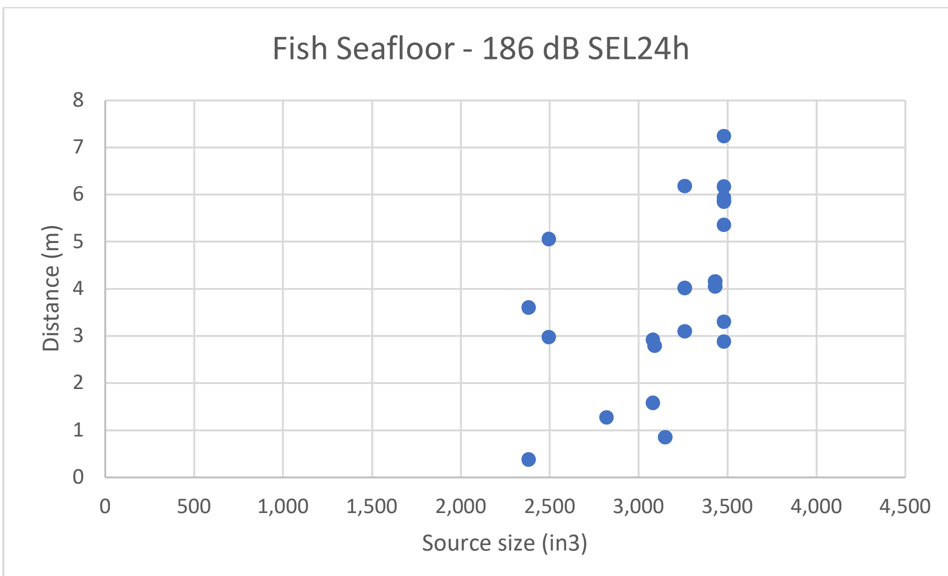


Figure 7-34: Distance to Fish 186 dB SEL24h Sound Effect Criteria (Seafloor) against Seismic Source

7.1.6.2 Impact Pathway

To identify the values and sensitivities associated with fish a review was undertaken of the existing environment within the CSEP OA and out to 14 km of the CSEP OA to identify those receptors associated with fish. A distance of 14 km was used as this is the furthers distance to the sound effect criteria as detailed in Table 7-10. This review identified the following values and sensitivities:

- Demersal fish species including commercial and recreational fish species such as snappers, emperors, groupers, and rock cods.
- Pelagic fish species including:
  - Commercial and recreational fish species Spanish and other mackerel species, tuna, billfish, and sharks.
  - Whale shark foraging BIA and is 8 km from the foraging (high density prey) BIA.
- Site-attached/dependent fish species associated with reef habitats.
- Syngnathid species.

7.1.6.3 Predicted Level of Impact

Demersal Fish Species

The various species of demersal fish species of snappers (Lutjanidae), emperors (Lethrinidae), rock cods and groupers (Serranidae) that are characteristic of the CSEP OA do not possess a mechanical connection between the swim bladder and the ears and can be said to have mid to poor hearing ability (Tavolga & Wodinsky 1963; Higgs et al. 2006; Braun & Grande 2008; Engineering- Environmental Management, Inc. 2008; United States Department of the Navy 2008; Popper 2012; Caiger et al. 2012). Note that commercially targeted Rankin cod and other demersal rock cods are not true cods (Gadidae) and so are not considered to have specialised hearing sensitivity.

Therefore, these species of fish are considered to belong to the group of fishes that are primarily sensitive to particle motion with some limited sensitivity to sound pressure (Group II fishes according to the Popper et al. 2014 classification in Table 7-10).

As shown in Table 7-10 the maximum modelled distance to sound effect criteria for Group II fishes are:

- Mortality/Potential Mortal Injury: 250 m
- Recoverable Injury: 310 m
- TTS: 14 km

The consequence rating for impacts to demersal including commercial and recreational fish species is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- Mortality of fish (both immediate and delayed) is considered highly unlikely based on no documented cases of mortality in free-swimming fish upon exposure to seismic source emissions under experimental or field operating conditions (DFO 2004; Boeger et al. 2006; Popper et al. 2016; Carroll et al. 2017, ERM 2017).

- Despite exhibiting habitat preferences and some fidelity to an area, demersal fish species can be found across a variety of habitats and are typically more mobile and have relatively large home ranges (several kilometres) (Ovenden et al. 2004; Moran et al. 2004; Newman et al. 2008; Parsons et al. 2011; Harasti et al. 2015). Therefore, demersal fishes can be expected to exhibit an avoidance response and swim away from the approaching seismic source before sound levels approach levels that may result in mortality, injury, or significant TTS effects. However, Webster et al. (2008) details that whilst most species of fish can swim fast over short distances, it was assumed that most demersal species tire over longer distances and are unable to swim beyond seismic exposure. However, it is likely that demersal fish species could swim beyond the injury sound effect criteria distances of up to 310 m as the seismic source approaches. Impacts to demersal fishes are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur.
- Popper et al. (2005) report that fish that showed TTS recovered to normal hearing levels within18-24 hours, the potential area of impact for fish TTS is assessed as being acceptable based on hearing loss (and subsequent decrease in fitness) being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced.
- Popper (2018) in his review of TTS for the Santos Bethany 3D MSS, which considered similar demersal fish species as present in the CSEP OAs, noted:
  - It is highly unlikely that there would be physical damage to fishes as a result of the survey unless the animals are very close to the source (perhaps within a few metres).
  - Most fishes in the Bethany region (and given the similarity in fish species, this also applies for the North West Shelf region), being species that do not have hearing specialisations, are not likely to have much (if any) TTS as a result of the Bethany 3D survey.
  - If TTS takes place, its level is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity. Even if fish do show some TTS, recovery will start as soon as the most intense sounds end, and recovery is likely to even occur, to a limited degree, between seismic pulses. Based on very limited data, recovery within 24 hours (or less) is very likely.
  - Little is known about the behavioural implications of TTS in fishes in the wild. However, since the TTS is likely very transitory, the likelihood of it having a significant impact on fish fitness and survival is very low.
- Meekan et al. (2021) undertook a large-scale experiment that quantified the impacts of exposure of an assemblage of tropical demersal emperors, snappers and groupers targeted by commercial fisheries to a commercial-scale seismic source on the North West Shelf off Western Australia did not identify any short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour, or movement of fishes at any exposure sites.
- Popper et al. (2014) indicates that the potential for behavioural impacts for Group II fishes is high in the near-field (tens of metres), moderate at intermediate distances

(hundreds of metres) and low in the far field (thousands of metres). Therefore, behavioural responses are considered likely to occur within tens or hundreds of metres from the seismic source. The fishes' awareness of the sound and any resultant behavioural responses may be limited to a few hours as the seismic source approaches from several kilometres away and passes, while significant behavioural responses (startle or avoidance) are more likely to be limited to a short period (less than an hour) when the seismic source passes close by. As the seismic source will be transient (i.e., continuously moving) during seismic data acquisition, demersal fishes will only be exposed to significant sound levels for a relatively short period of time as the seismic survey vessel passes nearby before sailing away again.

- Any behavioural impacts are likely to be short-lived and fish would return to normal behaviours once the vessel has moved away based on research by Woodside (2011), Miller and Cripps (2013) and Wardle et al. (2001). Behavioural impacts to pelagic fish species are possible but would be temporary, localised, and unlikely to impact at a population level.
- Limited data on biochemical stress indicators in fishes exposed to seismic sound indicate there may not be any discernible change (e.g., McCauley et al. 2000, 2003). However, if fishes were to experience stress as a result of sound exposure, levels may return to normal within 72 hours (Santulli et al. 1999).

Pelagic Species

Key pelagic fish species that may occur in the CSEP OAs include Spanish mackerel and various other mackerels (e.g., grey mackerel), as well as various species of tuna and billfish, and sharks.

There are 13 listed threatened or migratory shark and ray species that may be present in the CSEP OA including oceanic and river sharks, whale sharks, manta rays and four species of sawfish (Table 5-10).

The CSEP OA overlaps the whale shark foraging BIA and is 8 km from the foraging (high density prey) BIA. At the closest point the CSEP OA is ~20 km from a river shark or sawfish BIA (Figure 5-23).

These species either do not possess a swim bladder or it is poorly developed and not directly connected to hearing (Popper et al. 2014), indicating that they are sensitive only to the particle motion component of sound at close range to a sound source. Therefore, these species of fish are considered to belong to the Group I fishes according to the Popper et al. 2014 classification in Table 7-10.

As shown in Table 7-10 the maximum modelled distance to sound effect criteria for Group I fishes are:

- Mortality/Potential Mortal Injury: 145 m
- Recoverable Injury: 145 m
- TTS: 14 km

The consequence rating for impacts to commercial fish species is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- Pelagic fishes such as mackerel travel distances up to 100 ‑ 300 km or more, while tunas and billfish may travel in the order of thousands of kilometres. Therefore, pelagic fishes can reasonably be expected to exhibit an avoidance response and swim away from the approaching seismic source before sound levels approach levels that may result in mortality, injury or TTS.
- Popper et al. (2014) indicates that the potential for behavioural impacts in fishes that do not possess a swim bladder or where the swim bladder is not directly linked to hearing is high in the near-field (tens of metres), moderate at intermediate distances (hundreds of metres) and low in the far field (thousands of metres). Therefore, behavioural responses in species such as mackerel are considered likely to occur within tens or hundreds of metres from the seismic source. In addition, the transient nature of the seismic source and the highly mobile nature of pelagic fish species means that behavioural avoidance responses and effects on distribution will be localised and of short duration. However, behaviours and distributions of the pelagic species could be affected for hours or days following exposure as a result of potential disturbance to more sound-sensitive prey species, such as herrings, sardines, sprat, and shads.
- TTS impacts to pelagic fish, including whale sharks, sharks, and sawfish, are less likely than for demersal fish as pelagic fish are constantly moving and therefore unlikely to be within the TTS sound effect criteria range for a period of time to receive TTS. Popper (2018) detailed that for demersal fish that if TTS did occur it is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity and that since the TTS is likely very transitory, the likelihood of it having a significant impact on fish fitness and survival is very low. Thus, TTS impacts to pelagic fish including whale sharks is unlikely.
- Shark species are highly vagrant and naturally cover large distances. As such, short-term exposures from the transient seismic source are expected to result in localised behavioural responses and movements of sharks. The research by Bruce et al. (2018), which tagged two commercially targeted shark species (broadnose shark and school shark) and monitored their movements in response to a seismic survey in Australian waters noted that both control sharks and exposed sharks moved freely in and out of the study area which did not indicate any changes in behaviour or distribution as a result of seismic sound exposure.
- The CSEP OA at the closest point is ~20 km from a river shark or sawfish BIA, thus impacts to these BIAs are not predicted within these BIAs.
- Seismic sound emissions have not been identified as a threat to river sharks and sawfish (CoA 2015a) and white shark (DSEWPaC 2013) in their respective recovery plans and conservation advice.
- The CSEP OA is within 8 km of the whale shark foraging (high density prey) BIA thus the Mortality/Potential Mortal Injury effect criteria (145 m) and Recoverable Injury effect criteria (145 m) are not met but the TTS 24hr effect criteria is reached at 14 km. However, this criterion will not be met as the whale shark foraging (high density prey) BIA is within the boundary of the Ningaloo World Heritage Area and as detailed in CM#6 a 70 km exclusion zone will be applied to the Ningaloo World Heritage Area

where the seismic source will not be activated. Thus, impacts to whale sharks within the foraging (high density prey) BIA are not predicted.

- The CSEP OA overlaps the whale shark foraging BIA that follows the 200 m isobath along the northern part of the Western Australian coast where whale shark migration occurs mainly between July and November (TSSC 2015a). It is expected that the potential effects to whale sharks associated with acoustic noise will be the same as for other pelagic fish species, resulting in minor and temporary behavioural change such as avoidance. This aligns with the Popper et al. (2014) guidelines, which detail that there is the potential for high risk of behavioural impacts in fish species near the seismic source (tens of metres) with the level of risk declining to low at thousands of metres from the seismic source.
- Seismic sound emissions have not been identified as a threat to whale sharks in either the Approved Conservation Advice (TSCC 2015) or previous in force Whale Shark Recovery Plan 2005 ‑ 2010 (DEH 2005a). Noise pollution is not identified as a pressure to whale sharks in the Marine Bioregional Plan for the North-west Marine Region (DSEWPaC 2012b) or in the Ningaloo Coast: World Heritage nomination report (CoA 2010).

Site-attached Species

For the purposes of the impact assessment, site-attached fish are defined as fish that rely on the benthic habitat and demonstrate a very high degree of site fidelity to the extent that they are unlikely or unable to flee an approaching seismic source and are instead likely to remain and/or seek refuge within habitat structures. For this assessment site-attached fish includes syngnathid species.

The biomass, diversity and abundance of fishes is typically greatest in the photic and upper mesophotic zones (<60 m depth) where biota such as hard corals are most abundant. The disappearance of live coral cover and corresponding lower fish diversity is often reported in water depths greater than 60 m (Lesser et al. 2009; Kahng et al. 2010, 2014; Lindfield et al. 2016; Fukunaga et al. 2016; Abdul Wahab 2018).

The CSEP OA overlaps several banks and shoals where hard substrate does occur or is likely to occur in water depths less than 60 m (Section 5.4.3 Table 5-9) where site-attached fish are likely to be present.

As shown in Table 7-10 the maximum modelled distance to sound effect criteria at the seafloor for Group II and Group III fishes which have a swim bladder and hence would represent site-attached fish are:

- Mortality/Potential Mortal Injury: 240 m
- Recoverable Injury: 310 m
- TTS: 7.5 km

The consequence rating for impacts to site-attached fish is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years given the following:

- Mortality of fish (both immediate and delayed) is considered highly unlikely based on no documented cases of mortality in free-swimming fish upon exposure to seismic source emissions under experimental or field operating conditions (DFO 2004; Boeger et al. 2006; Popper et al. 2016; Carroll et al. 2017, ERM 2017).

- Impacts to site-attached fish were studied by Woodside at Scott Reef during the Maxima 3DMSS activities (Woodside, 2011a, b, c) and determined that there was a lack of significant impacts to fish species considered sensitive because of their site-fidelity requirements (i.e., being restricted to reef habitat and unable move far when the seismic sound approaches) based on the following:
  - No lethal or sub-lethal effects on fish were experienced. Behavioural responses were observed at close range with general movement from the water column to the seabed, however normal feeding behaviour returned within 20 minutes of the survey vessel passing and when the vessel was beyond a distance of 1.5 km (Woodside, 2011a).
  - Fish exposed to acoustic pulses showed no structural abnormalities, tissue trauma or lesions, or auditory threshold changes (TTS) at the highest exposure level 190 dB re 1μPa^2.s. However, a small number of damaged hair cells (less than 1% of fish hearing capacity) were observed in fish exposed to acoustic noise (Hastings et al. 2008; Hastings and Miksis-Olds 2012).
  - No significant decreases in the diversity and abundance of fish after the seismic survey were detected compared with the long-term temporal trend before the survey (Woodside 2011b; Miller and Cripps 2013).
- Though mortality of site-attached fish (both immediate and delayed) is not predicted It is well recognised that coral reef fish assemblages exhibit high resilience and recovery to natural and anthropogenic disturbance, especially in absence of any habitat damage.
  - As reported in Planes et al. (2005), coral reef fish assemblages at Moruroa Atoll were surprisingly resilient to the impacts of French underground nuclear testing. The pressure wave from each nuclear test caused the instantaneous removal of all fish over an area of 12 km^2 (a radius of 2 km around each test site) but left the benthic habitats and invertebrates untouched. In each case, there must also have been a much larger zone of effect where fish would have experienced sub-lethal physiological and behavioural effects, extending out many kilometres from the test site. Yet despite these intense, large-scale perturbations, fish assemblages responded rapidly and were found to be restored to pre-test assemblage structure within 1-5 years (Planes et al. 2005). As long as the structural and biological integrity of the habitat is maintained, and there are neighbouring un-impacted areas that can supply recruits, coral reef fish assemblages appear able to respond rapidly to large-scale natural and anthropogenic change.
  - This observation is supported by another study (Syms and Jones 2000) in the Great Barrier Reef, where it was demonstrated that assemblages disturbed by fish removal were resilient, with recolonization from both immigration and larval settlement. The results of this experiment (albeit at a much-reduced scale to the Moruroa Atoll example) supported a model of patch-reef fish assemblages organized by a combination of deterministic factors (such as habitat structure) and stochastic processes (such as recruitment) (Syms and Jones 2000). Similarly, in a study that examined coral bleaching, reef fish community phase shifts and the

resilience of coral reefs Bellwood et al. (2006) concluded that: "Coral reef fishes would thus appear to be relatively resilient, in ecosystem terms, to short-term perturbations. It would appear that reef fishes are able to maintain ecosystem processes; the implicit assumption being that no change in the community composition is a reasonable indication that ecosystem processes are intact."

  - In a study that monitored coral and fish assemblages over 14 years on fixed sites spread over 80 km of the southern Great Barrier Reef, Halford et al. (2004) found evidence of large-scale resilience and predictable recovery of these assemblages. This study found that although processes such as settlement and immigration are ultimately responsible for replenishment of local populations, the data suggested that habitat plays a strong role in modifying fish assemblages. Tropical reef communities are typically characterized by very high species diversity in a spatially heterogeneous environment and display stochastic variability in community structure at small spatial and temporal scales. As reported by Halford et al. (2004), both coral and fish assemblages demonstrated resilience to large-scale natural disturbance and predictability in the structure of the assemblages.
  - Lefèvre and Bellwood (2015) examined the recolonisation of populations of small cryptic fishes on the Great Barrier Reef following experimental removal. After removing resident cryptobenthic reef fish assemblages from otherwise undisturbed coral rubble areas they observed a rapid recovery. Within eight weeks, fish assemblages were similar to their pre-removal structure in terms of fish abundance, species diversity and species richness. The return of larger species was largely mediated by recolonisation, while smaller, less mobile species relied primarily on recruitment, presumably from the plankton.

- Noting that there is the potential for mortality or injury to occur in site-attached fishes up to a maximum range of 310 m from the seismic source, exclusion zones will be applied around bank and shoal habitats. The seismic source will not be operated within 350 m horizontal distance of the 60 m depth contour (isobath) of banks and shoals (CM#8) therefore, potential impacts to site-attached fish species will be avoided in water depths < 60 m where the biomass, diversity and abundance of fishes is typically greatest. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the Group II fish mortality or injury criteria is less than 300 m. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to site-attached fish as the mortality or injury criteria will not be exceeded within the 60 m contour of banks and shoals.
- Popper (2018) in his review of TTS for the Santos Bethany 3D MSS, which considered similar demersal fish species as present in the CSEP OAs, noted:
  - It is highly unlikely that there would be physical damage to fishes as a result of the survey unless the animals are very close to the source (perhaps within a few metres).
  - Most fishes in the Bethany region (and given the similarity in fish species, this also applies for the North West Shelf region), being species that do not have hearing

specialisations, are not likely to have much (if any) TTS as a result of the Bethany 3D survey.

  - If TTS takes place, its level is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity. Even if fishes do show some TTS, recovery will start as soon as the most intense sounds end, and recovery is likely to even occur, to a limited degree, between seismic pulses. Based on very limited data, recovery within 24 hours (or less) is very likely.
  - Little is known about the behavioural implications of TTS in fishes in the wild. However, since the TTS is likely very transitory, the likelihood of it having a significant impact on fish fitness and survival is very low.

- TTS effects at the seafloor may occur up to 7.5 km from the seismic source (Table 7-10) thus there is the potential for some fishes at the seafloor to experience TTS effects. As detailed above, Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
- Limited data on biochemical stress indicators in fishes exposed to seismic sound indicates there may not be any discernible change (e.g., McCauley et al. 2000, 2003). However, if fishes were to experience stress as a result of sound exposure, levels may return to normal within 72 hours (Santulli et al. 1999).
- Any behavioural impacts are likely to be short-lived and fish would return to normal behaviours once the vessel has moved away based on research by Woodside (2011), Miller and Cripps (2013) and Wardle et al. (2001). Behavioural impacts to site-attached fish species are possible but would be temporary, localised, and unlikely to impact at a population level.

7.1.6.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-11: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature. However, there is some scientific uncertainty in relation to long term impacts to commercial species. Via commercial fishery workshops an additional control was identified to undertake an annual review of the relevant fisheries to identify change in the sustainability of the stock and commercial fishers catch rates (See Control Measure #1).	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	The Threat Abatement Recovery Plan for Sawfish and River Sharks Multispecies (CoA 2015a) does not identify sound as a threat. Impacts are not predicted in any river shark or sawfish BIA. Impacts outside of a BIA are predicted to be minor disturbance that would not impede their recovery. The Recovery Plan for the White Shark (DSEWPaC 2013) does not identify sound as a threat. Impacts are not predicted in any white shark BIAs. Impacts outside of a BIA are predicted to be minor disturbance that would not impede their recovery. The Whale Shark Approved Conservation Advice (TSCC 2015) does not identify sound as a threat. Impacts are not predicted in the whale shark foraging (high density prey) BIA. Impacts within the whale shark foraging BIA are predicted to be minor disturbance that would not impede their recovery, however, as the Mortality/Potential Mortal Injury and Recoverable Injury criteria is met within 145 m a shutdown zone of 200 m will be applied to whale sharks as per CM7.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
		They are no relevant legislative requirements in relation to seismic surveys and commercial fish species. The development of the Operational Protocol (Control Measure #2) and Adjustment Protocol (Control Measure #5) with the commercial fishing industry is best practice.	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within implementation strategy and the Operational Protocol (Control Measure #2) and Adjustment Protocol (Control Measure #5) developed with the commercial fishing industry and the controls identified within this section of the EP.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Commercial fishers have raised concerns in relation to direct impacts to commercial species and indirect impacts to catch rates. This resulted in the development of the Operational Protocol (Control Measure #2) which details spatial and temporal controls to minimise impacts to commercial species and the Adjustment Protocol (Control Measure #5) developed to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage where these impacts cannot be avoided. Via commercial fishery workshops an additional control was identified to undertake an annual review of the relevant fisheries to identify change in the sustainability of the stock to identify any long term impacts to the fishery and commercial fishers catch rates (See Control Measure #1).	Yes

7.1.6.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-12 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-12: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#1: Annual Fisheries Review	An annual review of the sustainability of fisheries will be undertaken to identify changes to stock status. The review will be undertaken within 1 month of the public release of the any of the following reports: • Status of Australian Fish Stock Report. • Status of Key Northern Territory Fish Stocks Report. • Status Reports of the Fisheries and Aquatic Resources of Western Australia. Where changes are identified consultation will be undertaken with the relevant fishery manager, licence holders and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant fishery fished area. In addition, where changes to a commercial fishing licence holder's catch are reported to a CSEP titleholder in connection with a seismic survey conducted under the CSEP, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to discuss and evaluate the available information.	Yes
CM#2: Operational Protocol	The Operational Protocol has been developed in consultation with the commercial fishing industry. The protocol establishes spatial and temporal controls to limit the size, location and frequency of seismic surveys conducted under the CSEP. Spatial and temporal controls are typically used to minimise impacts to commercial fish species. The operational protocol has the following commitments that will minimise potential impacts to commercial fish species: • Wherever possible and operationally feasible, and taking into consideration other critical timing factors, Petroleum Titleholders will work with commercial fishers to avoid seismic survey activities during the most active fishing and spawning periods of any directly affected managed fishery. • The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP will not exceed 40,000 km^2 in any calendar year. This equates to 6% of the CSEP OAs per year. • The Acquisition Area of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP will not exceed 10,000 km^2. This equates to 1.5% of the CSEP OAs. • The Active Source Area of any 3D or 4D seismic surveys conducted under the CSEP will not overlap other previously acquired 3D seismic survey Active Source Areas within the same Regulated Fishing Season of any surveys conducted under the CSEP. This will allow a minimum of one year between surveys	Yes

Control Measure	Justification	Adopted
	over the same survey area which would allow for recovery of any impacts to commercial fish species.	
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 in^3, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes
CM#5: Adjustment Protocol	The Adjustment Protocol has been developed in consultation with the commercial fishing industry. The CSEP titleholders commit to minimising potential impacts on commercial fishing and the fish stocks that support the industry primarily through avoidance of fishing activities. However, the titleholders recognise that their activities may, from time-to-time, take place in the same area and at the same time as commercial fishing. The purpose of the adjustment protocol is to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage.	Yes
CM#6 NCWHA Exclusion Zone	The acoustic source will not be operated within 70 km of the Ningaloo Coast World Heritage Area (NCWHA). This has been implemented based on consultation with the NCWHA Advisory Committee in relation to protecting the outstanding universal value (OUV) of the NCWHA. This distance has been based on the modelled distance to the noise criteria for divers (See Section 7.1.10). As the whale shark foraging (high density prey) BIA is within the boundary of the Ningaloo Coast World Heritage Area and the furthest distance to the noise effect criteria for whale sharks is 14 km a 70 km exclusion zone will ensure impacts to whale sharks within the foraging (high density prey) BIA do not occur.	Yes
CM#7: Whale shark shutdown zone	The CSEP OA overlaps the whale shark foraging BIA. As the Mortality/Potential Mortal Injury and Recoverable Injury criteria is met within 145 m a shutdown zone of 200 m radius will be applied to whale sharks. This will ensure that whale sharks are not injured while undertaking a biologically important behaviour.	
CM#8: Exclusion Zone – banks and shoals	Noting there is the potential for mortality or injury to occur in site-attached fishes up to a maximum range of 310 m from the seismic source, a seismic source exclusion zones around the bank and shoal habitats will be implemented. The seismic source will not be operated within 350 m horizontal distance of the 60 m contour of banks and shoals within the CSEP OA. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the Group II fish mortality or injury criteria is less than 300 m. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to site-attached fish as the mortality or injury criteria will not be exceeded within the 60 m contour of banks and shoals. The 60 m contour of a bank or shoal is based on the biomass, diversity and abundance of fishes is typically greatest in the photic and upper mesophotic zones (<60 m depth) where biota such as	

Control Measure	Justification	Adopted
	hard corals are most abundant. The disappearance of live coral cover and corresponding lower fish diversity is often reported in water depths greater than 60 m (Lesser et al. 2009; Kahng et al. 2010, 2014; Lindfield et al. 2016; Fukunaga et al. 2016; Abdul Wahab 2018). For a seismic survey: • A bank or shoal is defined as an identified banks or shoals as detailed in Figure 5-18, Figure 5-19 and Figure 5-20. • The 60 m contour of a bank or shoal will be identified using the data from the most recent version of the Geoscience Australia Northern Australian High Resolution Bathymetry Model.	

7.1.7 Diving Birds

Bird species that plunge dive such as tropicbirds, boobies, shearwaters, and tern species could potentially be exposed to underwater noise.

7.1.7.1 Sound Effect Criteria

There are no sound effect criteria for diving birds.

7.1.7.2 Impact Pathway

Stemp (1985; as cited in LGL 2012) conducted observations on the effects of seismic exploration on seabirds and did not observe any negative effects. Lacroix et al. (2003) assessed the effect of near shore seismic surveys on the foraging behaviour of moulting long-tailed ducks in the Beaufort Sea, Alaska. Long-tailed ducks are not capable of flying during the moult and to compensate for the nutritionally costly moult process they increase their foraging. Lacroix et al. (2003) found that the abundance and distribution of ducks, in both the seismic and control areas, changed similarly following the start of the seismic operations suggesting other influencing factors such as wind were more important for duck distribution than seismic activities, and that seismic activities did not significantly change the diving intensity of ducks. Overall Lacroix et al. (2003) concluded that there was no evidence to suggest any displacement away from seismic operations.

Pichegru et al. (2017) assessed the foraging behaviour of African penguins before, during and after a seismic survey conducted within 100 km of breeding colonies. Penguins foraging within 100 km of the active seismic source showed a change in foraging direction, increasing the distance between feeding area and the seismic vessel. Displaced penguins reverted back to normal foraging behaviours following the cessation of seismic activities, suggesting effects are relatively short-lived. The Pichegru et al. (2017) study was unable to differentiate between penguins shifting foraging activities in direct response to the seismic survey (i.e., behavioural effect) or indirectly due to a change in prey distribution, though a behavioural response was determined as the most likely cause. While the penguins were able to locate alternative feeding grounds, the displacement from traditional grounds resulted in an increase in energy expenditure.

As detailed in Section 5.5.2 the CSEP overlaps the following diving bird foraging BIAs:

- Brown booby (Browse OA, Carnarvon OA)
- Greater frigatebird (Browse OA)
- Lesser frigatebird (Bonaparte OA, Browse OA, Carnarvon OA
- Red-footed booby (Browse OA)
- Wedge-tailed shearwater (Browse OA, Carnarvon OA)

In addition, as detailed in Section 5.5.2 the PMST search identified the following diving birds are known or likely to foraging within the CSEP OA:

- Australian lesser noddy foraging known to occur within Browse OA
- Greater frigatebird foraging likely to occur within Browse OA
- Soft-plumaged petrel foraging likely to occur within Carnarvon OA

- White-tailed tropicbird foraging likely to occur within Browse OA and Carnarvon OA

7.1.7.3 Predicted Level of Impact

Impacts to foraging diving seabirds have not been observed during seismic surveys. Only birds diving and foraging within the Operational Area have the potential to be exposed to increased sound levels generated by the seismic source, while diving for small pelagic fishes near the sea surface. Such behaviours may result in a startle response during diving.

Birds resting on the water surface in proximity to the seismic vessel have limited potential to be affected by sound emissions underwater due to the limited transmission of sound energy between the water/air interface but may be startled in close proximity to the seismic source. However, given the likely avoidance response from fish and other prey species in waters immediately surrounding the seismic source, birds are unlikely to forage near the operating seismic source.

In the unlikely event that birds dive and forage near the seismic source, this is likely to only affect individual birds, resulting in a startle response with the affected birds expected to move away from the area. The consequence of this is expected to be negligible and impacts at a population level are extremely unlikely to occur. It is expected that birds foraging diving birds will not be displaced from the wider areas of the foraging BIAs from a seismic survey.

The behaviour and distribution of some fishes may be affected for short periods during and after exposure to the seismic source, which may result in short-term and localised changes in the distribution of target prey species for some species. However, these effects are unlikely to be discernible to foraging birds in the context of the normal movements and variation in the distribution of fishes. The behaviours and distribution of prey at any one time will remain largely unaffected in the area of a seismic survey.

The conservation advice for the Australian lesser noddy and the soft-plumaged petrel, both listed as vulnerable, do not identify underwater noise as a threat.

The severity is assessed as Minor (2) based on impacts to diving birds are predicted to be a minor disruption to small portion of population with no effects on critical habitats/ activities.

7.1.7.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-13: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	The conservation advice for the Australian lesser noddy (TSSC (2015b) and the soft-plumaged petrel TSSC (2015f) do not identify underwater noise as a threat. The Draft Wildlife Conservation Plan for Seabirds CoA (2019) does not identify underwater noise as a threat.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within this Section and the implementations strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	The has been no objections or claims raised in relation to impact to diving birds from seismic surveys.	Yes

7.1.7.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-14 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-14: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Operational Protocol: Soft Starts	The soft start requirements of EPBC Act Policy Statement 2.1 would also afford protection to diving birds.	Yes

7.1.8 Turtles

Marine turtles are considered to be less sensitive to noise than marine mammals as they do not have an external hearing organ but can detect sound through bone-conducted vibration in the skull with their shell providing a receiving surface (Lenhardt et al. 1985). Morphological studies of green and loggerhead turtles (Ridgway et al. 1969; Wever 1978; Lenhardt et al. 1985) found that the turtle ear is like other reptile ears but has adaptations for underwater listening.

Most studies researching the effect of seismic noise on sea turtles focused on behavioural responses, as physiological impacts are more difficult to observe in living animals. Turtles avoid low-frequency sounds (Lenhardt 1994) and sounds from an airgun (O'Hara and Wilcox 1990), but these reports did not note received sound levels. Moein et al. (1995) found that penned loggerhead turtles initially reacted to an airgun but then showed little or no response to the sound (i.e., they habituated to it).

Caged green and loggerhead turtles increased their swimming activity in response to an approaching airgun when the received SPL was above 166 dB re 1 μPa, and they behaved erratically when the received SPL was approximately 175 dB re 1 μPa (McCauley et al. 2000).

Finneran et al. (2017) identified 175 dB re 1 μPa SPL as the level at which marine turtles are expected to actively avoid seismic exposures. However, the Recovery Plan for Marine Turtles in Australia (DoEE 2017) acknowledges the 166 dB re1 μPa SPL reported by McCauley et al. (2000) as the level that may result in a behavioural response to marine turtles.

A summary of relevant studies in relation to seismic acoustic emission impacts to invertebrates is provided in Appendix A.

7.1.8.1 Sound Effect Criteria

Sound exposure guidelines for turtles have been established by the American National Standards Institute (ANSI) accredited report of Sound Exposure Guidelines for Fishes and Sea Turtles (Popper et al. 2014).

Though mortality or potential mortal injury to turtles from seismic sound exposure has not been reported, Popper et al. (2014) provides exposure guidelines of >207 dB re 1 μPa PK or >210 dB re 1 μPa2.s SEL_{cum}. Popper et al. (2014) also defined semi-quantitative exposure criteria for potential hearing impairment (recoverable injury and TTS). Finneran et al. (2017) recently proposed thresholds of 232 dB re 1 μPa (PK) and of 226 dB re 1 μPa (PK) for PTS and TTS effects in turtles respectively. Therefore, the Popper et al. (2014) criteria for mortality/mortal injury may be conservative.

McCauley et al. (2000a) found that marine turtles showed behavioural responses (i.e., increased swimming behaviour) to an approaching seismic source at received sound levels of approximately 166 dB re 1 μPa SPL, and a stronger avoidance response at around 175 dB re 1 μPa SPL. Similarly, Moein et al. (1995) monitored the behaviour of penned loggerhead turtles to seismic sources operating at 175–179 dB re 1 μPa SPL at 1 m. Avoidance of the seismic source was observed at first exposure, but the turtles habituated to the sound over time. The 166 dB re 1 μPa SPL reported by McCauley et al. (2000a) has been used by the U.S. NMFS as the threshold level for a behavioural disturbance response (NSF 2011). Finneran et al. (2017) identified 175 dB re 1 μPa SPL as the level at which marine turtles are expected to actively avoid seismic exposures and the Recovery Plan for Marine Turtles in Australia (DoEE 2017) details that the 166 dB re1 μPa

SPL reported McCauley et al. (2000) as the level that turtles may show behavioural responses to an approaching seismic noise.

These sound exposure guidelines and predicted maximum distances from the acoustic modelling are detailed in Table 7-15.

Figure 7-35 to Figure 7-45 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound exposure guidelines. For the per pulse sound exposure guidelines the data is shown relative to water depth and seismic source size as the modelling for the per pulse criteria is at a specific location. For the cumulative sound exposure guideline, the modelling is done over a 24 hr period and thus over a range of water depths thus the data is shown relative to seismic source size.

Table 7-15: Sound Exposure Guidelines and Predicted Maximum Distance for Turtles

	Mortality/Potential Mortal Injury		**PTS and TTS**		**Behavioural**
Threshold Criteria	Few studies to base criteria on, however, Popper et al. (2014) provides acoustic criteria for mortality and potential mortal injury. The criteria are based on pile driving and other impulsive sounds and do not represent the levels at which impacts will occur, but levels at which no impacts have been observed. They are therefore likely to be conservative.		A scale of relative risk is provided in Popper et al. (2014) for recoverable injury and TTS. The scale assumes that recoverable injury and TTS are possible. The relative risk is defined as High in the near field (tens of metres), and Low in the intermediate and far fields (hundreds to thousands of metres). Recent thresholds defined by Finneran et al. (2017) for PTS and TTS in marine turtles have been adopted.		There are currently no acoustic criteria for sea turtles, however, a scale of relative risk is provided below from Popper et al. (2014). The scale assumes that a behavioural response is possible. McCauley et al. (2000a) reported that turtles behaved more erratically at 175 dB SPL and observed behavioural response in caged marine turtles at 166 dB re 1 µPa SPL, as referenced by NSF (2011) and in the Recovery Plan for Marine Turtles in Australia (DoEE 2017).
Relevance of thresholds adopted	There is limited information on marine turtle hearing. Most studies looking at the effect of seismic noise on marine turtles have focussed on behavioural responses given that physiological impacts are more difficult to observe in living animals. Exposure criteria developed by Popper et al. (2014) based on results from the Working Group on the Effects of Sound on Fish and Turtles as well as Finneran et al. (2017) has been adopted. These thresholds are typically applied by NMFS, and within Australia as relevant threshold levels.				
Sound exposure guideline	**Per pulse**	**SELcum**	**Per Pulse**	**24 hr**	**Per Pulse**
	207 dB PK	210 dB SELcum	PTS: 232 dB PK TTS: 226 dB PK	PTS: 204 dB SEL24hr TTS: 189 dB SEL24hr	Behavioural response: 166 dB SPL Behavioural disturbance: 175 dB SPL
Modelled Distance	250 m	100 m	PTS: 20 m TTS: 20 m	PTS: 120 m TTS: 2.72 km	Behavioural response: 10 km Behavioural disturbance: 1.97 km

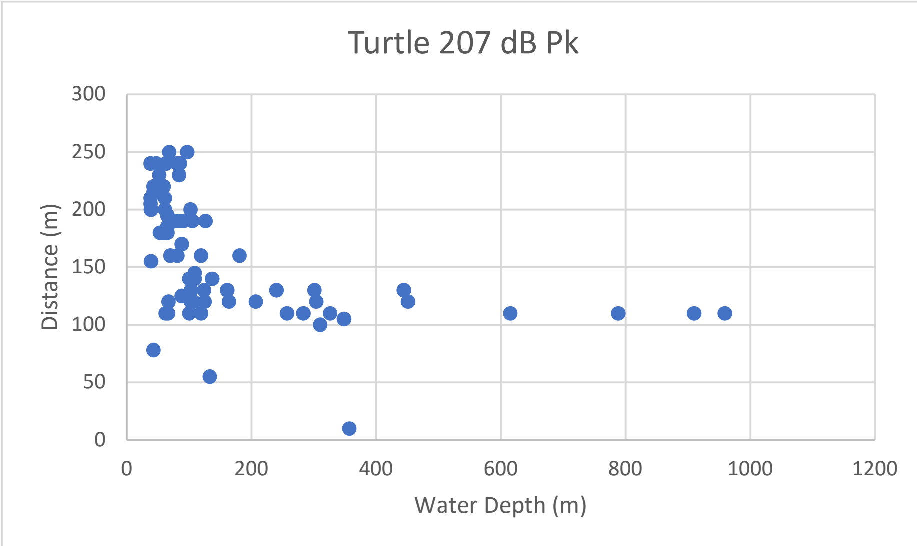


Figure 7-35: Distance to Turtle 207 dB PK Sound Effect Criteria against Water Depth

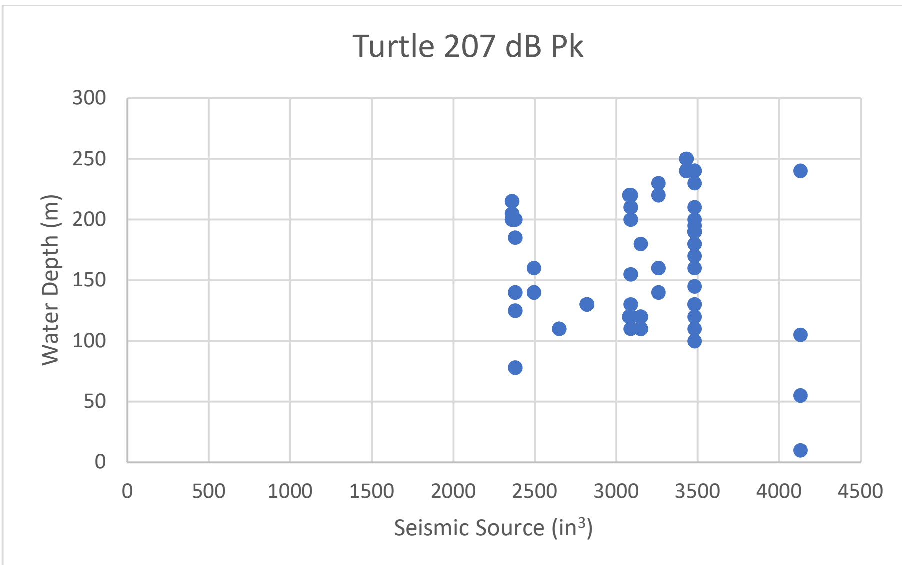


Figure 7-36: Distance to Turtle 207 dB PK Sound Effect Criteria against Seismic Source

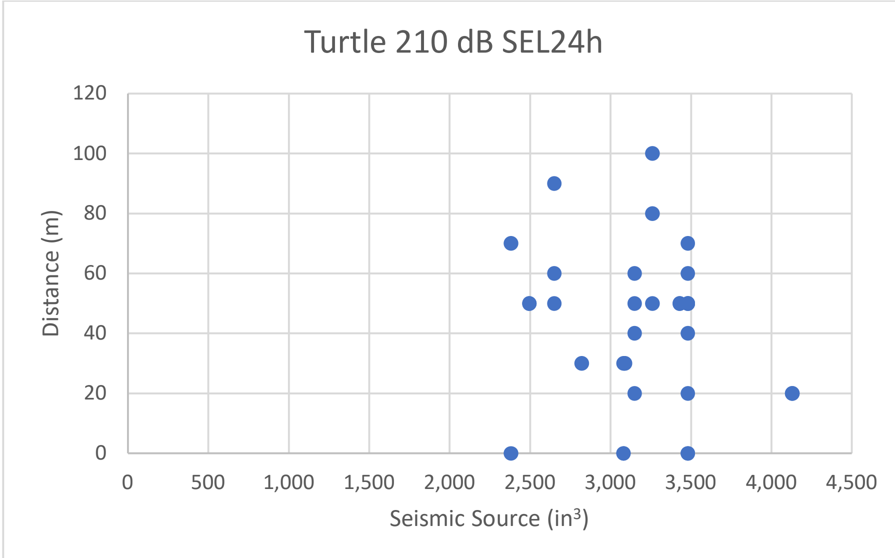


Figure 7-37: Distance to Turtle 210 dB SEL24h Sound Effect Criteria against Seismic Source

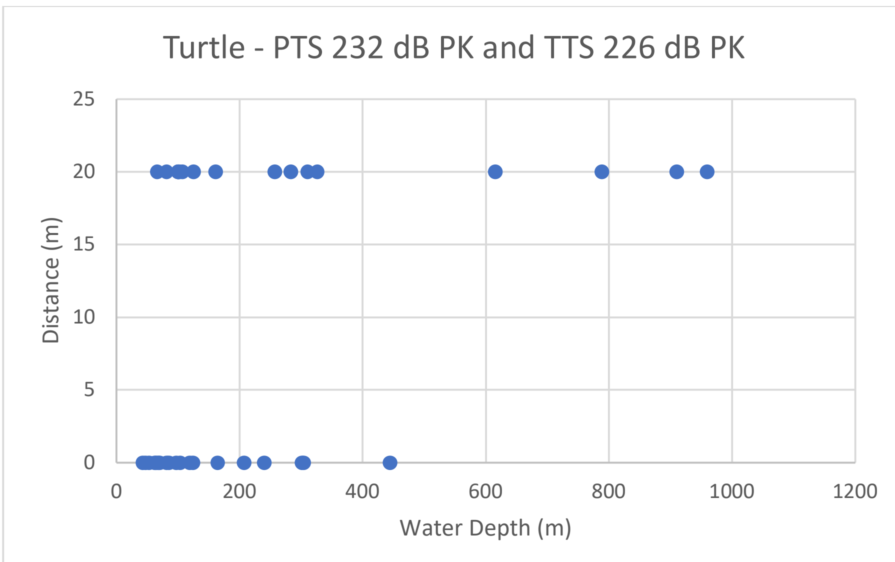


Figure 7-38: Distance to Finneran et al (2017) PTS and TTS Per Pulse against Water Depth

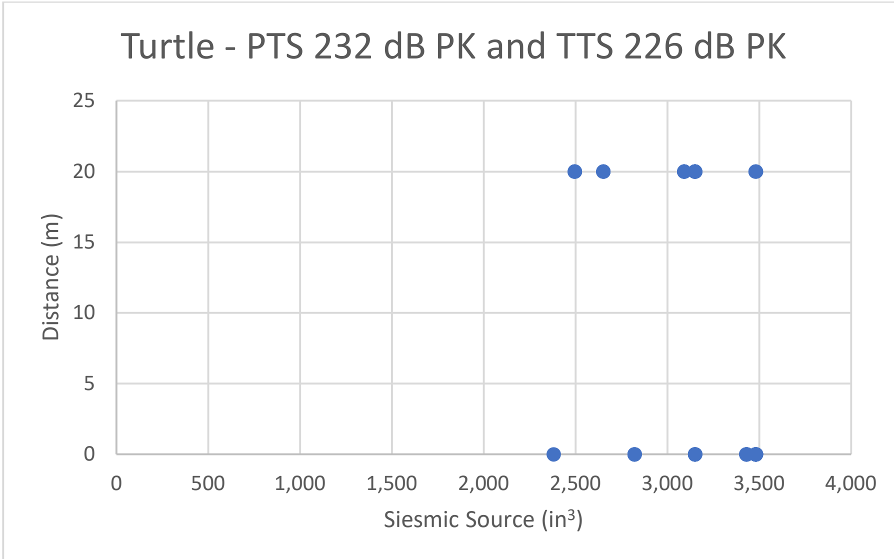


Figure 7-39: Distance to Finneran et al (2017) PTS and TTS Per Pulse against Seismic Source

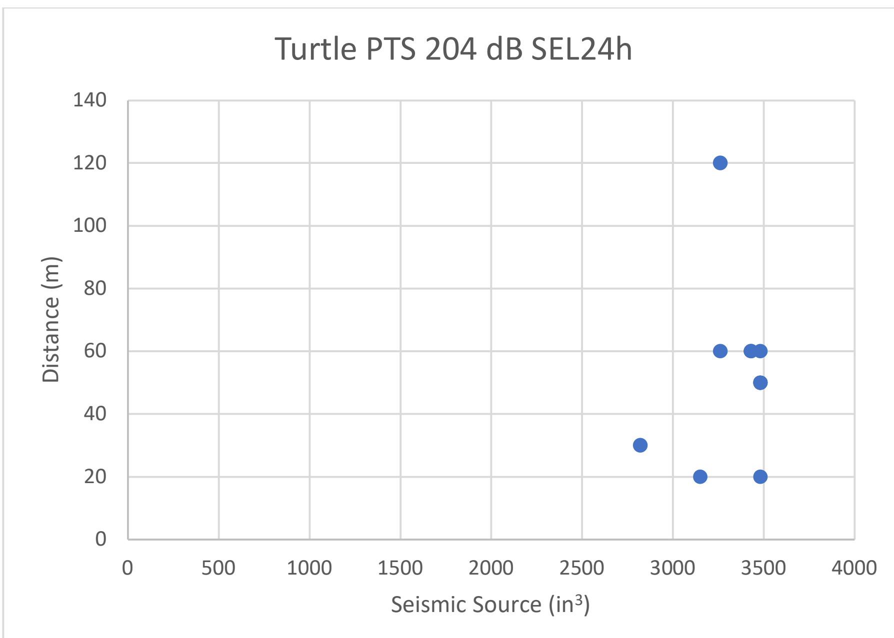


Figure 7-40: Distance to Finneran et al (2017) PTS 24 hr against Seismic Source

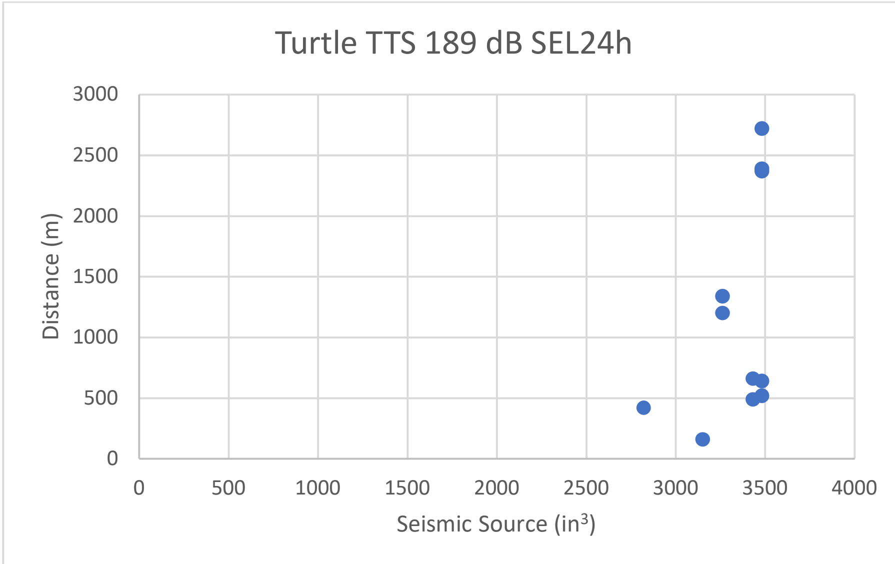


Figure 7-41: Distance to Finneran et al (2017) TTS 24 hr against Seismic Source

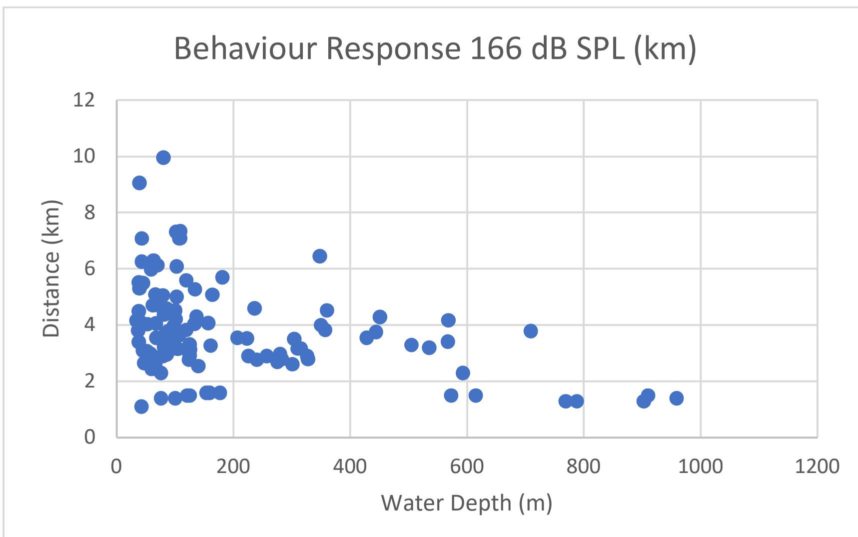


Figure 7-42: Distance to McCauley et al. (2000a, 2000b) Behavioural Response against Water Depth

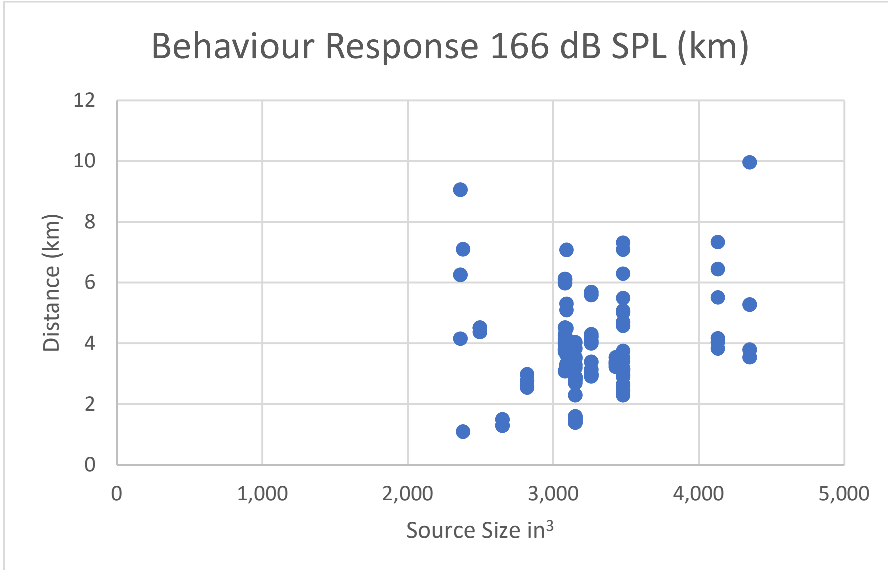


Figure 7-43: Distance to McCauley et al. (2000a, 2000b) Behavioural Response against Seismic Source

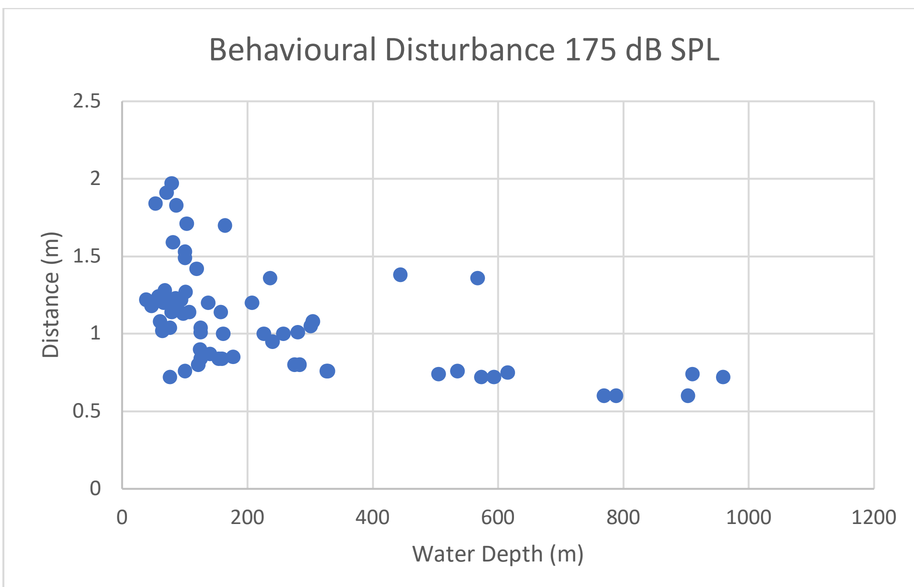


Figure 7-44: Distance to NSF (2011) Behavioural Disturbance against Water Depth

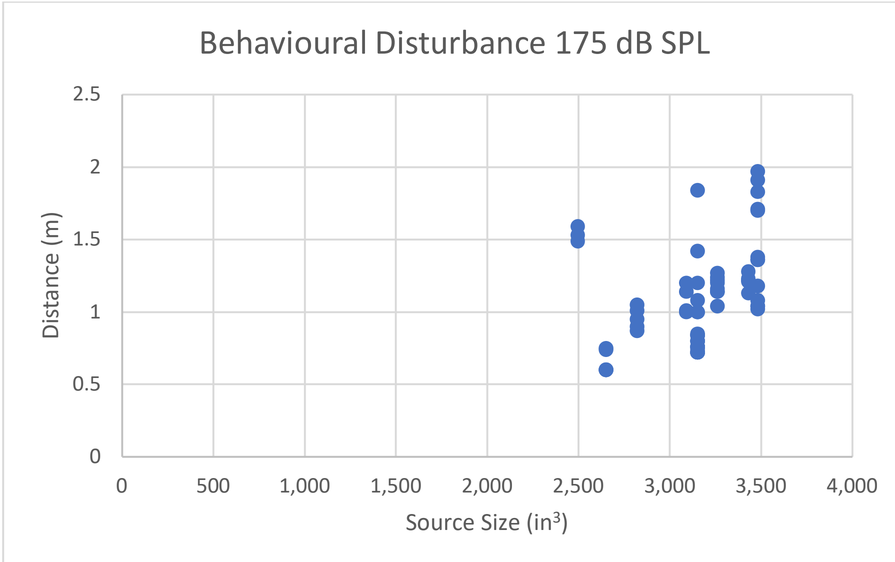


Figure 7-45: Distance to NSF (2011) Behavioural Disturbance against Seismic Source

7.1.8.2 Impact Pathway

To identify the values and sensitivities associated with turtles a review was undertaken of the existing environment within the CSEP OA and out to 10 km of the CSEP OA to identify those receptors associated with turtles. A distance of 10 km was used as this is the furthest distance to the sound effect criteria as detailed in Table 7-15. This review identified the following values and sensitivities relating to turtles (Table 7-16). More detailed information on these areas is provided in Section 5.5.3 and the Existing Environment Addendum.

Table 7-16: Marine Turtle Values and Sensitives relating to Seismic Sound

Turtle	Biologically Important Behaviour	Biologically Important Area	Habitat Critical to the Survival of the Species
Flatback	Bonaparte: foraging known to occur Bonaparte: breeding known to occur Browse: foraging known to occur Browse: breeding known to occur Carnarvon: breeding known to occur	Bonaparte: Foraging Internesting Buffer Browse: Foraging Internesting Buffer Carnarvon: Foraging Internesting buffer Nesting	Bonaparte: Nesting Browse: Nesting Carnarvon: Nesting
Green	Bonaparte: foraging known to occur Browse: foraging known to occur Browse: breeding known to occur	Bonaparte: Foraging Browse: Foraging Internesting Buffer Carnarvon: Basking	Bonaparte: NA Browse: Nesting Carnarvon: Nesting

Turtle	Biologically Important Behaviour	Biologically Important Area	Habitat Critical to the Survival of the Species
	Carnarvon: foraging known to occur Carnarvon: breeding known to occur	Foraging Internesting Buffer Mating Nesting	
Hawksbill	Bonaparte: known to occur Browse: known to occur Carnarvon: breeding known to occur	Bonaparte: NA Browse: Internesting Buffer Carnarvon: Foraging Internesting Buffer Mating Nesting	Bonaparte: NA Browse: NA Carnarvon: Nesting
Leatherback	Bonaparte: foraging likely to occur Browse: foraging likely to occur Carnarvon: known to occur	Bonaparte: NA Browse: NA Carnarvon: NA	Bonaparte: NA Browse: NA Carnarvon: NA
Loggerhead	Bonaparte: foraging known to occur Browse: foraging known to occur Carnarvon: foraging known to occur Carnarvon: breeding known to occur	Bonaparte: Foraging Browse: Foraging Carnarvon: Internesting Buffer Nesting	Bonaparte: NA Browse: NA Carnarvon: Nesting
Olive Ridley turtle	Bonaparte: known to occur Browse: known to occur Carnarvon: NA	Bonaparte: Foraging Browse: NA Carnarvon: NA	Bonaparte: NA Browse: Nesting Carnarvon: NA

7.1.8.3 Predicted Level of Impact

Due to the area of impact for sound emissions from seismic surveys in the CSEP OA overlapping numerous BIA and Habitat Critical to the Survival of the Species appropriate control measures will be implemented to ensure that turtles are not injured or disturbed when undertaking mating, breeding or internesting behaviours.

As shown in Table 7-15 the maximum modelled distance to sound effect criteria for turtles are:

- Mortality/Potential Mortal Injury: 250 m (PK)
- PTS: 120 m (24 hr)
- TTS: 2.72 km (24 hr)

- Behavioural response: 10 km
- Behavioural disturbance: 1.97 km

As detailed in Table 7-15, the Finneran et al. (2017) per pulse (PK) for PTS and TTS is reached at a maximum distance of 20 m from the centre of the seismic array. As the array is not a point source but an array of sources the actual effect range from the edge of the array will be less than 20 m. Therefore, it is highly unlikely that a marine turtle would be exposed at such close range given that the source is towed directly behind the seismic vessel and some attempt to swim away from the approaching vessel and/or increasing sound levels from the seismic source is likely.

The severity is assessed as Moderate (3) based on impacts to turtles are predicted to be minor disruption to small portion of population with minor, temporary effects on critical habitats/ activities and no threat to population viability based on:

- The Recovery Plan for Marine Turtles in Australia (DoEE 2017) identifies acute noise interference from anthropogenic noise sources, such as seismic surveys, as a low-risk threat to the stocks of marine turtles.
- Mortality or mortal injury to turtles is considered highly unlikely based on no documented cases of mortality in turtles exposed to seismic source emissions under experimental or field operating conditions (Popper et al. 2016).
- As the CSEP OA overlaps BIAs and Habitat Critical to the Survival of the Species appropriate control measures will be implemented to ensure that turtles are not injured or disturbed when undertaking mating, breeding or internesting behaviours.

7.1.8.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-17: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Moderate.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature. The Recovery Plan for Marine Turtles in Australia (DoEE 2017) details that a precautionary approach should be applied to seismic surveys, such that surveys should not occur inside important internesting habitat during nesting season. This has been applied as CM#9: Turtle Exclusion Zone.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Management of the activity is consistent with the requirement of the Recovery Plan for Marine Turtles in Australia (DoEE 2017) based on the following. The Recovery Plan for Marine Turtles in Australia (DoEE 2017) details that: • A precautionary approach should be applied to seismic surveys, such that surveys should not occur inside important internesting habitat during nesting season. This has been applied as CM#9: Turtle Exclusion Zone. • In accordance with the EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines, all seismic survey vessels operating in Australian waters must undertake a soft start during surveys irrespective of location and time of year of the survey. Although these guidelines are specifically designed for interactions with cetaceans, the soft start provision may also afford protection for marine turtles. Soft starts will be implemented for turtles as per CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Operational Protocol: Soft Starts and CM#11: Turtle Shutdowns. Actions from the Recovery Plan for Marine Turtles in Australia (DoEE 2017) relevant to seismic surveys are: • Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival as per section 3.3 Table 6 of the plan which details the nesting and internesting areas. CM#9: Turtle Exclusion Zone will be applied to ensure turtles are not displaced from identified habitat critical to the survival.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		• Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue. Biologically important behaviour is defined as breeding, foraging, resting and migration. CM#9: Turtle Exclusion Zone will be applied to ensure turtle breeding and resting can continue in nesting and internesting BIAs. CM#11: Turtle Shutdowns, CM#12: Turtle night time and low-visibility procedure and CM#13: Turtle Adaptive Management Procedure will be applied to ensure turtle foraging can continue in foraging BIAs.	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within this Section and the implementations strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	The Director of National Parks raised that the CSEP needs to identify and assess all marine park values for those marine parks potentially impacted by a seismic survey within and outside the operational areas. Section 7.1.12 details the assessment of predicted impact to marine park values such as turtles from seismic acoustic emissions.	Yes

7.1.8.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-18 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-18: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes
CM#9: Turtle Exclusion Zone	The Recovery Plan for Marine Turtles in Australia (DoEE 2017) states that a precautionary approach should be applied to seismic surveys, such that surveys should not occur inside important internesting habitat during nesting season. Thus, no operation of the seismic source will occur within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species as defined in the Recovery Plan for Marine Turtles in Australia (DoEE 2017) and/or National Conservation Values Atlas if the information is not available in the recovery plan. An exclusion zone has been applied to turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities as while turtles are undertaking these biologically important behaviours, they are potentially less likely to move away from the seismic source which could result in potential impact to the turtles and breeding behaviour. 3 km is based on: • PTS and TTS per pulse criteria is predicted up to a maximum of 20 m. • PTS 24hr criteria is predicted at a maximum up to 120 m. • TTS 24hr criteria is predicted at a maximum up to 2.72 km • The more precautionary injury threshold (Popper et al. 2014) is predicted up to a maximum of 250 m. • The behavioural disturbance criteria is predicated at 1.97 km. Thus, a 3 km exclusion zone will ensure that turtles internesting, nesting or mating within a BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species can continue these behaviours without being injured or displaced. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords	Yes

Control Measure	Justification	Adopted
	protection to turtles as impact criteria will not be exceeded within a BIA. An exclusion zone has not been applied to foraging BIAs as the timing of foraging within these BIAs is not known and additional controls (CM#10, CM#11, CM#12) have been applied to foraging BIAs to ensure impacts to foraging turtles can be manage such as they can continue to forage within injury. CM#10, CM#11, CM#12 will also be applied to surveys within turtle internesting, nesting or mating BIA or habitat critical for the survival of the species outside of the periods when they are undertaking biologically important behaviour within the BIA or habitat critical for the survival of the species.	
CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Operational Protocol: Soft Starts	The Recovery Plan for Marine Turtles in Australia (DoEE 2017) details: "In accordance with the EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines, all seismic survey vessels operating in Australian waters must undertake a soft start during surveys irrespective of location and time of year of the survey. Although these guidelines are specifically designed for interactions with cetaceans, the soft start provision may also afford protection for marine turtles." Thus, the soft start requirements of EPBC Act Policy Statement 2.1 will be applied to turtles for all surveys.	Yes
CM#11: Turtle Shutdowns	To ensure that turtles can continue to forage in foraging BIAs without injury, EPBC Act Policy Statement 2.1 – Interaction between Offshore seismic exploration: Part A will be applied to turtles within foraging BIAs. This control will also be applied to seismic surveys undertaken within a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species outside of the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species to account for any changes or uncertainty in the timing of when turtles are undertaking biologically important behaviour in these BIAs or habitat critical for the survival of the species. This control is not applied to areas outside of BIAs or habitat critical for the survival of the species as turtles in these areas would be transient and not undertaking biologically important behaviour, hence any impacts would be temporary and not impact an individual's survival or the population. To reduce the potential risks to turtles within a BIA or habitat critical for the survival, a 250 m shut-down zone is a practicable measure to implement. A 250 m shutdown zone is appropriate based on the following distances to the seismic source: • PTS and TTS per pulse criteria are predicted up to a maximum of 20 m. • PTS 24hr criteria is predicted at a maximum up to 120 m. • The more precautionary injury threshold (Popper et al. 2014) is predicted up to a maximum of 250 m. Observing for turtles at distances greater than 250 m from the source, which is towed a short distance behind the vessel, is	Yes

Control Measure	Justification	Adopted
	unreliable due to the small size of turtles' heads above the surface, even in calm conditions, and is not considered practicable. The seismic source will be shut down, or start-up will be delayed for 15 minutes, if a turtle is observed within the 250 m shut-down zone. Operation of the seismic source using soft-start shall only resume when 15 minutes have lapsed since the turtle sighting, or the turtle has been observed to move outside the 250 m shutdown zone. Over the course of 15 minutes, the seismic survey vessel will travel approximately 2 km from the sighting location at a speed of 4.5 knots. Given that turtles are slow swimming relative to the survey vessel and due to their limited sensitivity to sound (impairment impacts limited to <20 m from the seismic source), the shut-down and start-up delay is also considered protective against PTS and TTS effects. The 2 km distance that the vessel will travel from the sighting location is within the maximum modelled distance of 1.97 km for the 175 dB SPL behavioural disturbance threshold. Therefore, the shut-down / start-up delay duration is also considered to limit behavioural disturbance effects to foraging turtles. Further start up delay is not considered practicable, as it could result in significant periods of shutdown when turtles are not close enough to the seismic source to experience injury or hearing impairment impacts. Multiple shut-downs and delays could extend the overall survey duration at significant cost (tens of thousands of dollars per day that the survey is extended) and increased impacts to other receptors.	
CM#12: Turtle night time and low-visibility procedure	Visual observations and shutdown procedures for marine turtles are effective during periods of good visibility. However, observations for turtles cannot be effectively conducted at night time or during periods of low-visibility. Therefore, implementation of night time and low visibility procedures, such that start-up and operation of the seismic source may only commence at night-time or at other times of low-visibility if adequate daylight observations have taken place beforehand, provide a practicable means to reduce the likelihood of exposing significant numbers of turtles to PTS/TTS effects and close-range behavioural effects. This control will also be applied to seismic surveys undertaken within a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species outside of the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species to account for any changes or uncertainty in the timing of when turtle are undertaking biologically important behaviour in these BIAs or habitat critical for the survival of the species. This control is not applied to areas outside of BIAs or habitat critical for the survival of the species as turtles in these areas would be transient and not undertaking biologically important behaviour, hence any impacts would be temporary and not impact an individual's survival or the population. Consistent with EPBC Policy Statement 2.1 Procedure A.3.6 for whales, start-up of the seismic source (according to the A.3.2 Soft-Start Procedure) may only commence at night-time or at other times of low-visibility provided:	Yes

Control Measure	Justification	Adopted
	• There have not been 3 or more shut-downs for turtles during the preceding 24 hour period; and • If operations were not previously underway during the preceding 24 hours, the vessel has been in the vicinity (10 km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period, and no turtles have been sighted.	
CM#13: Turtle Adaptive Management Procedure	The proposed shutdown procedures (CM#11), soft-start procedures (CM#10) and night time / low visibility procedures (CM#12) are considered to be effective in reducing the risk of PTS/TTS effects and limit significant close range behavioural disturbance. Disturbances to turtles are currently predicted to be localised and short term. Foraging behaviours are predicted to be able to continue within the foraging BIAs. However, it is acknowledged that the area of overlap with turtle foraging BIAs and the Carbonate Bank and Terrace System of the Sahul Shelf KEF, Carbonate Bank and Terrace System of the Van Diemen Rise KEF and Pinnacles of the Bonaparte Basin KEF represent the most viable area of foraging habitat within the foraging BIAs within the CSEP OAs. Thus, the following adaptive management procedure will be implemented for seismic surveys within the foraging BIAs within the Carbonate Bank and Terrace System of the Sahul Shelf KEF, Carbonate Bank and Terrace System of the Van Diemen Rise KEF and Pinnacles of the Bonaparte Basin KEF: If there are 3 or more shut-downs for turtles within a 24-hour period, no operation of the seismic source will take place within 2 km of the Carbonate Bank and Terrace System of the Sahul Shelf KEF, Carbonate Bank and Terrace System of the Van Diemen Rise KEF or Pinnacles of the Bonaparte Basin KEF for 24 hours from the last turtle shutdown event. Three or more shut-downs for turtles within a 24-hour period is an appropriate trigger is indicating an increase in numbers of turtles within the survey area. 2km is an appropriate distance as the furthest distance that modelling predicts to the behavioural disturbance criteria is 1.97 km. The distance to behavioural response criteria is up to 10 km, however, at this level it is unlikely that foraging turtles would be disturbed or displaced from foraging. A 2 km buffer for 24 hrs reduces the potential for behavioural disturbance to a high number of foraging turtles during both daylight (when foraging is most likely to occur) and at night time (when it is not possible to observe or otherwise mitigate for turtles). This achieves additional environmental benefit and assurance that biologically important foraging behaviours can continue in the key foraging habitat areas of the foraging BIAs without delaying the survey which can add to the overall survey duration at significant cost (tens to hundreds of thousands of dollars per day that the survey is extended) and increased impacts to other receptors. The 2 km buffer may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the behavioural disturbance criteria is less than 2 km. The acoustic modelling must be undertaken using a numerical model as detailed	Yes

Control Measure	Justification	Adopted
	in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to foraging turtles as the behavioural disturbance criteria will not be exceeded. There would be a significant cost (financial and increased time to undertake the survey) if this control was applied to the full foraging area within the Bonaparte and Browse CSEP OAs as the foraging areas cover a large area and could result in the survey being delayed for 24 hr shutdowns. This would have increased impacts on other receptors.	
Exclusion zone for KEFs within foraging BIAs	An exclusion zone to manage potential impacts to foraging turtles within KEFs could result in the exclusion of a survey when no turtles are present. The proposed shutdown procedures (CM#11), soft-start procedures (CM#10) and night time / low visibility procedures (CM#12) which will be implemented within foraging BIAs ensure impacts to foraging turtles can be manage such as they can continue to forage within injury and biologically important foraging behaviours can continue in the key foraging habitat areas of the foraging BIAs without delaying the survey which can add to the overall survey duration at significant cost (tens of thousands of dollars per day that the survey is extended) and increased impacts to other receptors.	No
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes

7.1.9 *Marine Mammals*

Marine mammals and especially cetaceans rely on sound for important life functions including individual recognition, socialising, detecting predators and prey, navigation, and reproduction (Weilgart 2007, Erbe et al. 2015, Erbe et al. 2018). Underwater noise can affect marine mammals in various ways including interfering with communication (masking), behavioural changes, a shift in the hearing threshold, physical damage, and stress (Erbe 2012, Rolland et al. 2012).

A summary of relevant studies in relation to seismic acoustic emission impacts to marine mammals is provided in Appendix A.

7.1.9.1 Sound Effect Criteria

There are no defined sound effect criteria for mortality and potential mortal injury impacts for marine mammals. These effects are not predicted to occur as received sound levels are not of sufficient magnitude to cause mortality/ potential mortal injury.

The sound effect criteria used for cetaceans in the acoustic modelling and in this impact assessment, are summarised in Table 7-19, and are explained in more detail in Appendix A. Frequency weighting is also explained in Appendix A.

The peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL) presented in Table 7-19 are from the U.S. National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) in marine mammals. The marine mammal behavioural threshold presented in Table 7-19 is based on the current interim U.S. National Marine Fisheries Service (NMFS) (NMFS 2014) level of 160 dB re 1 µPa SPL for impulsive sound sources.

Figure 7-46 to Figure 7-54 detail the collated acoustic modelling data used to determine the predicted maximum distances to the sound exposure guidelines. For the per pulse sound exposure guidelines the data is shown relative to water depth and seismic source size as the modelling for the per pulse criteria is at a specific location. For the cumulative sound exposure guideline, the modelling is done over a 24 hr period and thus over a range of water depths thus the data is shown relative to seismic source size.

Table 7-19: Sound Effect Criteria and Predicted Maximum Distance for Marine Mammals

	PTS		TTS		Behavioural
Threshold Criteria	PTS is considered injurious in marine mammals, but there are no published data on the sound levels that cause PTS in marine mammals. Impact assessment evaluates dual metric criterion requiring consideration of both PK and accumulated SEL. PTS onset thresholds for marine mammals have not been directly measured, the NMFS (2018) criteria incorporate the best available science to estimate PTS onset in marine mammals from sound energy (SEL$_{24h}$), or very loud, instantaneous peak sound pressure levels (PK) through extrapolation from available TTS onset measurements.		The onset of TTS is often defined as threshold shift of 6 dB above the normal hearing threshold (Southall et al. 2007). In marine mammals, the onset level and growth of TTS is frequency specific, and depends on the temporal pattern, duty cycle, and the hearing test frequency of the fatiguing stimuli. There is considerable individual difference in all TTS related parameters between subjects and species tested so far.		NMFS currently uses a step function with a 50% probability of inducing behavioural responses at an unweighted SPL of 160 dB re 1 μPa to assess behavioural impact (NOAA 2019). This threshold value was derived from the HESS (1999) report, which, in turn, was based on the responses of migrating mysticete whales to seismic sounds (Malme et al. 1984). An extensive review of behavioural responses to sound was undertaken by Southall et al. (2007). They found varying responses for most marine mammals between an SPL of 140 and 180 dB re 1 μPa, consistent with the HESS (1999) report. There is no SEL$_{24h}$ metric for behavioural responses in HF cetaceans, so per pulse SPL of 160 dB re 1 μPa criterion is used to assess these impacts. The same unweighted behavioural response criteria are used for all cetaceans.
Relevance of thresholds adopted	The PTS and TTS thresholds are from NMFS (2018) which is the most current, globally recognised technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing. It is difficult to determine thresholds for behavioural response in individuals or groups of cetaceans (Southall et al. 2007, 2021). Often the way individuals or groups respond varies (Nowacek et al. 2004; Gomez et al. 2016; Southall et al. 2016, 2021) and is influenced by both biological and environmental factors such as age, sex, and activity at the time etc. The behavioural disturbance threshold criteria applied is the current NMFS (2019) criterion for marine mammals and which summates the most recent scientific literature on the impacts of sound on marine mammal hearing.				
High-frequency (HF) cetaceans - Porpoises, dwarf and pygmy sperm whales					
Sound exposure guideline	**Per pulse**	**SELcum**	**Per Pulse**	**24 hr**	**Per Pulse**
	202 dB PK	155 dB SEL$_{24h}$	196 dB PK	140 dB SEL$_{24h}$	160 dB SPL
Modelled Distance	440 m	90 m	870 m	6.88	17.84 km

	PTS		TTS		Behavioural
Mid-frequency (MF) cetaceans - Dolphins, beaked whales and sperm whales					
Sound exposure guideline	**Per pulse**	**SELcum**	**Per Pulse**	***24 hr***	**Per Pulse**
	230 dB PK	185 dB SEL_{24h}	224 dB PK	170 dB SEL_{24h}	160 dB SPL
Modelled Distance	20 m	40 m	20 m	50 m	17.84 km
Low-frequency (LF) cetaceans – baleen whales					
Sound exposure guideline	**Per pulse**	**SELcum**	**Per Pulse**	**24 hr**	**Per Pulse**
	219 dB PK	183 dB SEL_{24h}	213 dB PK	168 dB SEL_{24h}	160 dB SPL
Modelled Distance	40 m	5.96 km	100 m	92.3 km	17.84 km
Dugongs					
Sound exposure guideline	**Per pulse**	**SELcum**	**Per Pulse**	**24 hr**	**Per Pulse**
	226 dB PK	190 dB SEL_{24h}	220 dB PK	175 dB SEL_{24h}	160 dB SPL
Modelled Distance	20 m	Not reached	30 m	50 m	17.84 km

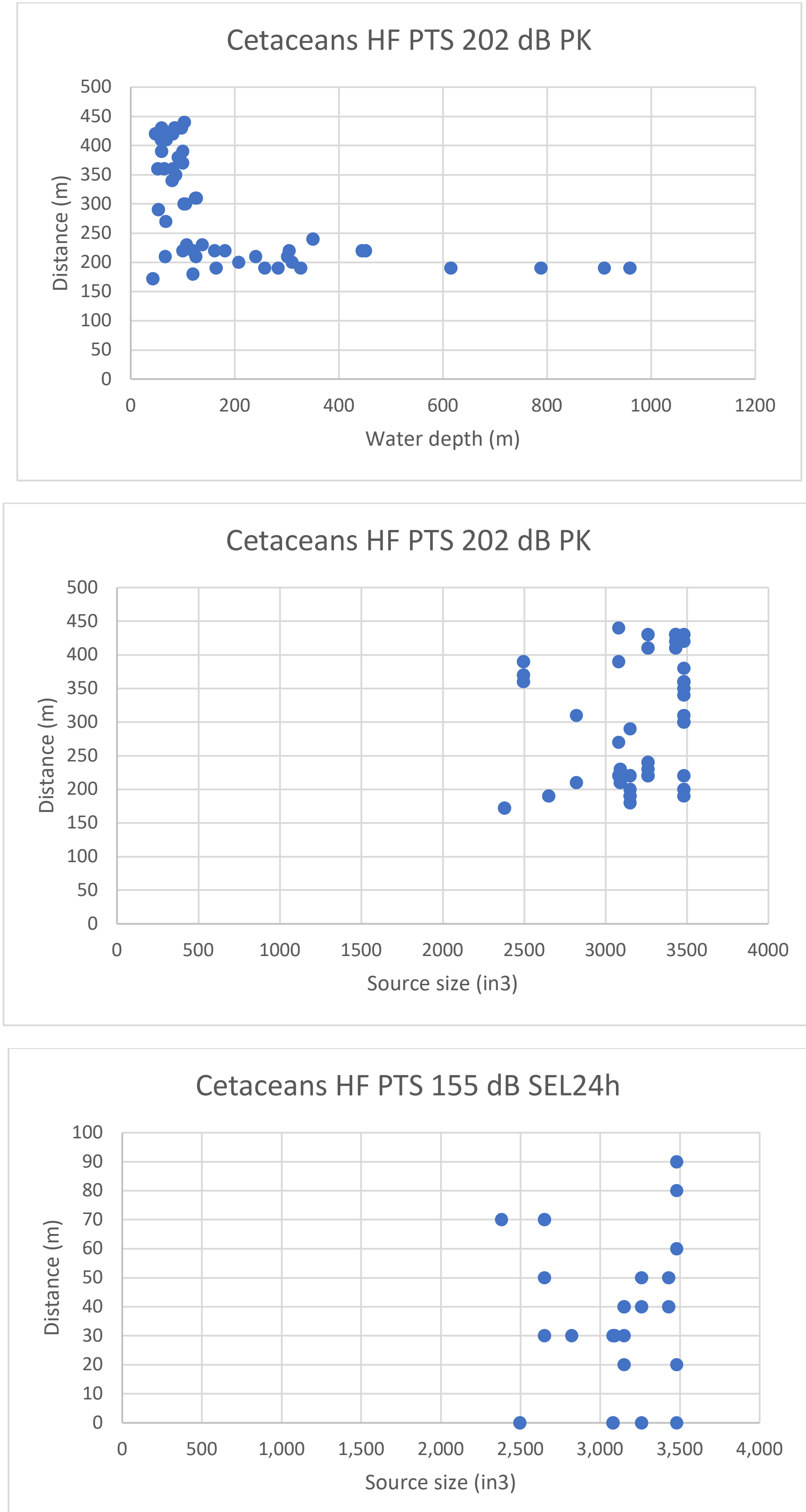


Figure 7-46: Distance to PTS PK and 24h Sound Effect Criteria for High Frequency Cetaceans

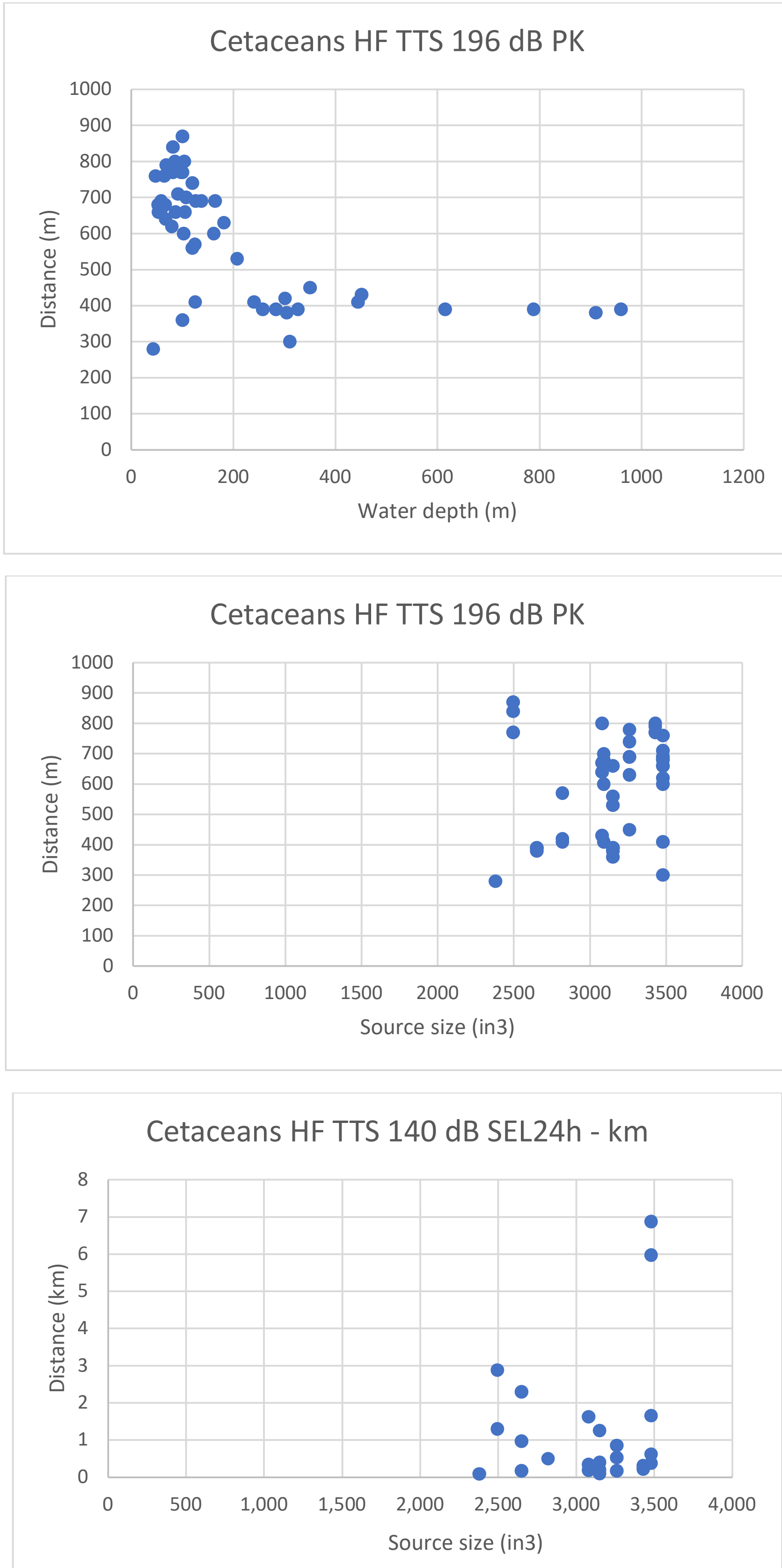


Figure 7-47: Distance to TTS PK and 24h Sound Effect Criteria for High Frequency Cetaceans

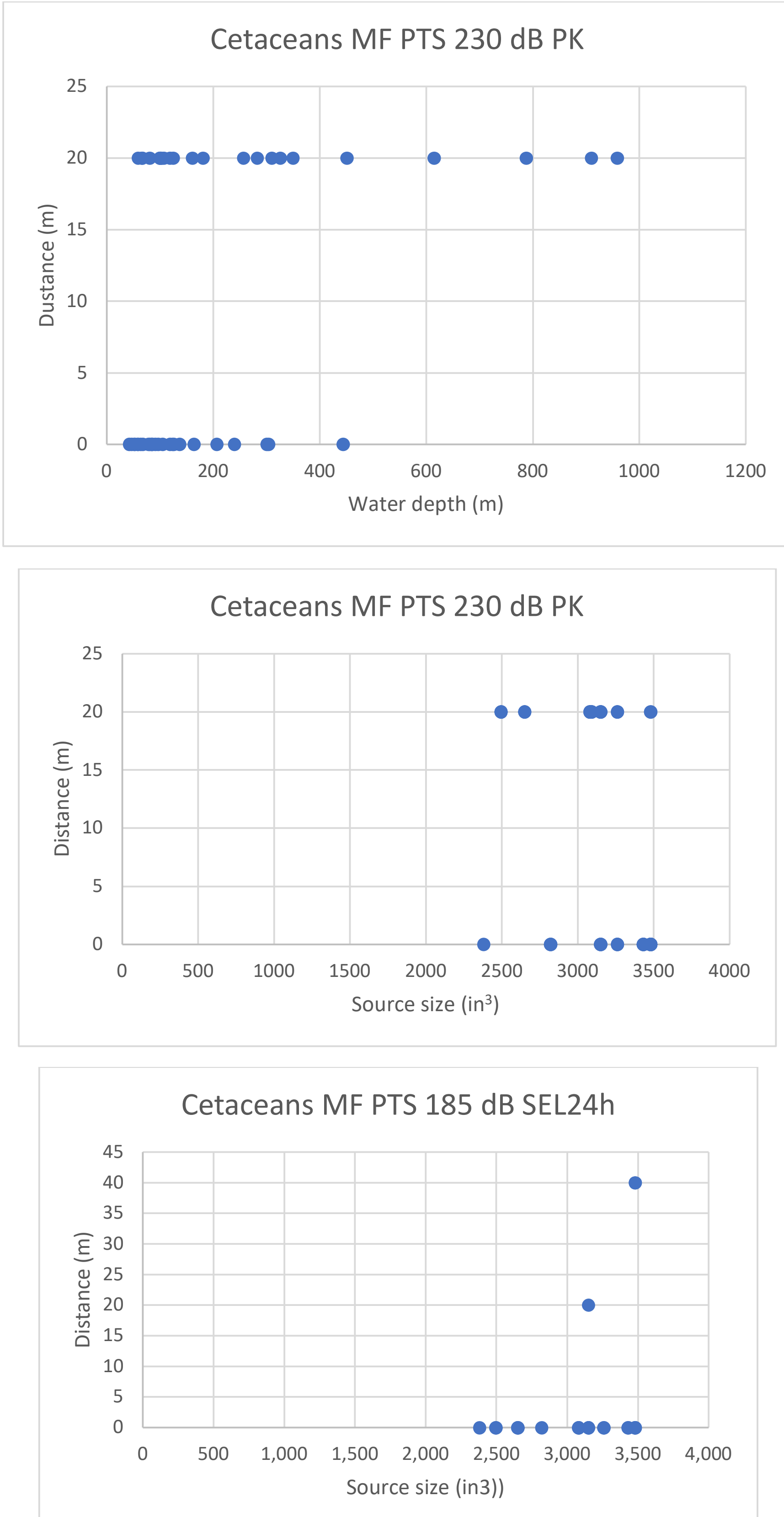


Figure 7-48: Distance to PTS PK and 24h Sound Effect Criteria for Mid Frequency Cetaceans

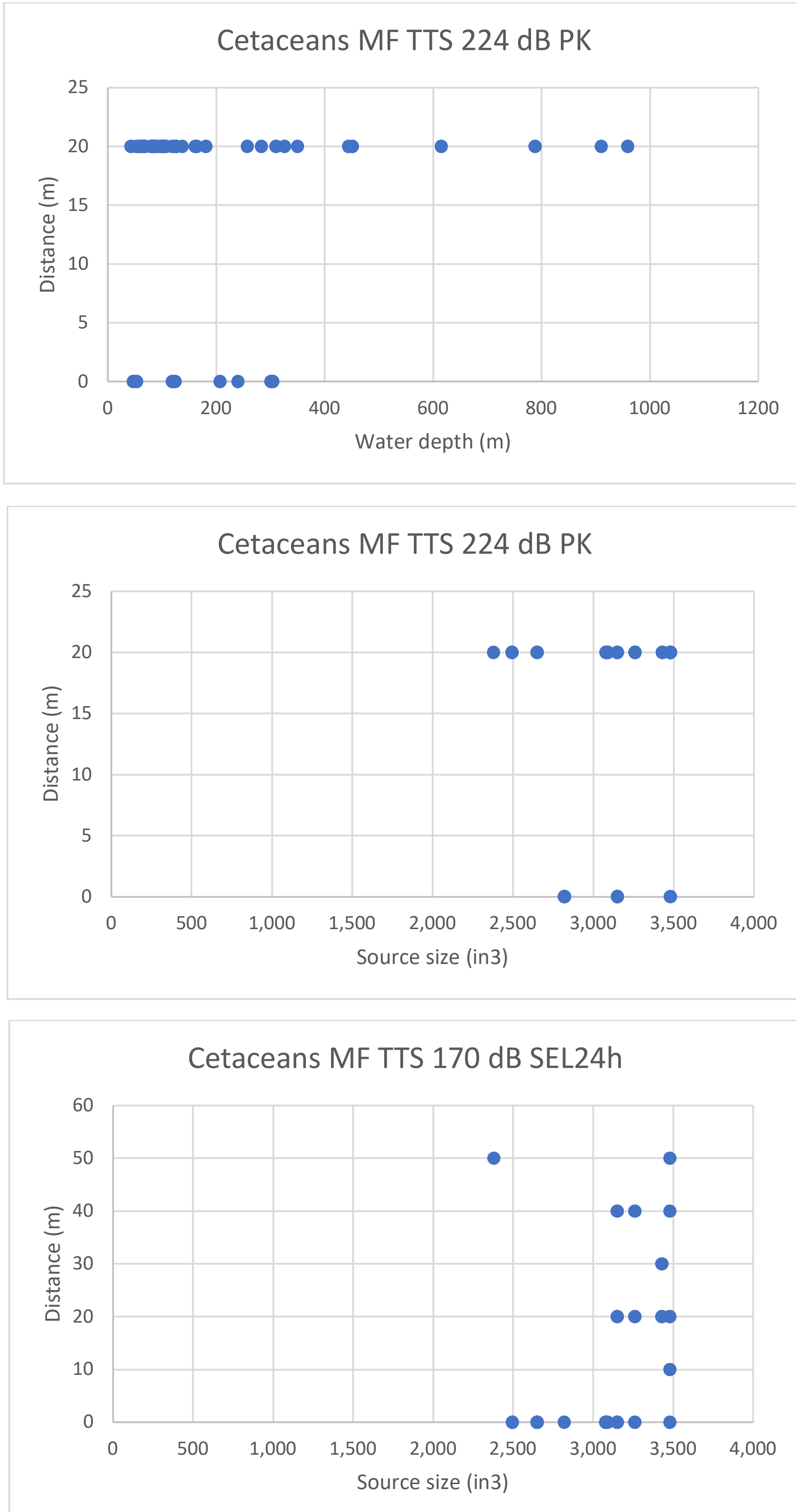


Figure 7-49: Distance to TTS PK and 24h Sound Effect Criteria for Mid Frequency Cetaceans

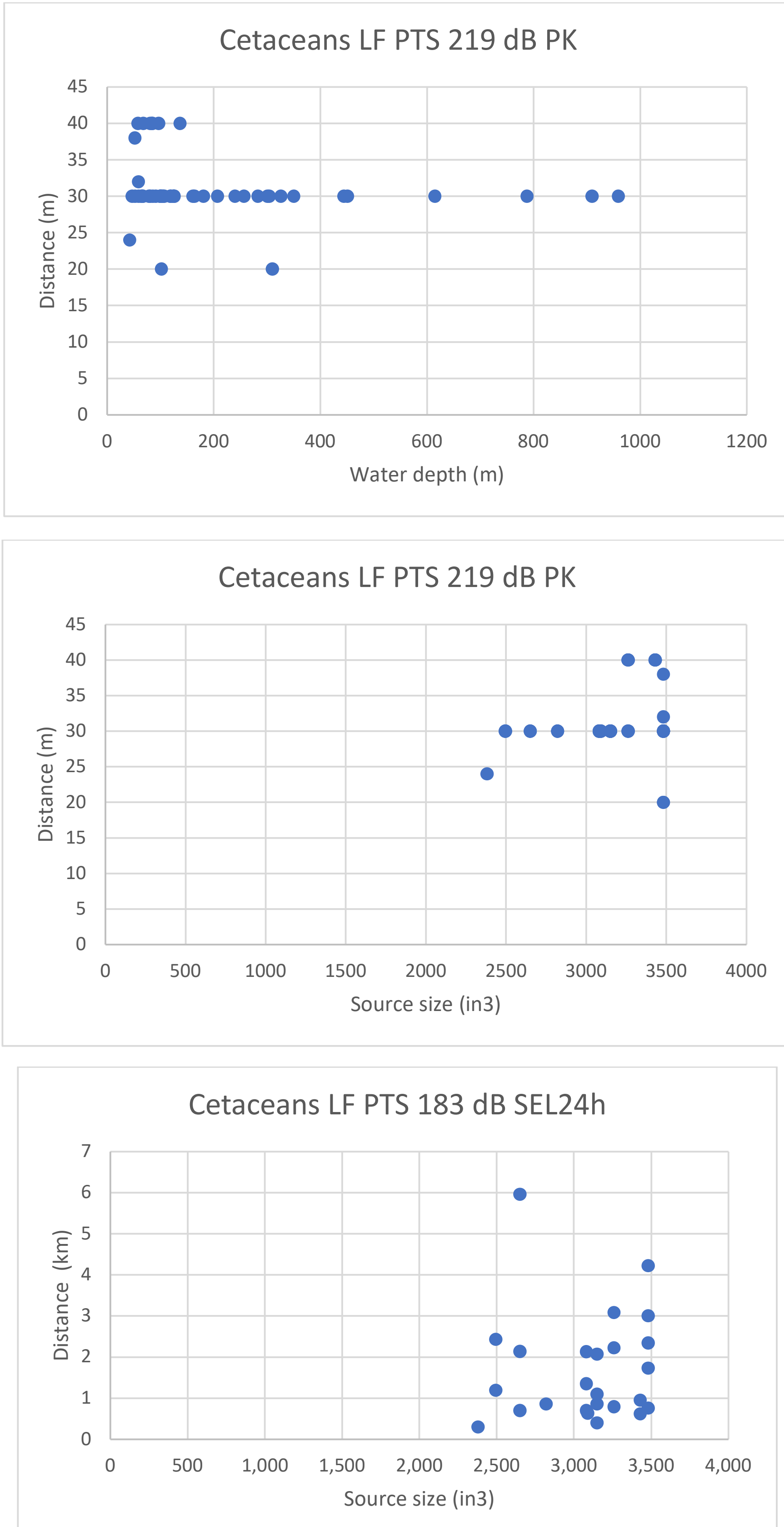
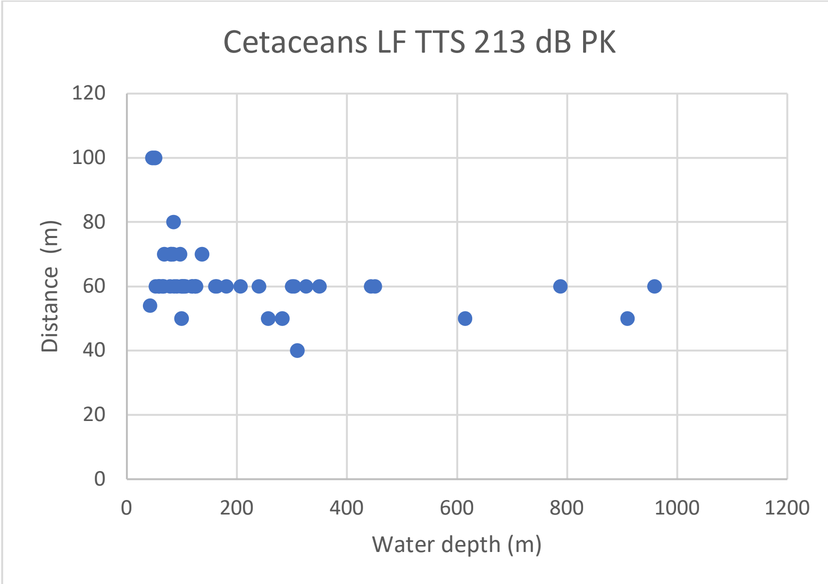
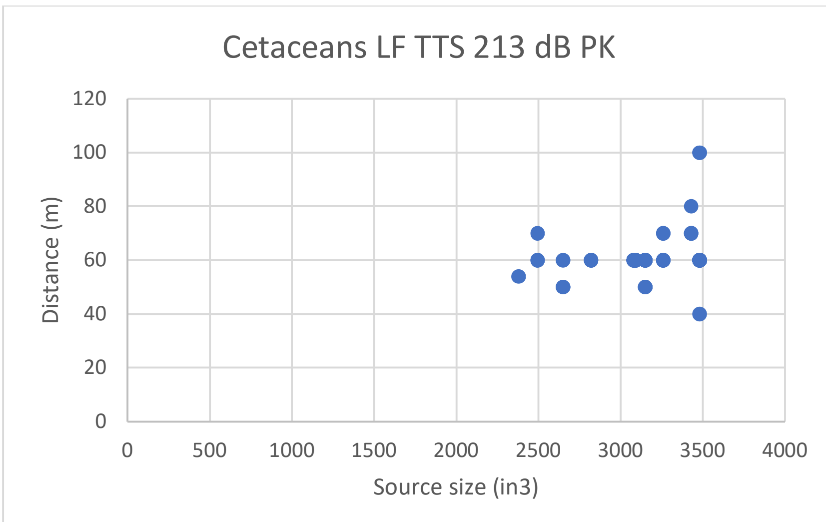


Figure 7-50: Distance to PTS PK and 24h Sound Effect Criteria for Low Frequency Cetaceans





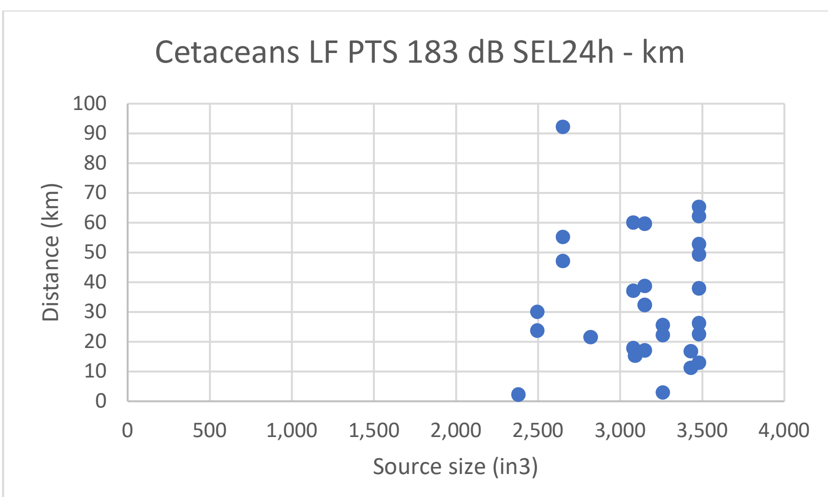
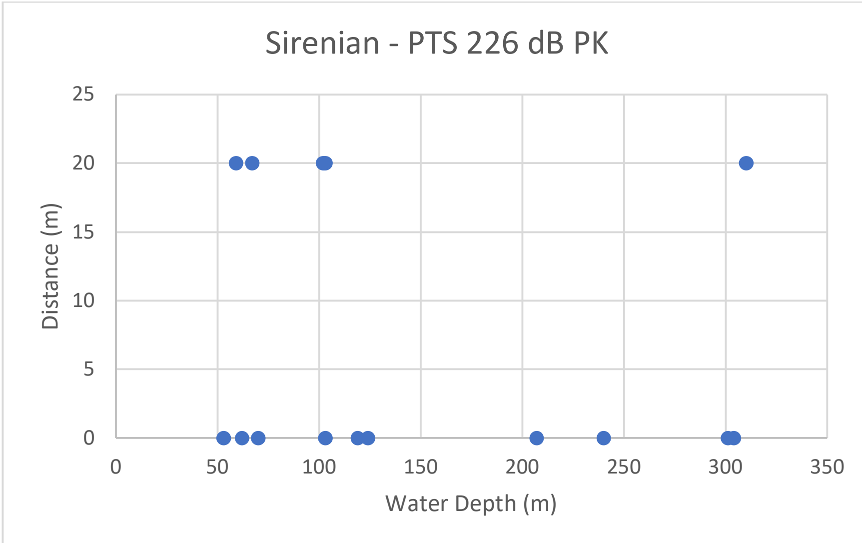
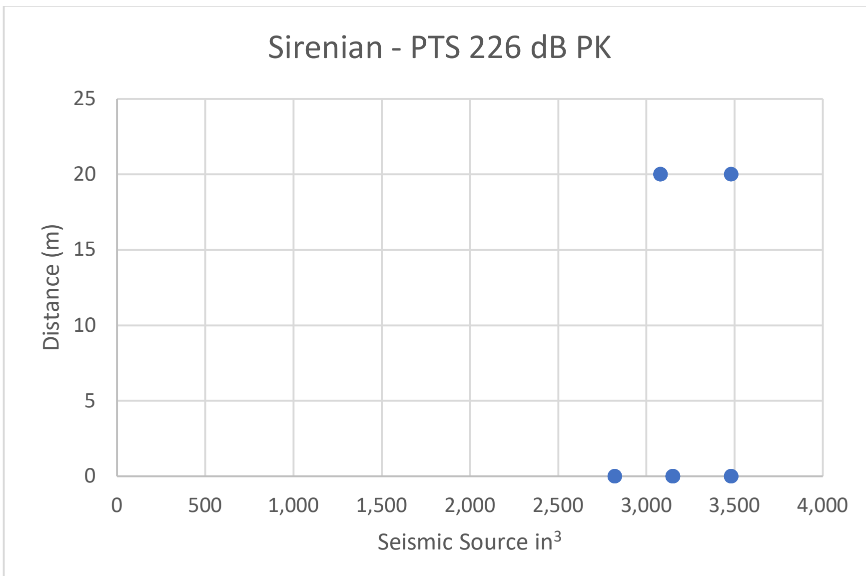


Figure 7-51: Distance to TTS PK and 24h Sound Effect Criteria for Mid Frequency Cetaceans





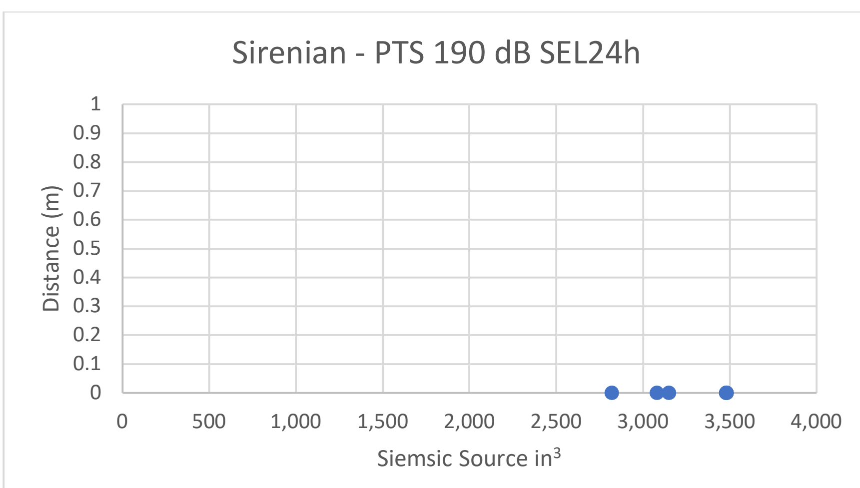


Figure 7-52: Distance to PTS PK and 24h Sound Effect Criteria for Dugongs

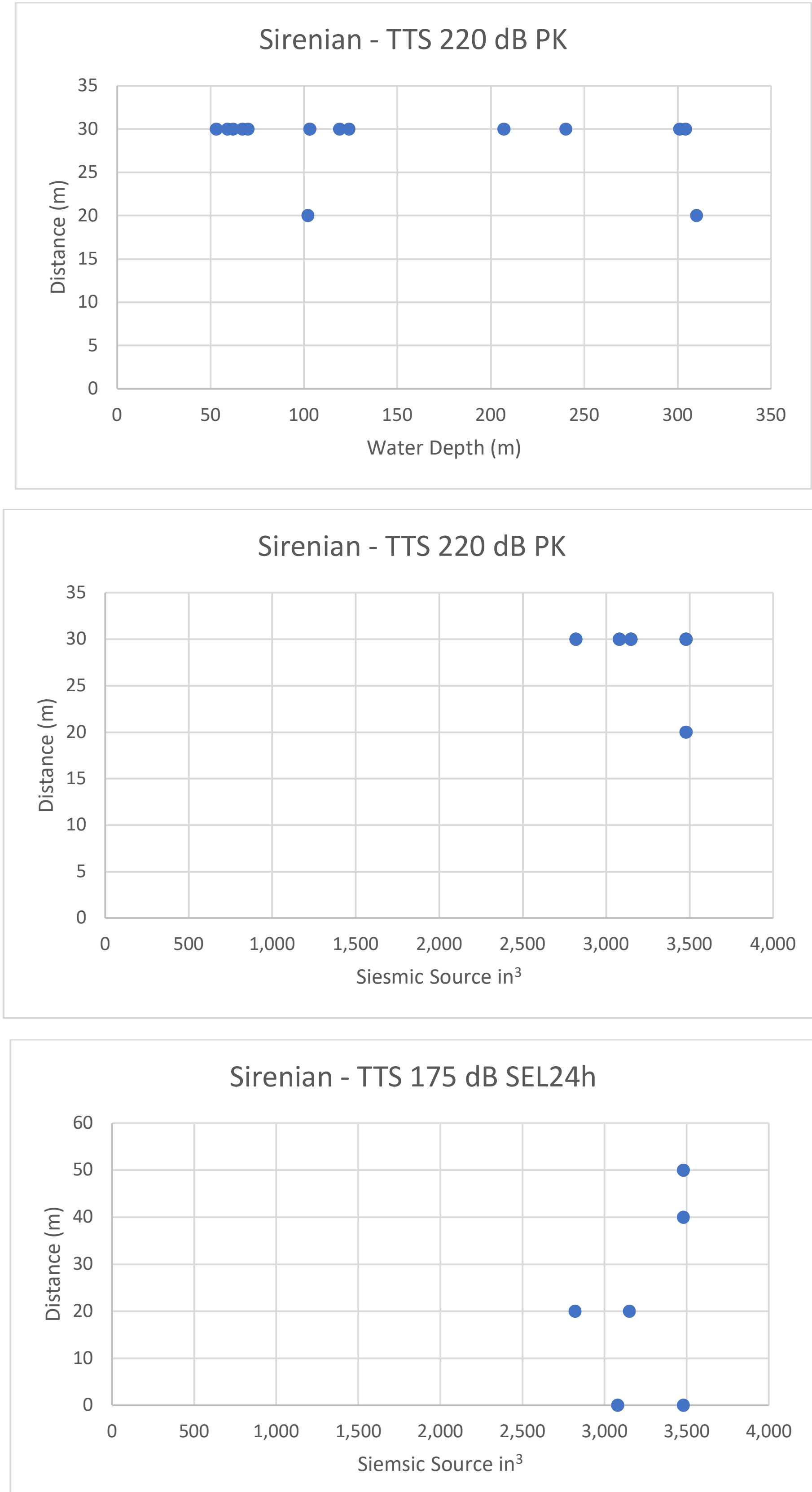
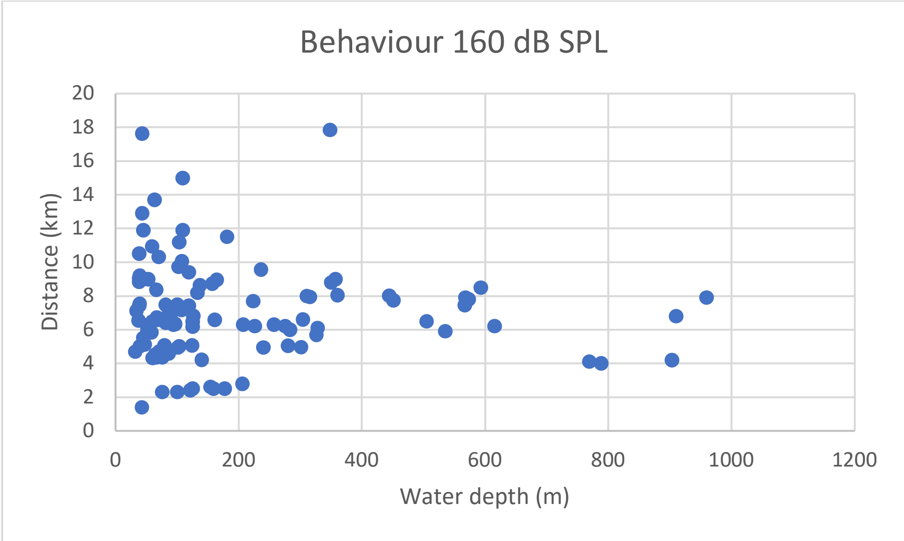


Figure 7-53: Distance to TTS PK and 24h Sound Effect Criteria for Dugongs



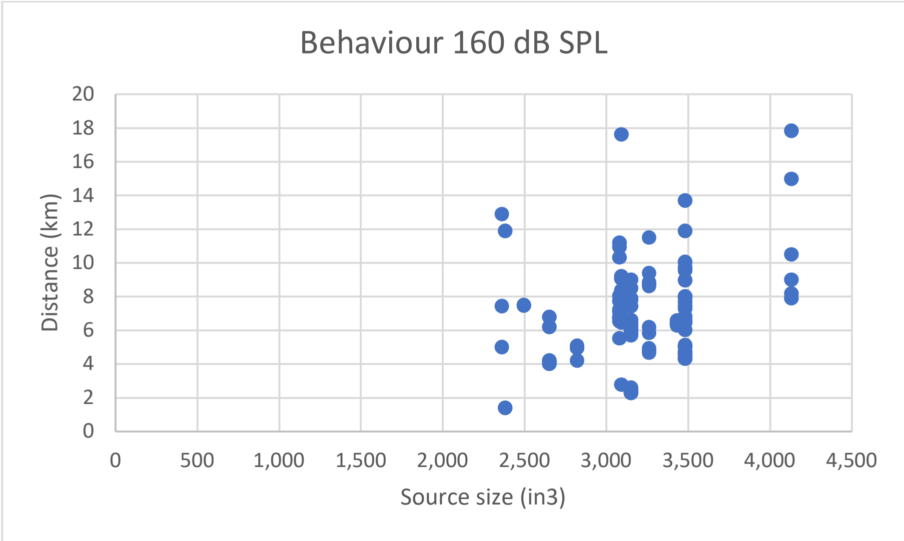


Figure 7-54: Distance to Behavioural Sound Effect Criteria for Marine Mammals

7.1.9.2 Impact Pathway

To identify the values and sensitivities associated with marine mammals a review was undertaken of the existing environment within the CSEP OA and out to a distance determined by the furthest distance to the sound effect criteria in Table 7-19 appropriate to the group of marine mammals:

- Dugong, medium-frequency and high-frequency whales and dolphins: 18 km
- Low frequency whales: 93 km

This review identified the following values and sensitivities relating to marine mammals as detailed in (Table 7-20). More detailed information on these areas is provided in Section 5.5.4 and the Existing Environment Addendum.

As detailed in Section 5.5.4 Omura's whales have been identified throughout north-western Australia, including in the Joseph Bonaparte Gulf where they maybe undertaking biologically important behaviour such as foraging, breeding, calving, and resting.

Table 7-20: Marine Mammal Values and Sensitives relating to Seismic Sound

Marine Mammal	Biologically Important Behaviour	Biologically Important Area
Dugong	Carnarvon: breeding known to occur	Carnarvon: Breeding, Calving, Foraging, Nursing
Australian snubfin dolphin	NA	Bonaparte: Breeding, Calving, Resting, Foraging, Foraging (high density prey) Browse: Breeding, Calving, Resting, Foraging (high density prey)
Indo-Pacific Humpback Dolphin	Bonaparte: breeding known to occur Browse: breeding known to occur	Browse: Breeding, Calving, Foraging (high density prey)
Spotted bottlenose dolphin	NA	Browse: Breeding, Calving, Foraging
Fin whale	Bonaparte: Foraging likely to occur Browse: Foraging likely to occur Carnarvon: Foraging likely to occur	NA
Humpback whale	Browse: Breeding known to occur Carnarvon: Breeding known to occur	Browse: Calving, Migration, Nursing, Resting Carnarvon: Migration, Resting,
Pygmy blue whale	Browse: Migration known to occur Carnarvon: Migration known to occur	Bonaparte: Migration Browse: Migration, Foraging Carnarvon: Migration, Foraging
Sei whale	Bonaparte: Foraging likely to occur Browse: Foraging likely to occur Carnarvon: Foraging likely to occur	NA

7.1.9.3 Predicted Level of Impact

The type and scale of the effect of seismic sound on cetaceans will depend on several factors. These include the level of exposure, the physical environment, the location of the animal in relation to the sound source, how long the animal is exposed to the sound, the exposure history, how often the sound repeats (repetition period) and the ambient sound level. The context of the exposure plays a critical and complex role in the way an animal might respond (Gomez et al. 2016; NMFS 2016).

Without appropriate control measures in place, noise emissions from the seismic source have the potential to impact cetaceans by causing changes to hearing (PTS and TTS) as a result of high sound levels at close range to the seismic source, or behavioural disturbance impacts.

With appropriate controls in place the severity is assessed as Moderate (3) based on impacts to marine mammals are predicted to be minor disruption to small portion of population with minor, temporary effects on critical habitats/ activities and no threat to population viability based on following.

Dugong were not identified by the PMST Reports (Table 5-16) to occur within the CSEP OA and hence PTS and TTS impacts are not predicted at the furthest modelled distance of 20 m and 50 m, respectively. However, the furthest modelled distance to the behavioural sound effect criteria for dugong (17.84 km) overlaps the breeding, calving, foraging, and nursing BIA off Ningaloo and Exmouth Gulf. As the seismic source will not be operated within 20 km of this BIA, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dugong sound effect criteria is less than 20 km (CM#14), impacts to dugong undertaking biologically important behaviour within this BIA are not predicted.

Australian snubfin dolphins were identified by the PMST Reports (Table 5-16) as known to occur within the Bonaparte OA and may occur within the Browse CSEP OA. PTS and TTS impacts are not predicted at the furthest modelled distance of 40 m and 50 m, respectively. However, the furthest modelled distance to the behavioural sound effect criteria for dolphins (17.84 km) overlaps the breeding, calving, foraging, and resting BIAs off the Kimberley, and Joseph Bonaparte Gulf. As the seismic source will not be operated within 20 km of these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dolphin sound effect criteria is less than 20 km (CM#14), impacts to Australian snubfin dolphins undertaking biologically important behaviour within these BIAs are not predicted.

Indo-Pacific humpback dolphins were identified by the PMST Reports (Table 5-16) as may occur within the CSEP OA and hence may transit through the CSEP OA. PTS and TTS impacts are not predicted at the furthest modelled distance of 40 m and 50 m, respectively. However, the furthest modelled distance to the behavioural sound effect criteria for dolphins (17.84 km) overlaps the breeding, calving and foraging BIAs off the Kimberley. As the seismic source will not be operated within 20 km of these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dolphin sound effect criteria is less than 20 km (CM#14), impacts to Indo-Pacific humpback dolphins undertaking biologically important behaviour within these BIAs are not predicted.

Spotted bottlenose dolphin were identified by the PMST Reports (Table 5-16) as known to occur within the Bonaparte and Carnarvon OAs and likely to occur within the Browse OA and hence may transit through the CSEP OAs. PTS and TTS impacts are not predicted at the furthest modelled distance of 40 m and 50 m, respectively. However, the furthest modelled distance to the behavioural sound effect criteria for dolphins (17.84 km) overlaps the breeding, calving and foraging BIAs off the Kimberley. As the seismic source will not be operated within 20 km of these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dolphin sound effect criteria is less than 20 km (CM#14), impacts to spotted bottlenose dolphins undertaking biologically important behaviour within these BIAs are not predicted.

The following whale species were identified by the PMST Reports (Table 5-16) as potentially occurring in the CSEP OA but do not have BIAs within the CSEP OA or within the distance of any of the modelled distances to sound effect criteria: Antarctic minke whale, Bryde's whale, fin whale. sei whale, southern right whale, and sperm whale. PTS and TTS impacts are not predicted to sperm whales at the furthest modelled distance of 40 m and 50 m, respectively. PTS and TTS impacts are not predicted to baleen whales such as the Antarctic minke whale, Bryde's whale, and southern right whales at the furthest modelled distance to the per-pulse noise criteria of 40 m and 100 m, respectively. As these species are not resident and would be transiting through the area PTS and TTS impacts based on 24 hr exposure are not predicted. Behavioural impacts to these species such as avoiding the area may occur, however, as detailed in EPBC Policy Statement 2.1 (DEWHA 2008g) at the scale of a seismic survey, such temporary displacements are unlikely to result in any real biological cost to the animals unless the interaction occurs during critical behaviours (e.g., breeding, feeding and resting), or in important areas such as narrow migratory corridors) which do not apply to these species.

The PMST Reports identified foraging likely to occur for the fin and sei whales. The conservation advice for both the sei and fin whales (TSSCi, TSSCj) identify anthropogenic noise and acoustic disturbance as a minor consequence rating. There is no information on foraging areas in north-west Australia, though it is likely foraging occurs in the same areas identified as foraging BIAs for blue whales as they are often recorded foraging in the same areas (Gill 2002, McCauley et al 2000g), therefore control measures applied to blue whales (CM#14) will ensure no PTS, TTS or behavioural disturbance to foraging fin and sei whales.

The CSEP OA is within ~19 km of the humpback whale resting BIA in Exmouth Gulf, overlaps the calving, nursing, and resting BIA in the Kimberley and overlaps the migration BIA where pregnant females transit north to the Kimberley calving area and then travel south with their calves to Antarctic feeding grounds (TSSC 2015k). Additionally, migratory routes include other biologically important areas such as resting areas and feeding areas that are essential for whales during migration (TSSC 2015k). The conservation advice for humpback whales (TSSC 2015k) identifies noise interference as a threat that may have adverse effects on the seasonal use, displacement from these areas, or the alteration of behaviour by humpback whales. To avoid impacts to humpback whales within calving, nursing, resting and migration BIAs the seismic source will not be operated within 100 km of these BIAs when they are present in these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km (CM#14). Thus, impacts to humpback whales undertaking biologically important behaviour are not predicted.

The CSEP OA overlaps the pygmy blue whale migration BIA and the possible foraging BIAs at Scott Reef and off Ningaloo. The Conservation Management Plan for the Blue Whale (DoE 2015) details that seismic surveys are almost certain to have a moderate consequence (population recovery stalls) on pygmy blue whales. The plan does detail that given the behavioural impacts of noise on pygmy blue whales are largely unknown, a precautionary approach has been taken regarding assignation of possible consequences. The Conservation Management Plan for the Blue Whale (DoE 2015) details that anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area. Thus, to meet this requirement the seismic source will not be operated within 100 km of the pygmy blue whale BIAs when they are present in these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km (CM#14). This will ensure that any seismic survey conducted under the CSEP is not inconsistent with the Blue Whale Conservation Management Plan.

Although not a listed threatened or migratory species, Omura's whales may be present in the Joseph Bonaparte Gulf and the wider region throughout the year. Although potentially transient to some degree, their movements and behaviours throughout the region are uncertain so key behaviours and life stages such as breeding, feeding, and migration in or through the Joseph Bonaparte Gulf cannot be confirmed or ruled out. Similar species such as Bryde's whales have swim speeds of between 2 and 7 km/hr while feeding but can swim as fast as 20 to 25 km/hr (Kato 2002). Sei whale swim speeds may be similar with top speeds reported to be 55 km/hr over short distances (NOAA Fisheries n.d.). Omura's whale may therefore be capable of moving away from the active seismic source before significant hearing impairment or injury occurs. Given the proposed observation, soft-start, low power and shutdown procedures, and other procedures that will be implemented in accordance with Part A of EPBC Act Policy Statement 2.1, the risk of PTS or TTS from acute close range exposures is reduced. Given the species' likely swim speeds, behavioural avoidance is also possible prior to SEL_{24hr} levels exceeding PTS or TTS thresholds over longer distances (up to a maximum of 5.96 km and 92.3 km respectively based on 24 hours of exposure). However, given that Omura's whales behaviours in the Joseph Bonaparte Gulf are unknown, additional adaptive management procedures (CM#15) are proposed specifically for this species to account for this uncertainty.

With the implementation of additional adaptive management procedures (CM#15), the potential for injury and hearing impairment (PTS and TTS) is further reduced. The adaptive management recognises that if other Omura's whales are detected, then the area is potentially being utilised by the species as an aggregation area; therefore, the seismic source will remain shut down for 24 hours to avoid interference with potential key life stages. The seismic source will not recommence operations until 24 hours has elapsed to ensure that impacts to potentially aggregating animals are reduced. This approach is considered precautionary to address the scientific uncertainty regarding this species.

7.1.9.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-21: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Moderate.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature. As there is some uncertainty in relation to where and when biologically important behaviours occur an adaptive management procedure will be implemented to take into account this uncertainty. See CM15 Whale Adaptive Management Procedure.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Management of the activity is consistent with the requirements of EPBC Act Policy Statement 2.1—interaction between offshore seismic exploration and whales as • The guidelines advise that seismic surveys should be undertaken outside of biologically important areas at biologically important times. CM#14 Marine Mammal Exclusion Zones details that the seismic source will not be operated within marine mammal biologically important areas at biologically important times. • The guidelines advise that Part A Standard Management procedures should be followed by all seismic vessels conducting surveys in Australian waters irrespective of location and time of year. CM#10 EPBC Act Policy Statement 2.1 details that Part A Standard Management procedures will be implemented for all seismic surveys conducted under the CSEP. • The guidelines advise that Part B Additional Management Procedures should be applied where the likelihood of encountering whales is moderate to high. A moderate to high likelihood is defined as spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat. As an exclusion zone (CM#14) will be applied for whales within BIAs, seismic surveys will not be spatially and/or temporally proximate to aggregation areas, migratory pathways and/or	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		areas considered to provide biologically important habitat while whales are undertaken biologically important behaviours. Thus, surveys will not be undertaken during periods when the likelihood of encountering whales is moderate to high. As there is some uncertainty in relation to where and when biologically important behaviours occur an adaptive management procedure will be implemented to take into account this uncertainty (CM#15 Whale Adaptive Management Procedure). In addition, Part B measures such as MMOs will be implemented, and other Part B requirements will form part of the adaptive management procedure (CM#15 Whale Adaptive Management Procedure). The conservation advice for the sei and fin whale (TSSC 2015i, TSSCj) detail that in assessing and addressing anthropogenic noise If required, additional management measures should be developed and implemented to ensure the ongoing recovery of sei and fin whales. CM#10 EPBC Act Policy Statement 2.1 will be implemented for sei and fin whales to manage noise impacts to ensure the ongoing recovery of sei and fin whales. In addition, control measures applied to blue whales (CM#14) will ensure no PTS, TTS or behavioural disturbance to foraging fin and sei whales as it is likely they forage in the same areas. Thus, the activity will be managed in a manner that is not inconsistent with the conservation advice for the sei and fin whale (TSSC 2015i, TSSCj). The Conservation Management Plan for the Blue Whale (DoE 2015) identifies the following requirements relevant to seismic surveys: • Anthropogenic noise in biologically important areas 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. To ensure that seismic surveys conducted under the CSEP will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area an exclusion zone (CM#14) will be applied to the pygmy blue whale BIAs while they are undertaking biologically important behaviour and CM#10 EPBC Act Policy Statement 2.1 will be implemented at all other times. Thus, the activity will be managed in a manner that is not inconsistent with	

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		the Conservation Management Plan for the Blue Whale (DoE 2015). The conservation advice for humpback whales (TSSC 2015k) identifies the following requirements in relevant to 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. CM#14 details that there will be an exclusion zone, where the seismic source will not be operated, when humpback whales are undertaking biologically important behaviour within a BIA and CM#10 details that EPBC Act Policy Statement 2.1 will be implemented at all other times. • For actions involving acoustic impacts (example 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). A review of acoustic modelling undertaken within the north-west was used to identify conservative maximum distances to noise effect criteria for whales (see Section 7.1.3 and Section 7.1.9.1). The conservative maximum distances to noise effect criteria for whales was used to identify exclusion zones (CM#14). • 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: ❍ Use of shutdown and caution zones. ❍ Pre and post activity observations. ❍ Use of marine mammal observers and / or Passive Acoustic Monitoring (PAM). ❍ 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). The conservative maximum distances to noise effect criteria for whales was used to identify exclusion zones (CM#14) for humpback calving, resting and migratory BIAs while they are undertaking biologically important behaviour.	

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
		Outside of these periods the following will be implemented: ❍ Shutdown and caution zones as per CM#10 EPBC Act Policy Statement 2.1. ❍ Pre and post activity observations as per CM#10 EPBC Act Policy Statement 2.1. ❍ Use of marine mammal observers and / or Passive Acoustic Monitoring (PAM) as per as per CM#10 EPBC Act Policy Statement 2.1. ❍ As the will be no operation of the seismic source within the furthest distance to a noise effect criteria of the humpback calving, resting, foraging areas, or confined migratory pathways verification of the noise levels produced from the action (i.e., if the noise levels created exceed original expectations) is not required as the furthest distance to a noise effect criteria for low-frequency whales used. In addition, the Rmax modelled values are used providing another layer of conservatism in the exclusion zone distance. Thus, the activity will be managed in a manner that is not inconsistent with the conservation advice for humpback whales (TSSC 2015k).	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within this Section and the implementations strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	The Director of National Parks raised that the CSEP needs to identify and assess all marine park values for those marine parks potentially impacted by a seismic survey within and outside the operational areas. Section 7.1.12 details the assessment of predicted impact to marine park values such as marine mammals from seismic acoustic emissions.	Yes

7.1.9.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-22 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-22: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes

CM#14: Marine Mammal Exclusion Zones	Exclusion zones will be applied to marine mammal BIAs during the periods when they are undertaking biologically important behaviours and are potentially less likely to move away from the seismic source which could result in potential impact to marine mammals while undertaking biologically important behaviour.
	Humpback whales
	There will be no operation of the seismic source within 100 km of a humpback whale BIA during the following periods:
	• Exmouth Gulf BIA: August to end of November. This is based on Irvine and Salgado Kent (2018) who identified high numbers of humpback whales, including adults and calves, occupy Exmouth Gulf between at least early August and early November each year. This timing has been extended to the beginning of August and end of November to allow for season changes in timing.
	• Kimberley BIA: August to the end of September. This is based TSSC (2015k) which details that breeding and calving takes place between mid-August and early September. This timing has been extended to the beginning of August and end of September to allow for season changes in timing.
	• Migration BIA:
	  ○ Carnarvon OA June to the end of November to take into account that humpback whales reach the north-west marine region in early June (TSSC 2015k) and adults and calves leaving Exmouth Gulf by the end of November Irvine and Salgado Kent (2018).
	  ○ Browse OA June to end of September to take into account that humpback whales reach the north-west marine region in early June (TSSC 2015k) and cows and calves leaving Kimberley the Kimberley BIA up to September.
	The distance of 100 km is considered appropriate as the furthest distance to a low-frequency whale sound effect criteria is 92.3 km (TTS 24hr). This control ensures that humpback whales are not impacted and can continue biologically important behaviour within these BIAs.
	This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748)
		Yes

Control Measure	Justification	Adopted
	Acoustic Impact Evaluation and Management. This still affords protection to humpback whales as the impact criteria will not be exceeded within a BIA. ***Pygmy blue whales*** There will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December based on the northern migration typically passes north-western Australia between approximately April to August with the return southern migration between October and December. The distance of 100 km is considered appropriate as the furthest distance to a low-frequency whale sound effect criteria is 92.3 km (TTS 24hr). The distance to the TTS 24hr criteria encompasses the behavioural sound effect criteria which was a maximum of 17.84 km. Thus, this control ensures any blue whale continues to utilise the area without injury, and is not displaced from a foraging area. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales as the impact criteria will not be exceeded within a BIA. ***Dugong and Dolphin*** There will be no operation of the seismic source within 20 km of a dugong or dolphin BIA. As dugongs and dolphins inhabit these BIAs all year round there is no season timing to this control. The distance of 20 km is considered appropriate as the furthest distance to a dugong or dolphin sound effect criteria is 17.84 km (behaviour). This controls ensures that dugong and dolphins can continue biologically important behaviour within these BIAs. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dugong or dolphin sound effect criteria is less than 20 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to dugong and dolphins as the impact criteria will not be exceeded within a BIA.	
CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales Part A	EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Part A will be applied to all seismic surveys conducted under the CSEP.	Yes
CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales Part B.1	Two dedicated marine fauna observers will be on the seismic survey vessel to implement EPBC Act Policy Statement 2.1 and additional controls to manage impacts to marine mammals. One will be on watch during daylight hours.	Yes

Control Measure	Justification	Adopted
Marine Mammal Observers	The MFOs will be trained in whale identification and behaviour, distance estimation, and be capable of making accurate identifications and observations of whales in Australian waters.	
CM#15: Whale Adaptive Management Procedure – Blue and humpback whales	Marine Mammal Exclusion Zones (CM#14) will be implemented for marine mammals undertaking biologically important behaviour in BIAs, however there is some uncertainty in relation to the timing and area of these behaviours and hence a Whale Adaptive Management Procedure will be implemented to ensure that impacts from the activity remain within the acceptable level and ALARP. This aligns with Policy Statement 2.1 which details where a survey is proposed in an area that is spatially and temporally on the edge of areas considered to provide biologically important habitat, the proponent may consider implementing adaptive management procedures to manage the potential increased likelihood of encountering whales. ***Cow-calf pairs*** If a cow- calf pair are observed the seismic source will be shut down and not restarted until the mother- calf pair are not observed, or it has been 30 min since the last sighting. Soft start procedures will be applied. This will afford additional protection to cow- calf pairs that may be migrating outside of the period's details in CM#14 Exclusion Zones. ***Biologically Important Areas*** For surveys undertaken within a humpback or pygmy blue whale BIA outside of the exclusion zone timing (CM#14) the following will be implemented: If observed numbers of whales are higher than expected, as determined by there being three or more humpback whales or three or more pygmy blue whales within the shutdown/powerdown zones in 24 hours the following will be implemented: • Shut-down zone will be increased from 500 m to 3 km for a humpback or pygmy blue whale*. This will afford additional protection to whales within a BIA outside of the period's details in CM#14: Marine Mammal Exclusion Zones. * A humpback or pygmy blue whale sighting is defined as an observed whale that is either: a) positively identified as a humpback or pygmy blue whale. b) cannot be positively identified as a humpback or pygmy blue whale but is potentially a humpback or pygmy blue whale (i.e., a large baleen whale).	Yes
CM#15: Whale Adaptive Management Procedure – Omura's whales	If Omura's whale behaviours in the Joseph Bonaparte Gulf are unknown, additional pre-start observations and adaptive management procedures are proposed specifically for this species to account for this uncertainty. If an Omura's whale (confirmed, potential or suspected) is observed during the survey, the following extended shut down procedures will be implemented with immediate effect and will apply for the remainder of the survey: • The shut-down zone will be increased from 500 m to 2 km; and	Yes

Control Measure	Justification	Adopted
	• The start-up delay / shut-down period will be increased from 30 minutes to 60 minutes. • If there are three Omura's whale (confirmed, potential or suspected) sightings, in a 24-hour period, the seismic source will be shut down for 24 hours. • If, during the 24-hour shutdown period, a Omura's whale (confirmed, potential or suspected) is sighted, then the seismic source will remain shut down until there has been 24 hours of no Omura's whale (confirmed, potential or suspected) sightings. Operations may recommence provided there has been no Omura's whale (confirmed, potential or suspected) sightings6 for 24 hours since the last sighting event, and start-up of the seismic source will commence according to CM#10 EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales Part A. This approach is considered precautionary in order to address the scientific uncertainty regarding this species. Due to the similarities between Omura's whale and Bryde's whale, sei whale and fin whale, a sighting of any of these species, or an unidentified large cetacean will be treated as a potential or suspected Omura's whale for the purpose of providing a precautionary approach to managing impacts to Omura's whales. The approach would indirectly provide additional protection to listed threatened and / or migratory Bryde's, sei and fin whales if they are observed during the survey.	
EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales B2 Night-time/Poor Visibility and B3 Spotter Vessel and Aircraft	Policy Statement 2.1 details that for seismic surveys operating in areas where the likelihood of encountering whales is moderate to high, the application of additional measures, to ensure that impacts and interference are avoided and/or minimised, are necessary. Policy Statement 2.1 defines moderate to high likelihood of encountering whales as spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat. As detailed in CM#14 spatially and/or temporally exclusion zones will be implemented such that surveys will not be undertaken proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat while biologically important behaviours are occurring. With the implementation of CM#14 Exclusion Zones and other proposed control measures the cost of this additional control is considered grossly disproportionate to the limited additional benefit that would be gained. MFOs on board the survey vessel will already provide coverage of the area surrounding the seismic source to an effective and proven industry standard. Aerial observations at great distances offshore, such as the pygmy blue whale migration BIA or within the Joseph Bonapart Gulf for Omura's whale, are not practicable as flight time and fuel is limited. The cost of an additional dedicated vessel or an aircraft to undertake additional marine fauna observations for the duration of a survey would likely cost hundreds of thousands of dollars and introduce additional health and safety risks.	No

Control Measure	Justification	Adopted
EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales Part B.5 Passive Acoustic Monitoring (PAM)	PAM was considered as an additional measure to detect marine mammals during night-time and low visibility conditions and/or during sensitive periods. Policy Statement 2.1 details that for seismic surveys operating in areas where the likelihood of encountering whales is moderate to high, the application of additional measures, to ensure that impacts and interference are avoided and/or minimised, are necessary. Policy Statement 2.1 defines moderate to high likelihood of encountering whales as spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat. As detailed in CM#14: Marine Mammal Exclusion Zones, spatial and/or temporal exclusion zones will be implemented such that surveys will not be undertaken proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat while biologically important behaviours are occurring. PAM has some ability to detect whale calls and estimate distance. However, its capabilities are limited and only effective if whales vocalise, thereby making it ineffective if whales cease vocalising temporarily in response to the seismic sound. While it may be possible to detect some whales, it would provide only a small increase in the probability of detection and therefore limited additional benefit when the impact to marine mammals is already reduced to an acceptable level with other proposed controls implemented. Therefore, considering this cost and uncertainty, the use of PAM was not considered commensurate with the limited additional benefit that may be gained for surveys that will be undertaken outside biologically important areas when biologically important behaviours are occurring.	No

7.1.10 Divers

Divers exposed to high levels of underwater sound can suffer from dizziness, hearing damage or other injuries to other sensitive (mainly air-filled) organs, depending on the frequency and intensity of the sound. Under water, the human ear is about 20 dB less sensitive than it is in air at low frequencies (20 z), increasing to 40 dB at mid-frequencies (less than 1 kHz), and increasing to 70–80 dB less sensitive at higher frequencies (Parvin 1998).

If seismic activities occur near dive sites, there is the potential for divers to be displaced.

A summary of relevant studies in relation to seismic acoustic emission impacts to divers is provided in Appendix A.

7.1.10.1 Sound Effect Criteria

There are no defined sound exposure criteria for divers. There have been several controlled acoustic exposure experiments studies on divers as detailed in Appendix A.

In alignment with these studies, Parvin (2005) suggested 145 dB re 1 µPa SPL as a safety criterion for recreational divers. This does not imply that this level is associated with the onset of injury but represents a conservative level for protection against prolonged sound exposure for health and safety purposes.

Figure 7-55 and Figure 7-56 detail the collated acoustic modelling data used to determine the predicted maximum distances to the 145 dB SPL suggested by Parvin (2005). This distance ranged from 6.1 km to 70.1 km depending on the water depth and seismic source size.

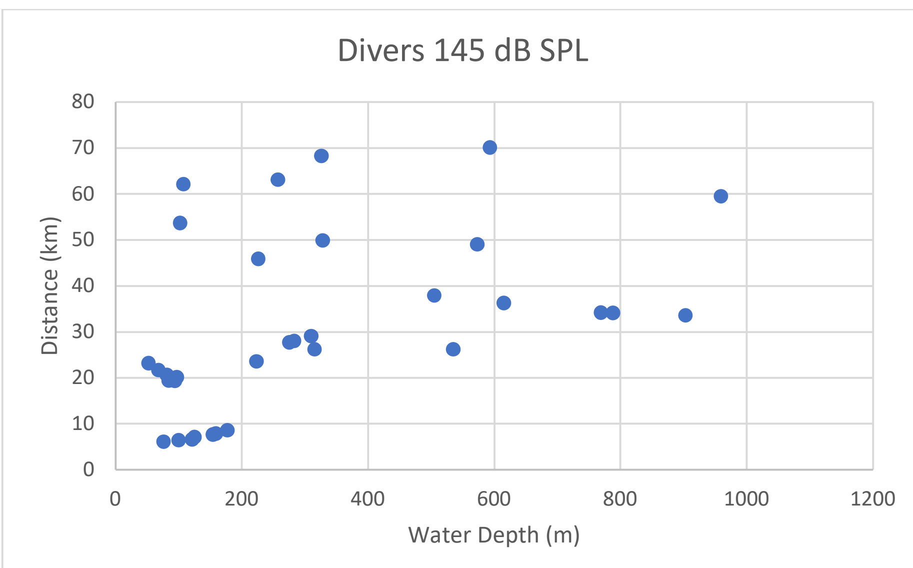


Figure 7-55: Distance to Diver 145 dB SPL Sound Effect Criteria against Water Depth

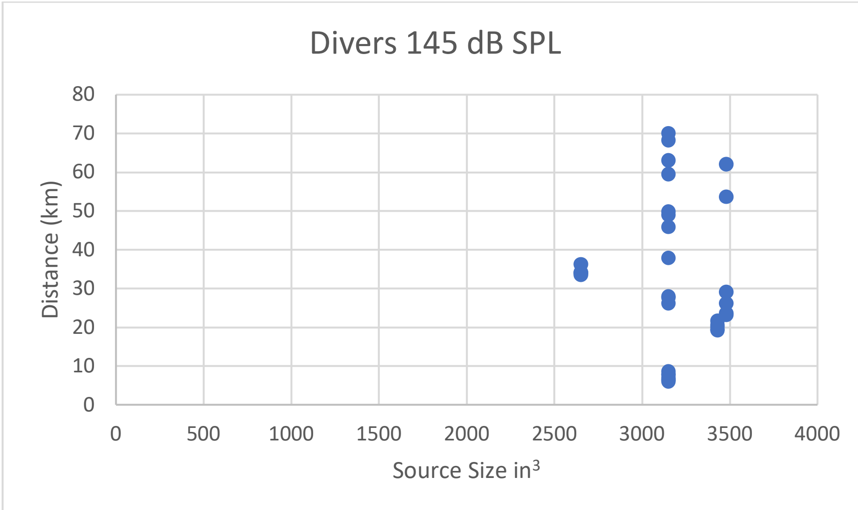


Figure 7-56: Distance to Diver 145 dB SPL Sound Effect Criteria against Source Size

7.1.10.2 Impact Pathway

To identify the values and sensitivities associated with divers a review was undertaken of the existing environment within the CSEP OA and out to 70 km of the CSEP OA to identify those receptors associated with diving. A distance of 70 km was used as this is the furthest distance to 145 dB SPL suggested by Parvin (2005). This review identified the following values and sensitivities relating to diving:

- Commercial diving at offshore oil and gas installations.
- Commercial fisheries:
  - Pearl Oyster Managed Fishery
  - WA Sea Cucumber Fishery
  - Specimen Shell Fishery
- Research and recreational diving:
  - Ashmore Reef
  - Barrow Island
  - Cartier Island
  - Dampier Archipelago
  - Mackerel Islands
  - Montebello Islands
  - Muiron Islands
  - Navy Pier in Exmouth
  - Ningaloo Reef
  - Rowley Shoals consisting of Imperieuse, Clerke and Mermaid reefs
  - Scott Reef

7.1.10.3 Predicted Level of Impact

From the acoustic modelling the maximum distance where received levels exceed 145 dB re 1 μPa SPL is 70 km. This level is not associated with the onset of injury but represents a conservative level for protection against prolonged sound exposure for health and safety purposes. Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) “Safe Diving Distance from Seismic Surveying Operations” (DMAC 2019) recommends that where diving and seismic activity occur within 30 km of each other, a joint risk assessment should be conducted, and planning/mitigation agreed between parties. Where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity.

Without appropriate control measures in place, noise emissions from the seismic source have the potential to impact divers depending on the distance they are from the seismic survey.

Consultation will be undertaken with commercial fisheries that undertake diving (Pearl Oyster Managed Fishery, WA Sea Cucumber Fishery and Specimen Shell Fishery), research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the areas identified where diving occurs in Section 7.1.10.2. If required, based on the distance to the acoustic source operation, or requested by the stakeholder, the DMAC guidance note requirement for a joint risk assessment and agreed planning/mitigation will be implemented to ensure divers are not impacted.

An additional control (CM#17 NCWHA Exclusion Zone) will be implemented for the Ningaloo Coast World Heritage Area (NCWHA) where the acoustic source will not be operated within 70 km of the NCWHA. This has been implemented based on consultation with the NCWHA Advisory Committee in relation to protecting the outstanding universal value (OUV) of the NCWHA. Due to the large number of diving activities that occur within the NCWHA it is not feasible to undertake engagement with all divers and implement DMAC guidance note requirements. This exclusion zone will ensure that the divers within the NCWHA are not impacted.

With appropriate controls in place the severity is assessed as Minor (2) based on no impacts to divers within the NCWHA are predicted and within other areas impact to divers will be minor and temporary effects on aesthetic, economic or recreational values.

7.1.10.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-23: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Guidance note DMAC 12 Safe Diving Distance from Seismic Surveying Operations (DMAC 2019) requirements will be implemented as per CM#16.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within this Section and the implementations strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	The Director of National Parks raised that the CSEP needs to identify and assess all marine park values for those marine parks potentially impacted by a seismic survey within and outside the operational areas. Section 7.1.12 details the assessment of predicted impact to marine park values such as divers from seismic acoustic emissions.	Yes

7.1.10.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-24 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-24: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Yes
CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations	Consultation will be undertaken with commercial fisheries that undertake diving (Pearl Oyster Managed Fishery, WA Sea Cucumber Fishery and Specimen Shell Fishery), research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the areas identified where diving occurs in Section 7.1.10.2. If required, based on the distance to the acoustic source operation, or requested by the stakeholder, the DMAC guidance note requirement for a joint risk assessment and agreed planning/mitigation will be implemented to ensure divers are not impacted. The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 μPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This will still afford protection to divers as the safety criterion for recreational divers will not be exceeded and the requirements of the DMAC guidance will still be met.	Yes
CM#6 NCWHA Exclusion Zone	The acoustic source will not be operated within 70 km of the Ningaloo Coast World Heritage Area (NCWHA). This has been implemented based on consultation with the NCWHA Advisory Committee in relation to protecting the outstanding universal value of the NCWHA. Due to the large number of diving activities that occur within the NCWHA it is not feasible to undertake engagement with all divers and implement DMAC guidance note requirements. This exclusion zone will ensure that the divers within the NCWHA are not impacted. This exclusion zone of 70 km will not change even if survey specific underwater acoustic modelling show a lesser distance to safety criterion for recreational divers. This is to ensure that the universal value of the NCWHA is not impacted.	Yes

Control Measure	Justification	Adopted
Exclusion zone for other known diving areas	Exclusion zones for other known diving areas have not been implemented as impacts to divers can be managed at these locations via the implementation of CM#16. Commercial and recreational diving outside of the NCWHA is undertaken in significantly smaller numbers and for recreational diving via charter operators due to the distances to the locations. Thus, identification and engagement with commercial fishers and tour operators is achievable. Consultation with commercial fishers and tour operators for the development of the CSEP did not result in any feedback that the implementation of CM#16 to manage impacts to divers was not adequate.	No

7.1.11 Subsea cables

As described in Section 5.7.6, three subsea telecommunications cables are within the OA.

7.1.11.1 Sound Effect Criteria

The International Cable Protection Commission (ICPC) document No 8 Procedure to be Followed Whilst Offshore Seismic Survey Work Is Undertaken In The Vicinity Of Active Submarine Cable Systems (ICPC 2020) states that if the internal components of the cable are subject to acceleration greater than specification, there is a risk of serious damage. Where a seismic survey results in pressure waves of 2 bar or above at the seabed, the survey design must be adjusted to reduce the pressure.

Overpressure is the positive peak pressure, or what is modelled in the acoustic modelling as peak pressure (PK). Based on the conversion of PK to bar 10(PK-220)/20, a 2 bar overpressure is equivalent to ~226 dB re 1uPa PK. This PK threshold is the same as that applied to sponges and corals on the seabed and was reached at a maximum distance of 20 m as detailed in Table 7-6.

7.1.11.2 Impact Pathway

As described in Section 5.7.6, three subsea telecommunications cables are within the OA.

7.1.11.3 Predicted Level of Impact

As detailed in Table 7-6 the maximum modelled distance to sound effect criteria of 226 dB re 1uPa PK at which impacts to subsea cables may occur is 20 m thus impacts to cables are not predicted as the minimum water depth for the CSEP is 25 m as detailed in the Seismic Survey Parameters (Table 4-2).

As there is no impact predicted the acceptable level of no impact to subsea cables is meet and further assessment to show the activity can meet the acceptable level and impacts are ALARP are not warranted.

Via stakeholder engagement the cable operator requested to be notified of seismic surveys within 5 km of a subsea cable and this requirement is detailed in Section 6.4.

7.1.12 Marine Protected Areas

The CSEP OA overlaps and abuts several marine protected areas as shown in Figure 5-9.

The CSEP OA only overlaps Australian Marine Park zones that allow mining operations including exploration (i.e., seismic surveys) in accordance with a permit, class approval or activity licence or lease issued by the Director (this EP). These zones are:

- Multiple Use (VI)
- Special Purpose (VI)

The assessment in the following sections reviews the predicted impacts associated with the seismic source acoustic emissions associated with a seismic survey within the CSEP OA and considers these in the context of the management plan objectives and values. The assessment considers the control measures previously identified in acoustic emissions impact assessment sections.

Details of the values of the marine parks are provided in Section 4 of the Existing Environment Addendum.

7.1.12.1 Argo-Rowley Terrace Marine Park

The Argo–Rowley Marine Park surrounds the Mermaid Reef Marine Park and reefs of the WA Rowley Shoals Marine Park. As detailed in Table 7-25 impacts to the values of the Argo–Rowley Marine Park are not predicted.

Table 7-25: Assessment of Predicted Level of Impact to Argo-Rowley Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	The CSEP OA overlaps the Multiple Use Zone and abuts the National Park.	
Benthic Habitat	NA	NA
Coastal habitats and communities	NA	
Marine Invertebrates	NA	
Birds	BIAs include foraging, resting, and breeding habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	NA	NA
Marine Reptiles	NA	NA
Marine Mammals	BIAs include a migratory pathway for the pygmy blue whale.	Impacts to pygmy blue whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for pygmy blue whales is 100 km thus there will be no operation of the

AMP	Values (DNP 2018a)	Predicted Impact
		seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December when they are present in the migration BIA (CM#14: Marine Mammal Exclusion Zones). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are: • Canyons linking the Argo Abyssal Plain with the Scott Plateau • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	No heritage listings apply to this marine park.	NA
Heritage values	Contains two known shipwrecks listed under the Historic Shipwrecks Act 1976.NA	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation and research	NA	NA
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Mining is an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.2 Ashmore Reef Marine Park and Nature Reserve

The Ashmore Reef Marine Park, which surrounds the Ashmore Reef Nature Reserve and Ashmore Reef Ramsar site is ~39 km from the CSEP OA. As detailed in Table 7-26 impacts to the values of Ashmore Reef Marine Park, Ashmore Reef Nature Reserve and Ashmore Reef Ramsar site are not predicted.

Table 7-26: Assessment of Predicted Level of Impact to Ashmore Reef Protected Areas from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	~39 km from the CSEP OA	
Benthic Habitat	Includes extensive reef flat and large areas of seagrass.	Impacts to benthic habitats, coastal habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for molluscs is 80 m.
Coastal habitats and communities	Includes habitats associated with two extensive lagoons, sand flats and shifting sand cays. The site includes the largest of the atolls in the region, and West Island, Middle Island and East Island represent the only vegetated islands in the region.	
Marine Invertebrates	The reef ecosystems are comprised of hard and soft corals, gorgonians, sponges and a range of encrusting organisms, with the highest number of coral species of any reef off the WA coast. The reefs and islands of the bioregion are regarded as biodiversity hotspots.	
Birds	The Ashmore Reef Ramsar site is located within the Ashmore Reef Marine Park. The site supports internationally significant populations of seabirds and shorebirds including colonies of bridled terns, common noddies, brown boobies, eastern reef egrets, frigatebirds, tropicbirds, red-footed boobies, roseate terns, crested terns and lesser crested terns. It is a staging point and feeding area for many migratory seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	Endemism in demersal fish communities of the continental slope is high with two distinct communities identified: one on the upper slope, the other mid slope.	Impacts to fish are not predicted based on: • As detailed in Table 7-10 the maximum modelled distance to sound effect criteria for fishes is 14 km.
Marine Reptiles	BIAs include foraging, mating, nesting and inter-nesting habitat for marine turtles. Contains critical nesting and inter-nesting habitat for green. Low level nesting activity by loggerhead turtles has also been recorded.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km.

AMP	Values (DNP 2018a)	Predicted Impact
	Large and significant populations of green, hawksbill and loggerhead turtles occur around the reefs. Internationally significant for abundance and diversity of seasnakes	
Marine Mammals	BIAs include foraging habitat for dugong and migratory pathway for pygmy blue whales. Small dugong population (<50 individuals) breed and feed around the reef.	Impacts to dugong and not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for dugongs is 17.84 km (CM#14: Marine Mammal Exclusion Zones). Impacts to pygmy blue whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for pygmy blue whales is 100 km thus there will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December when they are present in the migration BIA (CM#14: Marine Mammal Exclusion Zones). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters • Continental slope demersal fish communities	See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	Contains Indonesian artefacts and grave sites and Ashmore lagoon is still accessed as a rest or staging area for traditional Indonesian fishers travelling to and from fishing grounds within the MoU Box.	Impacts to heritage values from underwater acoustic emissions are not predicted.
Heritage values	Ashmore Reef listed on the Commonwealth Heritage List.	

AMP	Values (DNP 2018a)	Predicted Impact
Tourism, recreation and research	Tourism, recreation, and scientific research are important activities in the Marine Park.	As detailed in Section 7.1.10.1 the maximum distance where received levels exceed the prolonged sound exposure for health and safety purposes for divers is 70 km. To ensure impacts do not occur to divers who may be present at Ashmore Reef, consultation will be undertaken with research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the Ashmore Reef Marine Park, and as per the Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (DMAC 2019) a joint risk assessment and agreed planning/mitigation will be implemented (CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations). The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 µPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity.
Commercial Fisheries	NA	NA
Petroleum Activity	NA	NA

7.1.12.3 Cartier Island Marine Park

The Cartier Island Marine Park is ~20 km from the CSEP OA. As detailed in Table 7-27 impacts to the values of the Cartier Island Marine are not predicted.

Table 7-27: Assessment of Predicted Level of Impact to Cartier Island Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Benthic Habitat	Includes mature reef flat, a small, submerged pinnacle (Wave Governor Bank). The reef crests are generally algal dominated, while the reef flats feature ridges of coral rubble and large areas of seagrass.	Impacts to benthic habitats, coastal habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m.
Coastal habitats and communities	Includes an unvegetated sand island (Cartier Island), and two shallow pools to the north-east of the island.	
Marine Invertebrate	High diversity and abundance of hard and soft corals, gorgonians (sea fans), sponges and a range of encrusting organisms	
Birds	BIAs include breeding and foraging habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	Endemism of demersal fish communities of the continental slope is high with two distinct communities identified, one on the upper slope, the other mid slope. BIAs include foraging habitat for whale sharks.	Impacts to fish are not predicted based on: • As detailed in Table 7-10 the maximum modelled distance to sound effect criteria for fishes is 14 km.
Marine Reptiles	BIAs include inter-nesting, nesting and foraging habitat for marine turtles. Internationally significant for its abundance and diversity of sea snakes.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km.
Marine Mammals	NA	NA
KEFs	KEFs of the marine park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters • Continental slope demersal fish communities	See Table 7-36 for assessment of predicted impact to KEFs.

AMP	Values (DNP 2018a)	Predicted Impact
Heritage values of places	NA	NA
Heritage values	Contains one known shipwreck (Ann Millicent wrecked in 1888) listed under the *Underwater Cultural Heritage Act 2018.*	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation and research	Scientific research is an important activity in the Marine Park.	As detailed in Section 7.1.10.1 the maximum distance where received levels exceed the prolonged sound exposure for health and safety purposes for divers is 70 km. To ensure impacts do not occur to divers who may be present at Cartier Island, consultation will be undertaken with research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the Cartier Island Marine Park, and as per the Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (DMAC 2019) a joint risk assessment and agreed planning/mitigation will be implemented (CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations). The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 μPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity.
Commercial Fisheries	Within an area subject to a MoU between Indonesia and Australia.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	NA	NA

7.1.12.4 Dampier Marine Park

The Dampier Marine Park is ~6 km from the CSEP OA. As detailed in Table 7-28 impacts to the values of the Cartier Island Marine are not predicted.

Table 7-28: Assessment of Predicted Level of Impact to Dampier Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	~6 km from the CSEP OA.	
Benthic Habitat	The Marine Park includes several submerged coral reefs and shoals including Delambre Reef and Tessa Shoals.	Impacts to benthic habitats, coastal habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m.
Coastal habitats and communities	NA	
Marine Invertebrates	Hotspot for sponge biodiversity. Includes several submerged coral reefs and shoals including Delambre Reef and Tessa Shoals.	
Birds	Biologically important areas include breeding, foraging and resting habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	NA	NA
Marine Reptiles	Biologically important areas include foraging, inter-nesting and nesting habitat for marine turtles.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km.
Marine Mammals	Biologically important areas include a migratory pathway for humpback whales.	Impacts to humpback whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for humpback whales is 100 km thus there will be no operation of the seismic source within 100 km of a humpback whale Migration BIA in the Carnarvon OA June to the end of November

AMP	Values (DNP 2018a)	Predicted Impact
		(CM#14: Marine Mammal Exclusion Zones). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to humpback whales as the impact criteria will not be exceeded within a BIA.
KEFs	NA	NA
Cultural values	The Ngarluma, Yindjibarndi, Yaburara, and Mardudhunera people have responsibilities for sea country in the Marine Park.	Impacts to cultural values are not predicted as seismic surveys will not be undertaken within the marine park and impacts to marine park values are not predicted.
Heritage values	NA	NA
Tourism, recreation and research	Recreation including fishing, are important activities in the Marine Park.	Impacts to recreational fishing from seismic acoustic emissions are not predicted.
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Port activities are an important activity in the Marine Park.	Impacts to ports fishing from seismic acoustic emissions are not predicted.

7.1.12.5 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park is ~15 km from the CSEP OA. The Marine Park is adjacent to the Eighty Mile Beach Ramsar site and the WA Eighty Mile Beach Marine Park, As detailed in Table 7-29 impacts to the values of the Eighty Mile Beach Marine Park, Eighty Mile Beach Ramsar site and the WA Eighty Mile Beach Marine Park Cartier Island Marine are not predicted.

Table 7-29: Assessment of Predicted Level of Impact to Eighty Mile Beach Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	~15 km from the CSEP OA.	
Benthic Habitat	The bioregion includes diverse benthic communities and ancient coastline thought to be an important seafloor feature.	Impacts to benthic habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m.
Coastal habitats and communities	NA	NA
Marine Invertebrates	NA	NA
Birds	The Marine Park is adjacent to the Eighty Mile Beach Ramsar site, recognised as one of the most important areas for migratory shorebirds and waders in Australia. Biologically important areas include breeding, foraging and resting habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	The bioregion includes diverse benthic and pelagic fish communities. Biologically important areas include foraging, nursing and pupping habitat for sawfish. Coastal waters provide critical habitat for several shark and ray species at varying life stages.	Impacts to fish are not predicted based on: • As detailed in Table 7-10 the maximum modelled distance to sound effect criteria for fishes is 14 km.

AMP	Values (DNP 2018a)	Predicted Impact
Marine Reptiles	Biologically important areas include inter-nesting and nesting habitat for marine turtles.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km.
Marine Mammals	Biologically important areas include a migratory pathway for humpback whales.	Impacts to humpback whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for humpback whales is 100 km thus there will be no operation of the seismic source within 100 km of a humpback whale Migration BIA in the Carnarvon OA June to the end of November (CM#14: Marine Mammal Exclusion Zones). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to humpback whales as the impact criteria will not be exceeded within a BIA.
KEFs	NA	NA
Cultural values	The sea country of the Nyangumarta, Karajarri and Ngarla people extends into Eighty Mile Beach Marine Park.	Impacts to cultural values are not predicted as seismic surveys will not be undertaken within the marine park and impacts to marine park values are not predicted.
Heritage values	Three known shipwrecks listed under the *Underwater Cultural Heritage Act* 2018: Lorna Doone (wrecked in 1923), Nellie (wrecked in 1908), and Tifera (wrecked in 1923).	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation and research	Tourism and recreation including fishing, are important activities in the Marine Park.	Impacts to tourism and recreation including fishing are not predicted as seismic surveys will not be undertaken within the marine park and impacts to marine park values are not predicted.
Commercial Fisheries	Commercial fishing and pearling are important activities in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	NA	NA

7.1.12.6 Gascoyne Marine Park

The CSEP OA overlaps the Gascoyne Marine Park Multiple Use Zone and is ~8 km from the National Park Zone and ~9 km from the Habitat protection Zone. As detailed in Table 7-30 impacts to the values of the Gascoyne Marine Park are not predicted.

Table 7-30: Assessment of Predicted Level of Impact to Gascoyne Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	The CSEP OA overlaps the Gascoyne Marine Park Multiple Use Zone and is ~8 km from the National Park Zone and ~9 km from the Habitat protection Zone.	
Benthic Habitat	Seafloor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise. It also provides protection for sponge gardens in the south of the reserve adjacent to Western Australian coastal waters.	Impacts to benthic habitats, coastal habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m. • The physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered.
Coastal habitats and communities	NA	NA
Marine Invertebrates	NA	NA
Birds Fish	Biologically important areas within the Marine Park include breeding habitat for seabirds. Foraging area for whale sharks.	Impacts to birds from underwater acoustic emissions are not predicted. The whale sharks Approved Conservation Advice (TSCC 2015) does not identify sound as a threat. Impacts are not predicted in the whale shark foraging (high density prey) BIA. Impacts within the whale shark foraging BIA are predicted to be minor disturbance that would not impede their recovery, however, as the Mortality/Potential Mortal Injury and Recoverable Injury criteria is met within 145 m a shutdown zone of 200 m will be applied to whale sharks as per CM#7: Whale shark shutdown zone.
Marine Reptiles	Biologically important areas include inter-nesting habitat for marine turtles.	Impacts to turtles are not predicted based on:

AMP	Values (DNP 2018a)	Predicted Impact
		• As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km. Thus, no operation of the seismic source will occur within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species as per CM#9: Turtle Exclusion Zone. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to turtles as impact criteria will not be exceeded within a BIA.
Marine Mammals	Biologically important areas include a migratory pathway for humpback whales, and foraging habitat and migratory pathway for pygmy blue whales.	Impacts to pygmy blue whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for pygmy blue whales is 100 km thus there will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December when they are present in the migration BIA (CM#14: Marine Mammal Exclusion Zones). Impacts to humpback whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for humpback whales is 100 km thus there will be no operation of the seismic source within 100 km of a humpback whale Migration BIA in the Carnarvon OA June to the end of November (CM#14: Marine Mammal Exclusion Zones). These exclusion zones may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is

AMP	Values (DNP 2018a)	Predicted Impact
		less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales and humpback whales as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are: • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsular • Commonwealth waters adjacent to Ningaloo Reef • Continental slope demersal fish communities • Exmouth Plateau	See Table 7-36 for assessment of predicted impact to KEFs.
Cultural values	The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region.	Impacts to cultural values are not predicted as impacts to marine park values are not predicted.
Heritage values	The Ningaloo Coast World Heritage Property, National heritage listed Ningaloo Coast and the Commonwealth heritage listed Ningaloo Marine Area (Commonwealth waters) are adjacent to the Marine Park. The Marine Park contains more than five known shipwrecks listed under the *Underwater Culture Heritage Act* 2018.	Impacts to Ningaloo Coast World Heritage Property, National heritage listed Ningaloo Coast and the Commonwealth heritage listed Ningaloo Marine Area are not predicted as detailed in Section 7.1.12.11. Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation and research	Recreation is an important activity in the Marine Park.	Impacts to tourism and recreation including fishing are not predicted as seismic surveys will not be undertaken within the marine park and impacts to marine park values are not predicted.
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Mining is an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.7 Joseph Bonaparte Marine Park

The CSEP OA overlaps the Joseph Bonaparte Marine Park Multiple Use Zone and Special Purpose Zone. As detailed in Table 7-31 impacts to the values of the Joseph Bonaparte Marine Park are not predicted.

Table 7-31: Assessment of Predicted Level of Impact to Joseph Bonaparte Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018c)	Predicted Impact
Benthic Habitat	Contains a number of prominent shallow seafloor features including an emergent reef system, shoals, and sand banks.	Impacts to benthic habitats are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. Noting there is the potential for mortality or injury to occur in site-attached fishes up to a maximum range of 310 m from the seismic source, a seismic source exclusion zones around the bank and shoal habitats will be implemented. The seismic source will not be operated within 350 m horizontal distance of the 60 m contour of any banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the Group II fish mortality or injury criteria is less than 300 m. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to site-attached fish as the mortality or injury criteria will not be exceeded within the 60 m contour of banks and shoals.
Coastal habitats and communities	NA	NA
Marine Invertebrates	Characterised by sponges, soft corals, sessile filter feeders, polychaetes, and ascidians.	
Birds	NA	NA
Fish	NA	NA
Marine Reptiles	BIAs include foraging habitat for marine turtles.	The impact assessment for turtles (Section 7.1.8 identified that impacts to foraging turtles could occur without controls in place.

AMP	Values (DNP 2018c)	Predicted Impact
		The following controls measures will be implemented to ensure impacts to foraging turtles can be manage such as they can continue to forage within injury: • CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Operational Protocol. • CM#11: Turtle Shutdowns - A seismic source shutdown zone of 250 m will be applied to turtles • CM#12: Turtle night time and low-visibility procedure
Marine Mammals	Foraging BIA for Australian snubfin dolphin.	Impacts to Australian snubfin dolphin are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for Australian snubfin dolphin is 17.84 km, thus the seismic source will not be operated within 20 km of a Australian snubfin dolphin BIA (CM#14). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dugong or dolphin sound effect criteria is less than 20 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to Australian snubfin dolphins as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are • Carbonate bank and terrace system of the Sahul Shelf	See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	The Miriuwung, Gajerrong, Doolboong, Wardenybeng and Gija and Balangarra people have responsibilities for sea country in the Marine Park.	Impacts to cultural values are not predicted as impacts to marine park values are not predicted.
Heritage values	No heritage listings apply to the marine park, however, the park is adjacent to the West Kimberley National Heritage Place.	NA
Tourism, recreation and research	Tourism and recreation including fishing, are important activities in the Marine Park.	Impacts to tourism and recreational fishing from seismic acoustic emissions are not predicted.
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries

AMP	Values (DNP 2018c)	Predicted Impact
		are within the acceptable level with identified controls.
Petroleum Activity	Mining is an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.8 Kimberley Marine Park

The CSEP OA overlaps the Kimberley Marine Park Multiple Use Zone and abuts the Habitat Protection Zone and National Park Zone. As detailed in Table 7-32 impacts to the values of the Kimberley Marine Park are not predicted.

Table 7-32: Assessment of Predicted Level of Impact to Kimberley Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	The CSEP OA overlaps the Kimberley Marine Park Multiple Use Zone and abuts the Habitat Protection Zone and National Park Zone.	
Benthic Habitat	Diverse benthic communities, with ancient coastline thought to be an important seafloor feature. Reefs regarded as biodiversity hotspots.	Impacts to benthic habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m. • The physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered.
Coastal habitats and communities	NA	NA
Plankton	NA	NA
Marine Invertebrates	NA	NA
Birds	BIAs include breeding and foraging habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.

AMP	Values (DNP 2018a)	Predicted Impact
Fish	BIAs include foraging habitat for whale sharks.	The whale sharks Approved Conservation Advice (TSCC 2015) does not identify sound as a threat. Impacts are not predicted in the whale shark foraging (high density prey) BIA. Impacts within the whale shark foraging BIA are predicted to be minor disturbance that would not impede their recovery, however, as the Mortality/Potential Mortal Injury and Recoverable Injury criteria is met within 145 m a shutdown zone of 200 m will be applied to whale sharks as per CM#7: Whale shark shutdown zone.
Marine Reptiles	BIAs include internesting and nesting habitat for marine turtles.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km. Thus, no operation of the seismic source will occur within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species as per CM#9: Turtle Exclusion Zone. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to turtles as impact criteria will not be exceeded within a BIA.
Marine Mammals	BIAs include breeding, calving and foraging habitat for inshore dolphins, calving, migratory pathway and nursing habitat for humpback whales, migratory pathway for pygmy blue whales, foraging habitat for dugong.	Impacts to inshore dolphins are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria is 17.83 km, thus there will be no operation of the seismic source within 20 km of a dolphin BIA. Impacts to humpback whales are not predicted based on:

AMP	Values (DNP 2018a)	Predicted Impact
		• As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for humpback whales is 100 km thus there will be no operation of the seismic source within 100 km of the Kimberley humpback whale BIA from August to the end of September. (CM#14: Marine Mammal Exclusion Zones). Impacts to pygmy blue whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for pygmy blue whales is 100 km thus there will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December when they are present in the migration BIA (CM#14: Marine Mammal Exclusion Zones). These exclusion zones may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales and humpback whales as the impact criteria will not be exceeded within a BIA. Impacts to dugongs are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria is 17.83 km, thus there will be no operation of the seismic source within 20 km of a dugong BIA. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dugong or dolphin sound effect criteria is less than 20 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to

AMP	Values (DNP 2018a)	Predicted Impact
		dugong as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are: • Ancient coastline at the 125m depth contour • Continental slope demersal fish communities	See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	The Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi and the Nyul Nyul people's sea country extends into the Kimberley Marine Park. The national heritage listing for the West Kimberley recognises the following key cultural heritage values: • Wanjina Wunggurr Cultural Tradition which incorporates many sea country cultural sites. • Log-raft maritime tradition, which involved using tides and currents to access warrurru (reefs) far offshore to fish. • Interactions with Makassan traders around sea foods over hundreds of years. • Important pearl resources that were used in traditional trade through the wunan and in contemporary commercial agreements.	Impacts to cultural heritage values are not predicted.
Heritage values	Contains more than 40 known shipwrecks listed under the *Underwater Culture Heritage Act 2018*.	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation and research	Tourism and recreation, including fishing, are important activities in the Marine Park.	Diving has not been identified as an activity that is undertaken within the Kimberley AMP. Impacts to tourism and recreational fishing from acoustic emissions are not predicted.
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Mining is an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.9 Mermaid Reef Marine Park

The CSEP OA abuts the Mermaid Reef Marine Park. As detailed in Table 7-33 impacts to the values of the Mermaid Reef Marine Park are not predicted.

Table 7-33: Assessment of Predicted Level of Impact to Mermaid Reef Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	The CSEP OA abuts the Mermaid Reef Marine Park which is assigned National Park Zone.	
Benthic Habitat	Ecosystems of the Marine Park are associated with emergent reef flat, deep reef flat, lagoon, and submerged sand habitats.	Impacts to benthic habitats, coastal habitats and marine invertebrates are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to non-lethal sound effect criteria for molluscs is 80 m. • The physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered.
Coastal habitats and communities	NA	NA
Marine Invertebrates	NA	NA
Birds	BIAs include breeding habitat for seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	Though not detailed expressly as a value in the North-west Marine Parks Network Management Plan site-attached fish are likely to be present within the Mermaid Reef Marine Park.	As there is the potential for mortality or injury to site-attached fishes at a maximum range of 310 m from the seismic source, a seismic source exclusion zones around bank and shoal habitats will be implemented. The exclusion zone will be based on the maximum modelled distance to the Group II fish mortality or injury criteria and will be applied to the 60 m contour of banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). Though the maximum modelled distance to the TTS sound effect criteria for site-attached fish is 7.5 km, Popper et al. (2005)

AMP	Values (DNP 2018a)	Predicted Impact
		reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
Marine Mammals	BIAs include migratory pathway for the pygmy blue whale.	Impacts to pygmy blue whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for pygmy blue whales is 100 km thus there will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December when they are present in the migration BIA (CM#14: Marine Mammal Exclusion Zones). These exclusion zones may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales as the impact criteria will not be exceeded within a BIA.
Marine Reptiles KEFs	NA KEF of the marine park: • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	NA See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	NA	NA
Heritage values	Mermaid Reef–Rowley Shoals Commonwealth Heritage Listed.	Impacts to heritage values are not predicted based on impacts to fauna and benthic communities are not predicted.

AMP	Values (DNP 2018a)	Predicted Impact
	Contains one known shipwreck (Livey wrecked in 1810) listed under the *Underwater Culture Heritage Act* 2018.	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation, and research	Tourism, recreation, and scientific research are important activities in the Marine Park.	As detailed in Section 7.1.10.1 the maximum distance where received levels exceed the prolonged sound exposure for health and safety purposes for divers is 70 km. To ensure impacts do not occur to divers who may be present at Mermaid Reef, consultation will be undertaken with research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the Mermaid Reef Marine Park, and as per the Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (DMAC 2019) a joint risk assessment and agreed planning/mitigation will be implemented (CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations). The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 µPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity.
Commercial Fisheries	NA	NA
Petroleum Activity	NA	NA

7.1.12.10 Montebello Marine Park

The CSEP OA overlaps the Montebello Marine Park. As detailed in Table 7-34 impacts to the values of the Montebello Marine Park are not predicted.

Table 7-34: Assessment of Predicted Level of Impact to Montebello Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018a)	Predicted Impact
Location	The CSEP OA overlaps the Montebello Marine Park.	
Benthic Habitat	A prominent seafloor feature in the Marine Park is Trial Rocks consisting of two close coral reefs. The reefs are emergent at low tide.	Impacts to Trial Rocks is not predicted as seismic surveys will not be undertaken in water depths less than 25 m.
Coastal habitats and communities	NA	NA
Marine Invertebrates	NA	NA
Birds	Biologically important areas include breeding habitat for seabirds and foraging areas for migratory seabirds adjacent to breeding areas.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	Biologically important areas include foraging habitat for whale sharks.	The whale sharks Approved Conservation Advice (TSCC 2015) does not identify sound as a threat. Impacts are not predicted in the whale shark foraging (high density prey) BIA. Impacts within the whale shark foraging BIA are predicted to be minor disturbance that would not impede their recovery, however, as the Mortality/Potential Mortal Injury and Recoverable Injury criteria is met within 145 m a shutdown zone of 200 m will be applied to whale sharks as per CM#7: Whale shark shutdown zone.
Marine Reptiles	Biologically important areas include inter-nesting, foraging, mating, and nesting habitat for marine turtles.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km. Thus, no operation of the seismic source will occur within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat

AMP	Values (DNP 2018a)	Predicted Impact
		critical for the survival of the species as per CM#9: Turtle Exclusion Zone. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to turtles as impact criteria will not be exceeded within a BIA.
Marine Mammals	Biologically important areas include migratory pathway for humpback whales.	Impacts to humpback whales are not predicted based on: • As detailed in Table 7-19 the maximum modelled distance to sound effect criteria for humpback whales is 100 km thus there will be no operation of the seismic source within 100 km of a humpback whale Migration BIA in the Carnarvon OA June to the end of November (CM#14: Marine Mammal Exclusion Zones). These exclusion zones may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to humpback whales as the impact criteria will not be exceeded within a BIA.
KEFs	KEFs of the marine park are: • Ancient coastline at the 125 m depth contour	See Table 7-36 for assessment of predicted impact to KEFs.
Cultural values	The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara region.	Impacts to cultural values are not predicted as impacts to marine park values are not predicted.
Heritage values	The Marine Park is adjacent to the WA Barrow Island and the Montebello– Barrow Island Marine Conservation Reserves which have been nominated for national heritage listing.	Seismic surveys will not be undertaken within the WA Barrow Island and the Montebello– Barrow Island Marine Conservation Reserves.

AMP	Values (DNP 2018a)	Predicted Impact
	The Marine Park contains two known shipwrecks listed under the *Underwater Culture Heritage Act* 2018.	Impacts to shipwrecks from acoustic emissions are not predicted.
Tourism, recreation, and research	Tourism and recreation including fishing, are important activities in the Marine Park.	As detailed in Section 7.1.10.1 the maximum distance where received levels exceed the prolonged sound exposure for health and safety purposes for divers is 70 km. To ensure impacts do not occur to divers who may be present within the Montebello Marine Park, consultation will be undertaken with research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the Montebello Marine Park, and as per the Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (DMAC 2019) a joint risk assessment and agreed planning/mitigation will be implemented (CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations). The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 µPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur within 45 km of each other, all parties should be made aware of the planned activity.
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Mining is an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.11 Ningaloo Coast World Heritage Area and Marine Parks

The CSEP OA abuts the Ningaloo Coast World Heritage Area (NCWHA) which includes the Commonwealth and State Marine Parks and Muiron Islands. Impacts to the NCWHA and marine parks are not predicted based on:

- The acoustic source will not be operated within 70 km of the NCWHA (CM#6 NCWHA Exclusion Zone).
- There will be no operation of the seismic source within 100 km of a humpback whale BIA during the following periods (CM#14: Marine Mammal Exclusion Zones):
  - Exmouth Gulf BIA: August to end of November.
  - Migration BIA within the Carnarvon OA June to the end of November.
- There will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December (CM#14: Marine Mammal Exclusion Zones).

These controls ensure that the acoustic emissions do not impact the NCWHA and marine parks values as 70 km is based on the furthest distance to a noise effect criteria for receptors other than for whales. For whales an additional control will be implemented when they are present in the NCWHA and marine parks of 100 km as this is the furthest distance to a noise effect criteria for whales.

These whale exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales and humpback whales as the impact criteria will not be exceeded within a BIA.

If there is a situation where the survey specific underwater acoustic modelling furthest distance to a low-frequency whale sound effect criteria is less than 70 km, the exclusion zone where the acoustic source will not be operated within 70 km of the NCWHA (CM#6 NCWHA Exclusion Zone) remains.

7.1.12.12 Oceanic Shoals Marine Park

The CSEP OA overlaps the Oceanic Shoals Marine Park Multiple Use Zone and Special Purpose Trawl Zone and abuts the Habitat Protection Zone. As detailed in Table 7-35 impacts to the values of the Oceanic Shoals Marine Park are not predicted.

Table 7-35: Assessment of Predicted Level of Impact to Oceanic Shoals Marine Park from Seismic Source Emissions

AMP	Values (DNP 2018c)	Predicted Impact
Location	The CSEP OA overlaps the Oceanic Shoals Marine Park Multiple Use Zone and Special Purpose Trawl Zone and abuts the Habitat Protection Zone.	
Benthic Habitat	As per KEFs.	As per KEFs

AMP	Values (DNP 2018c)	Predicted Impact
Coastal habitats and communities	NA	NA
Marine Invertebrates	Terraces, banks, channels and valleys support sponges, soft coral, polychaetes, ascidians.	Impacts to benthic habitats are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m.
Birds	Local upwellings of nutrient-rich water attract aggregations of seabirds.	Impacts to birds from underwater acoustic emissions are not predicted.
Fish	Contains the largest concentration of pinnacles along the Australian margin, where local upwellings of nutrient-rich water attract aggregations of fish plus patch reefs and hard substrate pinnacles that support over 280 demersal fish species.	Impacts to fish associated with pinnacles are not predicted based on: • As there is the potential for mortality or injury to occur in site-attached fishes up to a maximum range of 310 m from the seismic source, a seismic source exclusion zones around the bank and shoal habitats will be implemented. The seismic source will not be operated within 350 m horizontal distance of the 60 m contour of any banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the Group II fish mortality or injury criteria is less than 300 m. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to site-attached fish as the mortality or injury criteria will not be exceeded within the 60 m contour of banks and shoals.
Marine Reptiles	BIAs include foraging and internesting habitat for marine turtles.	Impacts to turtles are not predicted based on: • As detailed in Table 7-15 the maximum modelled distance to injury or behavioural disturbance for sound effect criteria for turtles is 3 km. Thus, no operation of the seismic source will occur within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the

AMP	Values (DNP 2018c)	Predicted Impact
		survival of the species as per CM#9: Turtle Exclusion Zone. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to turtles as impact criteria will not be exceeded within a BIA.
Marine Mammals	-	-
KEFs	KEFs of the marine park are: • Carbonate bank and terrace systems of the Van Diemen Rise • Carbonate bank and terrace system of the Sahul Shelf • Pinnacles of the Bonaparte Basin • Shelf break and slope of the Arafura Shelf	See Table 7-36 for assessment of predicted impact to KEFs.
Heritage values of places	No heritage listings apply to the marine park.	NA
Heritage values	NA	NA
Tourism, recreation, and research	NA	NA
Commercial Fisheries	Commercial fishing is an important activity in the Marine Park.	Based on the impacts assessment in Section 7.1.5 Invertebrates and Section 7.1.6 predicted impacts to commercial fisheries are within the acceptable level with identified controls.
Petroleum Activity	Oil and gas are an important activity in the Marine Park.	Impacts to petroleum activities from acoustic emissions are not predicted.

7.1.12.13 Roebuck Marine Park

The CSEP OA is ~65 km from the Roebuck Marine Park. The only value of the Roebuck Marine Park potentially impacts at this distance is the migratory pathway for humpback whales. Impacts to humpback whales are not predicted based on:

- To avoid impacts to humpback whales within migration BIAs the seismic source will not be operated within 100 km of these BIAs when they are present in these BIAs, or a lesser distance if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km (CM#14). Thus, impacts to humpback whales undertaking biologically important behaviour are not predicted.

7.1.13 Key Ecological Features

The CSEP OA overlaps and abuts several key ecological features (KEFs) as shown in Figure 5-14, Figure 5-15 and Figure 5-16.

The assessment in Table 7-36 reviews the predicted impacts s associated with the seismic source acoustic emissions associated with a seismic survey within the CSEP OA and considers these in the context of the value of the KEFs. The assessment considers the control measures previously identified in acoustic emissions impact assessment sections.

Table 7-36: Assessment of Predicted Level of Impact to Key Ecological Features from Seismic Source Emissions

KEF	Predicted Impact
Ancient coastline at the 125m depth contour	Where the ancient submerged coastline provides areas of hard substrate it may contribute to higher biological diversity. As detailed in this assessment impacts to the physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered and thus the values of the Ancient Coastline KEF are not predicted to be impacted. In addition, the ancient coastline could be important as a migratory pathway for cetaceans and pelagic species such as the whale shark and humpback whale. Controls will be implemented to managed predicted impacts to whale sharks (CM#7: Whale shark shutdown zone) and humpback whales (CM#14: Marine Mammal Exclusion Zones) to the acceptable level, thus impacts to these values of the Ancient Coastline KEF are not predicted.
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	As this KEF is over 20 km from the CSEP OA area impacts to reef species and nesting green and hawksbill turtles as not predicted.
Canyons linking the Argo Abyssal Plain with the Scott Plateau	No impacts are predicted to the Canyons linking the Argo Abyssal Plain with the Scott Plateau KEF as they are approximately 55 km from the CSEP OA.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsular	The seismic source will not be operated within 70 km of the NCWHA (CM#6 NCWHA Exclusion Zone). This exclusion zone overlaps a significant proportion of this KEF. The canyons are thought to be significant contributors to the biodiversity of the adjacent Ningaloo Reef, as they channel deep water nutrients up to the reef, stimulating primary productivity (DEWHA 2008c). Acoustic emissions are not predicted to impact this flow of deep water nutrients up to the reef.
• Carbonate bank and terrace systems of the Van Diemen Rise • Carbonate bank and terrace system of the Sahul Shelf • Pinnacles of the Bonaparte Basin • Shelf break and slope of the Arafura Shelf	The main value of these KEFs is that they provide hard substrate in a relatively sparse soft sediment habitat sessile benthic invertebrates including hard and soft corals, sponges, whips, fans, bryozoans and aggregations of demersal, and site attached fish species. Impacts to these values are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • The physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered. • As there is the potential for mortality or injury to site-attached fishes at a maximum range of 310 m from the seismic source, a seismic source exclusion zones around bank and shoal habitats will be implemented.

KEF	Predicted Impact
	The exclusion zone will be based on the maximum modelled distance to the Group II fish mortality or injury criteria and will be applied to the 60 m contour of banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). • It is likely that demersal fish species within the Continental Slope Demersal Fish Communities KEF could swim beyond the injury sound effect criteria distances of up to 310 m as the seismic source approaches. Impacts to demersal fishes are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur. • Though the maximum modelled distance to the TTS sound effect criteria for demersal fish is 14 km, Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
Commonwealth waters adjacent to Ningaloo Reef	The seismic source will not be operated within 70 km of the NCWHA (CM#6 NCWHA Exclusion Zone). This exclusion zone overlaps with the Commonwealth waters adjacent to Ningaloo Reef KEF. Thus, impacts to this KEF are not predicted.
Continental slope demersal fish communities	It is likely that demersal fish species within the Continental Slope Demersal Fish Communities KEF could swim beyond the injury sound effect criteria distances of up to 310 m as the seismic source approaches. Impacts to demersal fishes are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur. Though the maximum modelled distance to the TTS sound effect criteria for demersal fish is 14 km, Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
Exmouth Plateau	Water depths within the Exmouth Plateau range from 800 to 4,000 m thus impacts are not predicted to benthic habitats. Whaling records suggest sperm whales may be present at Exmouth Plateau. PTS and TTS impacts are not predicted to sperm whales as the furthest distance to the PTS or TTS noise effect criteria is 50 m. Behavioural impacts to these species such as avoiding the area may occur, however, as detailed in EPBC Policy Statement 2.1 (DEWHA 2008g) at the scale of a seismic survey, such temporary displacements are unlikely to result in any real biological cost to the animals unless the interaction occurs during critical behaviours (e.g., breeding, feeding and resting), or in important areas such as narrow migratory corridors) which do not apply to these species.

KEF	Predicted Impact
Glomar Shoals	The Glomar Shoals are a submerged feature situated at a depth of 33–77 m are known to be an important area for a number of commercial and recreational fish species. Impacts to these species are not predicted based on: • As there is the potential for mortality or injury to site-attached fishes at a maximum range of 310 m from the seismic source, a seismic source exclusion zones around bank and shoal habitats will be implemented. The exclusion zone will be based on the maximum modelled distance to the Group II fish mortality or injury criteria and will be applied to the 60 m contour of banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). • It is likely that demersal fish species at Glomar Shoals could swim beyond the injury sound effect criteria distances of up to 310 m as the seismic source approaches. Impacts to demersal fishes are, therefore, considered more likely to be limited to behavioural and TTS effects, with injury/mortality being highly unlikely to occur. • Though the maximum modelled distance to the TTS sound effect criteria for demersal fish is 14 km, Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	Impacts to Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m. • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for crustaceans is 763 m. • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for molluscs is 80 m. • As detailed in Table 7-10 the maximum modelled distance to sound effect criteria for mortality or injury for attached fish is 310 m. Though the maximum modelled distance to the TTS sound effect criteria for site-attached fish is 7.5 km, Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours, thus the potential impact for fish TTS is assessed as being acceptable based on hearing loss and subsequent decrease in fitness being temporary and recovery taking place in a relatively short timeframe after the source array has moved away from the exposed fish, and the sound levels are reduced. Based on this the potential for impacts to individuals' fitness and survival is limited and impacts to fish community structures are not predicted.
Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	Impacts to reef species at Scott and Seringapatam Reefs are not predicted based on: • As detailed in Table 7-6 the maximum modelled distance to sound effect criteria for corals is 20 m thus impacts to corals are not predicted as the minimum water depth for the CSEP is 25 m.

KEF	Predicted Impact
	• The physical structure, ecosystem functioning, and integrity of benthic habitats are not predicted to be altered. • As there is the potential for mortality or injury to site-attached fishes at a maximum range of 310 m from the seismic source, a seismic source exclusion zones around bank and shoal habitats will be implemented. The exclusion zone will be based on the maximum modelled distance to the Group II fish mortality or injury criteria and will be applied to the 60 m contour of banks and shoals within the CSEP OA (CM#8: Exclusion Zone – banks and shoals). Other values of this KEF are: Green and hawksbill turtles nest during the summer months on Sandy Islet on South Scott Reef. Impacts to turtles are not predicted based on: • Exclusion zones will be implemented for turtle internesting, nesting or mating BIAs or habitat critical for the survival of the species, for the period when they are undertaking those activities within the BIA or habitat critical for the survival of the species, to the maximum modelled distance to the sound effect criteria for injury or behavioural disturbance for turtles as per CM#9: Turtle Exclusion Zone. Pygmy blue whale foraging BIA: Impacts to pygmy blue whales are not predicted based on: • Exclusion zones will be implemented for BIAs to the maximum modelled distance to sound effect criteria for pygmy blue whales during April to August and October to December, when they are present in the migration BIA and foraging BIAs as per CM#14: Marine Mammal Exclusion Zones.

7.1.14 Vessel and helicopter

7.1.14.1 Predicted Level of Impact

The potential receptors of sound produced by vessels and helicopters are cetaceans, marine turtles, seabirds, and migratory shorebirds.

Helicopters

Vessel noise comprises a combination of continuous noise generated by engine and machinery noise, and modulated, broadband noise produced by propeller rotation and cavitations (Richardson et al. 1995; Southall 2007; Jensen et al. 2009; Wales and Heitmeyer, 2002; Hildebrand, 2009). Vessel noise emissions varies with the size, speed, and engine type and the activity being undertaken. Noise levels for a range of vessels have been measured at 150-182 dB re 1 μPa at 1 m (SPL) at dominant frequencies between 50 Hz and 7 kHz (Wyatt 2008; Simmonds et al. 2004; Jiménez-Arranz et al. 2017).

Strong underwater sounds are detectable for only brief periods when a helicopter is directly overhead (Richardson et al. 1995). Sound emitted from helicopter operations is typically below 500 Hz and sound pressure in the water directly below a helicopter is greatest at the sea surface but diminishes quickly with depth. A significant proportion of the sound energy is lost due to reflection and attenuation at the air-water interface.

The sound from the flyover of a Bell 214 helicopter (stated to be one of the noisiest) was recorded by underwater hydrophones (Richardson et al. 1995). The sound source was 162 dB re 1 μPa @ 1 m at its peak and had a frequency of 155 Hz. The helicopter was audible in the air for four minutes before it passed over the underwater hydrophones. The helicopter was audible underwater for only 38 seconds at 3 m depth and 11 seconds at 8 m depth (Greene 1985a cited in Richardson et al. 1995). Noise levels reported for a Sikorsky-61 were 108 dB re 1μPa at 305 m (Simmonds et al. 2004) showing that the noise levels dissipate quickly with distance.

Reactions of cetaceans to circling aircraft (fixed wing or helicopter) are sometimes conspicuous if the aircraft is below an altitude of 300 m, uncommon at 460 m and generally undetectable at 600m (NMFS, 2001). Baleen whales sometimes dive or turn away during overflights, but sensitivity seems to vary depending on the activity of the animals. The effects on cetaceans seem transient, and occasional over-flights probably have no long-term consequences on cetaceans. Observations by Richardson and Malme (1993) indicate that, for bowhead whales, most individuals are unlikely to react significantly to occasional single-pass low-flying helicopters transporting personnel and equipment at altitudes above 150 m. Leatherwood and Reeves (1983) observed that minke whales responded to helicopters at an altitude of 230 m by changing course or slowly diving.

Helicopters will be used during seismic surveys for crew change and in an emergency. It is expected that underwater sounds from helicopters will only be detectable in the upper water column for very brief periods during landing and take-off. Some minor behavioural disturbance may occur for short periods if marine fauna are present near the surface in the vicinity of helicopters landing on the seismic survey vessel. This would be limited to a temporary change in behaviour due to avoidance of the area but is not expected to have any longer term impacts. Thus, the consequence rating for impacts to fauna from helicopters is assessed as Slight (1) based on impacts are predicted to be incidental effects in a locally affected environmental setting.

Vessels

Marine fauna including cetaceans, marine turtles, seabirds and migratory shorebirds are expected to show minor behavioural responses to vessels, with avoidance and other significant behavioural responses most likely to occur within tens or hundreds of metres from a passing vessel (Southall et al. 2007; Popper et al. 2014). However, based on a practical spreading loss of $15\log_{10}$(Range) (Urick 1983) and accounting for the NOAA (2019) recommended 120 dB re 1µPa marine mammal behavioural response threshold for continuous sound sources, some behavioural effects may occur over ranges of a few kilometres. For example, McCauley (1998) measured underwater sound levels from a 64 m long support vessel transiting at 11 knots during calm conditions in the Timor Sea and found the distance to 120 dB re 1 µPa to be approximately 1 km, while a 62 m long research vessel transiting at 10 knots was found to exceed to 120 dB re 1 µPa at distances up to 1.6 km (Chorney et al. 2011).

Any potential marine fauna behavioural impacts due to vessel noise are expected to be localised and short term. Some individuals may avoid the immediate proximity of the vessel, but this is not expected to have any widespread or longer-term impacts on their behaviour or populations. Thus, the consequence rating for impacts to fauna from vessels is assessed as Minor (2) based on the potential for minor and temporary disruption to small portion of population with no effects on critical habitats/ activities.

7.1.14.2 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-37: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Slight for helicopters and Minor for vessels.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature with little uncertainty.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	EPBC Regulations 2000 (Part 8 Division 8.1 Interacting with cetaceans) will be complied with as per CM#18.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and	The activity will be managed as per the requirements within this Section and the implementations strategy.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
	implementation strategy.		
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	No objections or claims have been raised regarding helicopter or vessel noise.	Yes

7.1.14.3 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-38 details the controls that will be implemented specifically for vessels and helicopters. Controls identified for the management of seismic acoustic emissions to fish (Table 7-12), turtles (Table 7-18) and marine mammals (Table 7-24) will ensure impacts to these species from vessel and helicopter noise are of an acceptable level and ALARP.

Table 7-38: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#18: EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	The requirements to manage interactions between vessels, helicopters and cetaceans as detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be applied to vessels and helicopters. This includes: • Travel at less than 6 knots within the cautionary zone of a cetacean (150 m radius for dolphins, 300 m for whales. • Do not approach closer than the caution zones for a cetacean. • If a cetacean shows signs of disturbance move away at a constant speed less than 6 knots. • Must not operate a helicopter at a height lower than 1,650 feet or within a horizontal radius of 500 m of a cetacean and must not allow the aircraft to approach a cetacean from head on. The requirements of the EPBC regulations set out measures to reduce vessel speed and avoid approaching cetaceans, which also reduce engine in close proximity to cetaceans. The requirements of the EPBC regulations set out clear measures on altitudes above cetaceans and on approaching cetaceans, which reduce the risk of helicopter noise in close proximity to cetaceans. It is a legislative requirement for vessels to comply with the EPBC Act.	Yes
CM#19: Preventative Maintenance System	Power generation and propulsion systems on the vessels will be maintained in accordance with manufacturer's instructions to ensure efficient operation.	Yes

7.1.15 Cumulative Impacts

Cumulative impacts from seismic surveys can potentially occur when:

- Multiple seismic surveys occur in an area concurrently (at the same time), leading to an increase in sound exposure to the same receptors.
- Seismic surveys occur successively (one after the other) in the same area when the timeframe between surveys is less than the recovery rate of any potential impacts to receptors from the previous survey.

Table 5-18: Seismic Surveys Proposed within the CSEP OA, identifies known seismic surveys that have recently been undertaken or are proposed to be undertaken within the CSEP OA. Based on the information publicly available it is likely that seismic surveys outside of the CSEP will be undertaken within the CSEP OA within the 5-year period that the CSEP is valid. One of the aims of the CSEP is to be able to manage cumulative impacts to receptors as the CSEP titleholders can plan seismic survey timings and locations to avoid cumulative impacts. Also, the implementation of exclusion zones for protected species when undertaking biologically important behaviours limits cumulative impacts especially for those species that are migrating through the CSEP OA.

The Bureau of Ocean Energy Management (BOEM 2014) published a final environmental review of geological and geophysical survey activities off the mid- and South Atlantic coast. To minimise the impacts to marine life by providing a 'corridor' between vessels, the environmental impact statement from this review included a requirement for a 40 km geographic separation distance (based on worst case scenarios) between the seismic sources of simultaneous seismic surveys. This 40 km separation distance has become best practice and will be implemented as CM#42 to manage potential cumulative impacts between simultaneous seismic surveys.

An assessment of cumulative impacts from seismic source emissions is detailed in Table 7-39 to identify if additional controls are required to managed impacts to receptors to the acceptable level.

Table 7-39: Assessment of Cumulative Impacts from Seismic Source Emissions

Receptor	Potential for Cumulative Impacts	Further Controls Required
Plankton	Richardson et al. (2017) determined that zooplankton abundance would not be adversely affected as the extensive movement of water masses carrying plankton through seismic survey area, and the rapid reproductive cycle and high reproductive potential characteristics of planktonic organisms. The study showed that it would take approximately three days after the end of a typical 4000 cubic inch seismic survey for the zooplankton to recover to original levels and that zooplankton communities can begin to recover during the seismic survey such that a continuous decline in zooplankton throughout the duration of the seismic survey is not anticipated and parts of the survey area would be replenished as the survey progressed. Thus, cumulative impacts to plankton are not predicted. As impacts to plankton are predicted to a distance of 250 m from the sound source, cumulative impacts from simultaneous seismic survey are not predicted as the seismic source from simultaneous	N

Receptor	Potential for Cumulative Impacts	Further Controls Required
	seismic surveys will not be operated within 40 km of each other (CM#42: Seismic Survey Separation Distance).	
Invertebrates	The potential impact for sub-lethal (763 m) and lethal (80 m) impacts to benthic invertebrates is within tens to hundreds of metres from the seismic source and changes in overall benthic community composition and structure are expected to be negligible in the context of natural variability in mortality and recruitment. Thus, cumulative impacts to invertebrates are not predicted. As impacts to invertebrates are predicted to 763 m from the sound source, cumulative impacts from simultaneous seismic survey are not predicted as the seismic source from simultaneous seismic surveys will not be operated within 40 km of each other (CM#42: Seismic Survey Separation Distance).	N
Fish	TTS and behavioural impacts may occur in demersal and pelagic fish species. Popper et al. (2005) reports that fish that showed TTS recovered to normal hearing levels within18-24 hours and behavioural impacts may occur for the period a seismic survey is within the area though Meekan et al. (2021) who undertook a large-scale experiment that quantified the impacts of exposure of an assemblage of tropical demersal emperors, snappers and groupers targeted by commercial fisheries to a commercial-scale seismic source on the North West Shelf off Western Australia did not identify any short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour, or movement of fishes at any exposure sites. Thus, cumulative impacts to fish are not predicted. As impacts to fish species are predicted to 14 km from the sound source, cumulative impacts from simultaneous seismic survey are not predicted as the seismic source from simultaneous seismic surveys will not be operated within 40 km of each other (CM#42: Seismic Survey Separation Distance). For site-attached fish lethal and sub-lethal effects could occur at distances up to 310 m. CM#8: Exclusion Zone – banks and shoals where the seismic source will not be operated within the maximum modelled distance to the Group II fish mortality or injury criteria horizontal distance of the 60 m contour of any bank and shoal ensures that impacts to benthic habitats with a high diversity of site-attached fish are not exposed to sounds levels where lethal impacts may occur not. Thus, cumulative impacts to site-attached fish in these high diversity areas are not predicted. Behavioural impacts to site-attached fish could occur up to 7.5 km thus cumulative impacts from simultaneous seismic survey are not predicted as the seismic source from simultaneous seismic surveys will not be operated within 40 km of each other (CM#42: Seismic Survey Separation Distance).	N
Commercial fish species/catch	Cumulative impacts to commercial fish species and catch have been raised by commercial fishers and was one of the key issues addressed by the Operational Protocol. The Operational Protocol implements a number of spatial and temporal controls to limit seismic surveys (extent and frequency) to a level where titleholders	N

Receptor	Potential for Cumulative Impacts	Further Controls Required
	and commercial fishers can co-exist and to prevent overlapping 3D seismic surveys within the same regulated fishing season for each potentially affected managed fishery.	
Marine reptiles	Impacts to turtles are predicted to be short term behavioural impacts as the seismic survey occurs in an area, as controls will be implemented to avoid operating the seismic source within biologically important areas and habitat critical for the survival of the species when turtles are internesting, nesting or mating cumulative impacts are not predicted. A separation distance of 40 km between seismic survey operating sources (CM#42: Seismic Survey Separation Distance) will ensure cumulative behavioural impacts are avoided based on the furthest distance to the injury sound effect criteria is 2 km and behavioural response is 10 km.	N
Marine mammals	Impacts to marine mammals are predicted to be short term behavioural impacts as controls will be implemented to avoid operating the seismic source within biologically important areas when marine mammals are undertaking biologically important behaviours (CM#14: Marine Mammals Exclusion Zones). Outside of these areas CM#10: EPBC Act Policy Statement 2.1 (CM#10) and CM#15: Whale Adaptive Management Procedure will be implemented to manage PTS and TTS impacts. Thus, impacts to whales not undertaking biologically important behaviour is predicted to be short term behavioural impacts as the seismic survey occurs in an area. A separation distance of 40 km between seismic survey operating sources (CM#42: Seismic Survey Separation Distance) will ensure cumulative behavioural impacts are avoided based on the furthest distance to the behavioural disturbance sound effect criteria is 17.82 km.	N

7.2 Impact: Atmospheric Emissions

7.2.1 Source of Impact

Atmospheric emissions are generated on vessels from use of fuel in combustion engines and the incineration of waste.

7.2.2 Impact Pathway

The survey vessels will generate atmospheric emissions from power generation and waste incineration. Atmospheric emissions have the potential to result in a localised reduction in air quality in the immediate vicinity of the vessel exhaust and to provide a minor contribution to Australian and global levels of greenhouse gas (GHG) in the atmosphere.

As the surveys will occur in offshore waters impact to social amenity or human health are not predicted.

7.2.3 Predicted Level of Impact

Atmospheric emissions have the potential to result in a localised reduction in air quality in the immediate vicinity of the vessel. Any reduction in air quality would be temporary as the air emissions dissipate as the vessels are constantly moving.

Due to the low emissions levels, it is predicted that emissions resulting from the survey vessels will result in a short term and localised reduction in air quality, with emissions quickly dispersing and decreasing to within background levels. Given the low level of emissions anticipated, survey vessel emissions would represent an exceedingly small contribution to overall Australian and global GHG emissions.

The severity is assessed as Slight (1) based on impacts are predicted to be a short term and localised reduction in air quality.

7.2.3.1 Cumulative Impacts

Cumulative atmospheric emissions are unlikely to occur from seismic surveys vessels operating under the CSEP and from other marine users within the CSEP OA based on:

- atmospheric emissions from vessels result in a localised reduction in air quality in the immediate vicinity of the vessel and hence are unlikely to overlap.
- the addition of atmospheric emissions from CSEP survey vessels will be an exceedingly small contribution to overall Australian and global GHG emissions to the atmosphere.

7.2.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-40: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Slight.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is a low level of scientific uncertainty thus the precautionary principle is not required.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Management of the activity is consistent with legislation and other requirements as detailed in CM#20: Marine Order 97: Marine pollution prevention – air pollution.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the CSEP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	There have been no stakeholder objections or claims regarding atmospheric emissions.	Yes

7.2.5 *Identification of Controls and Demonstration of ALARP*

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-41 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-41: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted

CM#20: Marine Order 97: Marine pollution prevention – air pollution	Marine Order 97: Marine pollution prevention – air pollution details requirements for:
	• International Air Pollution Prevention Certificate where required by vessel class confirming:
	  ○ Incinerators are certified to meet prescribed emission standards.
	  ○ Diesel engines >130 kW are certified to meet prescribed emission standards.
	• Use of low sulphur fuel (0.50% m/m).
	• Ship Energy Efficiency Management Plan where required by vessel class.
	Marine Order 97 gives effect under Australian law to MARPOL Annex VI: Regulations for the prevention of air pollution from ships.
		Yes

CM#19: Preventative Maintenance System	Combustion equipment maintained in accordance with manufacturer's specification as detailed in the preventative maintenance system.	Yes
CM#21: Low carbon fuels	The International Maritime Organisation (IMO) has adopted an initial strategy on the reduction of GHG emissions from ships which includes research and development support for alternative low-carbon and zero-carbon fuels. However, to date the use of low-carbon and zero-carbon fuels is limited to a small number of vessels worldwide. If within the life of the CSEP suitable vessels for seismic surveys that use low-carbon and zero-carbon fuel are available, they would be considered for use if the cost of using these vessels is not disproportionate to the environmental benefits.	Partial

7.3 Impact: Light Emissions

7.3.1 Source of Impact

Light emissions will occur from survey vessels. The characteristics of light emissions will differ depending upon the number, intensity, spectral output and type of light. Historically, vessels used a combination of high-pressure sodium, fluorescent, metal halide and mercury vapour lights. However, recent advances in light emitting diode (LED) technology has seen a switch to this more efficient and cost-effective technology. The light sources associated with survey vessels are currently unknown and could comprise any or a combination of those mentioned above.

Light may appear as a direct light source from an unshielded light with direct line of sight to the observer or through sky glow. Where direct light falls upon a surface, be it land or ocean, this area of light is referred to as light spill. Sky glow is the diffuse glow caused by light that is screened from view but through reflection and refraction creates a glow in the atmosphere. Scattering of light by dust, salt and other atmospheric aerosols increases the visibility of light as sky glow, while the presence of clouds reflecting light back to earth can substantially illuminate the landscape (Kyba et al. 2011). White/blue light scatters more easily and further in the atmosphere compared to yellow-orange light (Kyba et al. 2011). Therefore, the distance at which direct light and sky glow may be visible from the source is dependent on the number, intensity, and types of lights, and how such lights are orientated or shielded, in addition to environmental conditions.

7.3.2 Impact Pathway

Artificial light at night can alter critical behaviours in fauna. For some species, artificial lighting may extend diurnal or crepuscular behaviours by improving an animal's ability to forage (e.g., Hill 1990). For nocturnal species, artificial light can result in detrimental changes in behaviour.

The severity to which artificial light negatively impacts individuals depends upon the vulnerability, which varies between and within species, their behaviour, and on the spectral output of the light emissions. The sensitivity of species to different wavelengths is summarised in Figure 7-57 which shows that most species are sensitive to short wavelength light (UV/violet/blue). The body of evidence demonstrating potential negative impacts of artificial light across the animal kingdom is growing, and includes receptors such as zooplankton, invertebrates, fish, marine reptiles, seabirds, and migratory shorebirds. The potential impact of light emissions associated with the survey vessels on these receptors are described below.

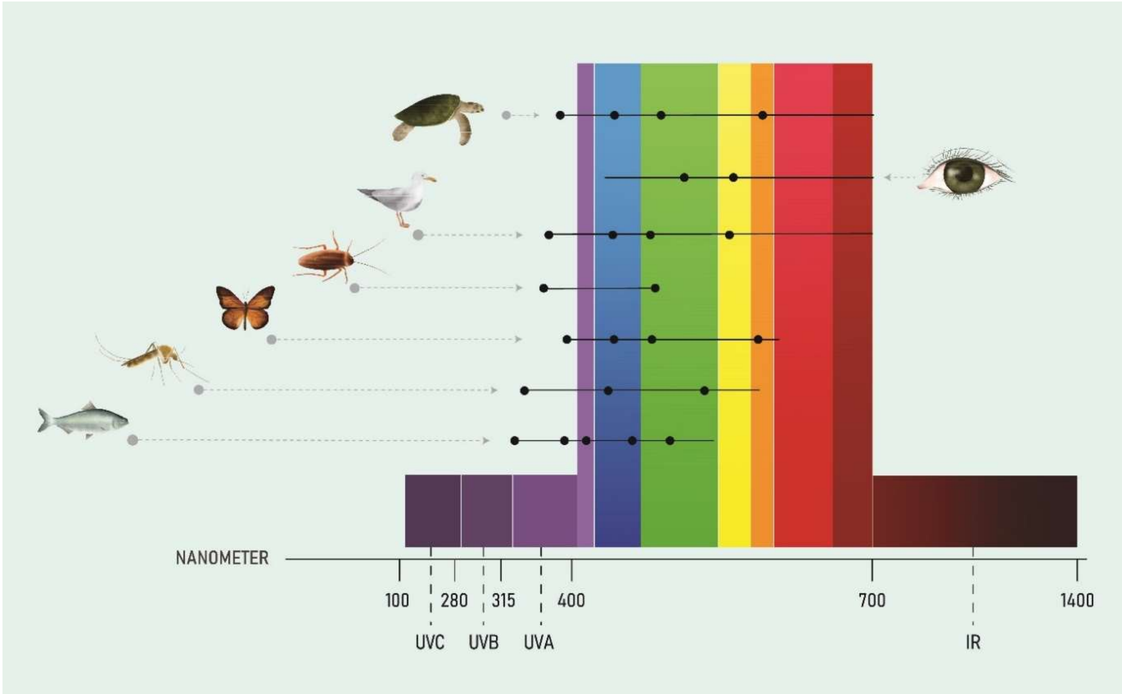


Figure 7-57: Visibility of different wavelengths of light in humans and wildlife is shown by horizontal lines. Black dots represent reported peak sensitivity. Source: CoA (2020).

7.3.2.1 Zooplankton

Diel vertical migration is an omnipresent phenomenon in plankton communities whereby plankton migrate to surface waters at dusk and return to deeper waters at dawn (see Hays 2003 for review). Diel vertical migration patterns have also been shown to be influenced by the lunar cycle (Ochoa-de-la-Torre et al. 2013). Although evidence has shown that diel vertical migration also occurs in the deep sea where no direct and background sunlight penetrates (van Haren & Compton 2013), light levels in the water column are thought to be strong cues for diel vertical migration (Hays 2003). These vertical migrations of zooplankton are integral in structuring pelagic communities since they influence the behaviour of predators (Hays 2003). While not empirically tested, it is possible that artificial light could influence diel vertical migration should the intensity of the light exceed other light cues. While not empirically demonstrated, disruption to diel vertical migration could potentially reduce survival or zooplankton on an individual level.

Zooplankton in the CSEP OA may include the egg and larval stages of some fish and invertebrates. Under laboratory conditions, eggs of a site attached reef fish (the clown fish, *Amphiprion ocellaris*) failed to hatch when incubated in the presence of artificial light for the duration of the incubation period (Fobert et al. 2019).

The effect of artificial light on zooplankton would most likely be confined to areas of direct light spill on the ocean surface which would be restricted to areas in close proximity to vessels, and in the case of impacts to fish spawn, limited to surface waters. Vessels will be continually moving in the CSEP OA reducing the duration of time zooplankton may be exposed to artificial light. Combined with ocean currents in the region continually circulating zooplankton, individual zooplankton are not expected to be exposed to artificial light for durations long enough to result in physiological or behavioural effects. Population or ecosystem level effects, both in terms of the regional biomass of zooplankton and of fish or invertebrate populations which may include egg or larval stages, are not considered credible.

7.3.2.2 Invertebrates

The reproductive biology of marine invertebrates is influenced by light cues, which may include broadcast spawning, larval phototaxis and recruitment (see Garratt et al. 2019 for review). Micronekton invertebrates (such as krill) may be affected by artificial light via the same pathways described for zooplankton above. Further, negative impacts of artificial light on corals has been demonstrated, including reduced settlement of larvae (Tamir et al. 2020) and changes in symbiotic algae density and chlorophyll concentrations (Ayalon et al. 2019). In intertidal areas, the response of invertebrates to artificial light has been shown to differ, with some species increasing abundance in areas of illumination, and others a decrease in abundance (Garratt et al. 2019), which may be indicative of a behavioural response to light. Snowshoe crabs showed attraction to blue and white LEDs under laboratory conditions and higher catch rates when LEDs were attached to baited traps (Nguyen et al. 2017). Like zooplankton, impacts to micronekton invertebrates may include localised changes in distribution in areas of direct light spill.

Considering that light emissions from the survey vessels are unlikely to be reached at the seafloor and that survey vessels are continually moving, impacts to benthic and micronekton invertebrates are not considered credible.

7.3.2.3 Fish

Behavioural responses of fish to artificial light have been demonstrated in various fish species (Marchesan et al. 2005; Nguyen & Winger 2019). Nguyen & Winger (2019) describe four common movement patterns of fish in response to light; phototaxis (movement towards or away from light), photokinesis (movement or lack of movement in response to light), aggregation and diel vertical migration showed that behavioural responses are influenced by both wavelength and intensity. Since many predatory fish rely on visual cues to locate and capture prey, increased light can lead to changes in predator-prey interactions (e.g., Batty et al. 1990). Although artificial light is shown to impact hatching of fish eggs, the spawning frequency and duration was no different under artificial light conditions compared to natural conditions (Fobart et al. 2019).

Light emissions associated with the survey vessels are unlikely to influence behaviour of fish, or result in attraction or aggregation, given that the vessels are continually moving.

7.3.2.4 Seabirds

Artificial light can have a variety of effects on seabirds depending upon the species and the life stage or behaviours being undertaken at the time. Negative responses of birds to artificial light may include collision, entrapment, stranding, grounding, disorientation, or interference with navigation (being drawn off course from usual migration route), potentially resulting in reduced fitness, injury and/or death (CoA 2020).

Species with a nocturnal component of their life history, such as procellariforms (albatrosses, petrels, shearwaters) are at greater risk of negative impacts. The bulk of the literature concerning impacts of lighting upon procellariforms relate to the synchronised mass exodus of fledgling seabirds from their nesting sites (Deppe et al. 2017; Raine et al. 2007; Rodriguez et al. 2015a; Rodriguez et al. 2015b; Le Corre et al. 2002; Reed et al. 1985), with fewer investigating the impacts of light at sea. Reports of interactions between seabirds and artificial light at sea is generally anecdotal following significant interaction events (e.g., Black 2005) or by opportunistic and unsystematic monitoring by oil and gas operators (e.g. Day et al. 2015; Glass & Ryan 2013; Weise et al. 2001; Ronconi et al. 2015). Deck lights and spotlights on fishing vessels have been recorded attracting numerous seabirds at night, particularly on nights with little moon light or low visibility (Black 2005; Merkel & Johansen 2011; Montevecchi 2006).

While it has been shown that all seabirds are sensitive in the shorter, violet – blue region of the visible spectrum (380 nm – 440 nm (Machovsky-Capuska et al. 2011)), white light poses a potential threat to seabirds as they contain all wavelengths of light (Rich & Loncore 2006; Wiltschko & Wiltschko 1999; Deppe et al. 2017). Further, Raine (2007) concluded the intensity of light may be a more important cue than colour; a very bright light will attract seabirds, regardless of the colour (Raine et al. 2007).

That procellariforms are shown to be attracted to artificial lights on land, and anecdotally to vessels and oil and gas facilities, in addition to undertaking nocturnal foraging on bioluminescent prey, makes them susceptible to attraction to light sources on the survey vessels, depending on the intensity.

Diurnal seabird species, such as terns, noddies and boobies, in contrast to procellariforms, are less vulnerable to impacts resulting from nocturnal behaviours. Although, the presence of artificial light can alter foraging behaviours and provide artificial roosting sites, this is most likely to occur at permanent offshore infrastructure where light sources are continually lit, and prey species may aggregate. Impacts to diurnal seabirds from the continually moving survey vessels are not considered credible.

7.3.2.5 Migratory shorebirds

As with diurnal seabirds described above, artificial lighting has been shown to influence the foraging behaviour in shorebirds, with increased foraging success in areas illuminated by artificial light (Santos et al. 2010). Although shorebirds may be attracted to foraging areas with increased illumination, artificial light near nocturnal roosting sites may displace shorebirds if they select darker roost areas where risk of predation is perceived to be lower (Rogers et al. 2006). However, direct light spill onto foraging or roosting areas for extended durations of time would be required to elicit such a behavioural response. Extended periods of direct light spill onto foraging or roosting habitat are not expected from the survey vessels, given the continual movement.

Artificial light may also attract migratory shorebirds in flight (Longcore et al. 2013) influencing stop-over selection and impacting successful migration and decrease fitness (McLaren et al. 2018). Sage (1979) (cited in Ronconi et al. 2015) reports incidents of migrating waders colliding with offshore platforms, though whether this was due to attraction by artificial light is unknown. In addition to attraction to facilities, artificial light, specifically long wavelength red light, has been shown to impact migration of passerines via disruption of magnetic orientation in the laboratory (Wiltschko et al. 1993) and in the field (Poot et al. 2008). Studies indicate that some migratory shorebirds possess a magnetic compass and suggest that magnetic cues are of primary directional importance (e.g., sanderling: Gudmundsson & Sandberg 2000). Although the survey vessels are continually moving, light sources may be visible for a bird in flight for extended periods of time (depending upon flight height). It is possible that migrating birds may be attracted to, or disorientated by, artificial light associated with the survey vessels.

7.3.2.6 Sea snakes

Documentation of the effects of artificial lighting on sea snakes is lacking. However, as active and intensive foragers, that display prolonged episodes (weeks) of continuous effort in search of prey (Bonnet 2012), sea snakes may be attracted to well-lit areas around permanent marine infrastructure due to the associated attraction of prey species. Since survey vessels are continually moving, this is not considered credible.

7.3.2.7 Marine turtles

Potential impacts of artificial light on marine turtles has been well documented, although the vulnerability of individuals to negative impacts is influenced by life history stage and behaviour.

While the behavioural responses of marine turtles are relatively well understood, there is currently no quantitative impact thresholds for artificial light due to the expansive suite of factors that influence individual vulnerability. In addition to the intensity of the light source, the spectral power distribution (wavelength and colour), atmospheric scattering, cloud reflectance, spatial extent of sky glow, duration of exposure, horizon elevation and lunar phase can all influence behavioural responses to varying degrees.

Wavelength has been shown to significantly affect the vulnerability of individuals to artificial light. In general, artificial light rich in short wavelength blue and green light are most disruptive (Fritsches 2012; Pendoley 2005; Witherington & Bjorndal 1991a). Green, flatback and loggerhead turtles all show increased sensitivity to wavelengths <600 nm (Fritsches 2012; Pendoley 2005; Levenson et al. 2004) with green and flatback turtles show stronger preference for blue light <500 nm (Fritsches 2012; Pendoley 2005). Although longer wavelengths of light are less attractive than shorter wavelengths, long wavelength light can still disrupt sea-finding of hatchlings (Robertson et al. 2016; Pendoley 2005; Pendoley & Kamrowski 2015), and if bright enough can elicit a similar response to shorter wavelength light (Mrosovsky 1972; Mrosovsky & Shettleworth 1968; Pendoley & Kamrowski 2015; Cruz et al. 2018). Hence, the disruptive effect of light on hatchlings is also strongly correlated with intensity. Red light must be almost 600 times more intense than blue light before green turtle hatchlings show an equal preference for the two colours (Mrosovsky 1972).

Foraging, migrating, internesting, mating

Foraging adult carnivorous turtles have been observed feeding on prey presumed to be attracted by lights of oil production platforms in the Gulf of Mexico (Kebodeaux 1994). Since aggregation of prey species around the survey vessels are not expected, impacts to foraging marine turtles are not predicted. Marine turtles do not forage during the breeding season and light cues are not thought to guide migration, mating or internesting behaviours. Further, to date, there is no evidence to suggest internesting turtles are attracted to light from offshore vessels.

Nesting and hatchling emergence

Adult female marine turtles return to land, predominantly at night, to nest on sandy beaches, relying on visual cues to select, and orientate on, nesting beaches and return to the ocean post nesting. That artificial lighting on or near beaches has been shown to disrupt nesting behaviour is relatively well documented (see Witherington & Martin 2003 for review). Beaches with light spill, such as those located adjacent to urban developments, roadways, and piers, often have lower densities of nesting females compared to beaches with less development (Salmon 2003; Hu et al*.* 2018). In addition to potential impacts to nesting females prior to or during nesting, artificial light also has the potential to impact post-nesting behaviour. On completion of laying, nesting females are thought to use light cues to return to open ocean, orientating towards the brightest light (Witherington & Martin 2003). However, observations of nesting females and emerging hatchlings at the same beach showed that females were disorientated much less frequently than hatchlings (Witherington 1992) indicating that nesting females are less vulnerable to impacts of artificial light on sea-finding behaviour post nesting.

Hatchling turtles emerge from the nest, typically at night (Mrosovsky & Shettleworth 1968), and must rapidly reach the ocean to avoid predation (Salmon 2003). Hatchlings locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon, and away from elevated darkened silhouettes of dunes and/or vegetation behind the beach (Pendoley & Kamrowski 2015; Lohmann et al*.* 1997; Limpus & Kamrowski 2013).

Artificial lights interfere with natural light levels and silhouettes, which disrupts hatchling sea-finding behaviour (Withington & Martin 2003; Pendoley & Kamrowski 2015; Kamrowski et al*.* 2014). Hatchlings may become disorientated - where hatchlings crawl on circuitous paths; or become misorientated - where they move in the wrong direction, possibly attracted to artificial lights (Withington & Martin 2000; Lohmann et al*.* 1997; Salmon 2003). Hatchlings disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation, or exhaustion (Salmon & Witherington 1995).

Although the survey vessels are constantly moving, depending upon the orientation of sail lines in relation to nesting beaches, light sources may be visible for durations long enough to result in impacts to nesting females and emerging hatchlings.

Hatchling dispersal

Once in nearshore waters, artificial lights on land can also interfere with the dispersal of hatchlings. Presence of artificial light can slow down their in-water dispersal (Witherington & Bjorndal 1991b; Wilson et al*.* 2018) or increase their dispersion path, potentially depleting yolk reserves, or even attract hatchings back to shore (Truscott et al. 2017). In addition to interfering with swimming, artificial light can influence predation rates, with increased predation of hatchlings in areas with significant sky glow (Gyuris 1994; Pilcher et al*.* 2000). Since the nearshore area tends to be predator-rich, hatchling survival may depend on them exiting this area rapidly (Gyuris 1994). Should this be the case, aggregation of predatory fish occurring in artificially lit areas and under artificial structures (Wilson et al*.* 2019) may further increase predation of hatchlings.

An internal compass set while crawling down the beach, together with wave cues, are used to reliably guide hatchlings offshore (Lohmann & Lohmann 1992, Stapput & Wiltschko 2005; Wilson et al. submitted). In the absence of wave cues, however, swimming hatchlings have been shown to orientate towards light cues (Lorne & Salmon 2007, Harewood & Horrocks 2008) and in some cases, wave cues were overridden by light cues (Thums et al*.* 2013, 2016; Wilson et al*.* 2018).

The speed and direction of at-sea dispersal is substantially influenced by currents; the offshore trajectory of flatback hatchlings at Thevenard Island was displaced by tidal currents that ran parallel to the beach, an effect that increased as the hatchlings moved further offshore (Wilson et al. 2018, 2019). However, when light was present this effect was diminished, showing that hatchlings actively swam against currents and towards the light source (Wilson et al. 2018). Wilson et al. (2018) demonstrated that flatback hatchlings can move in any direction when their swimming speed is greater than the speed of the nearshore current, although the speed at which currents can no longer be overcome by hatchlings will be species specific and related to swimming speeds. Swimming towards offshore light increases energy expenditure in hatchlings, potential reducing individual fitness. Further, if hatchlings can overcome current speed, they may become entrapped in areas of light spill, potentially increasing risk of predation. Wilson et al. (2018) observed flatback hatchlings becoming entrapped in the light spill from a small survey vessel for up to one hour. Other reports of the duration of time in which hatchlings may be entrapped in direct light spill varies widely; while Thums et al. (2016) found that light trapping was temporary (minutes), anecdotal observations of hatchlings entrapped by light spill from a pipelay vessel off Barrow Island found hatchlings remained within the light spill in the lee of the barge all night until dawn (K. Pendoley, pers. obs., 2003).

Should lighting associated with survey vessels be at a sufficient intensity and spectral output, hatchlings may be attracted to the light source.

7.3.2.8 Marine Mammals

There is a paucity of research investigating the effects of artificial lighting on marine mammals and direct effects of artificial lighting on cetaceans have not been reported. Many dolphin species are thought to be diurnal, or at least more active during the day, possibly related to prey availability (Sekiguchi & Kohshima 2003). Since fish species may pool in areas of light spill, dolphins may be indirectly attracted to lit structures or illuminated marine environments for foraging purposes.

As herbivores, dugongs will be less likely affected by artificial lighting influencing food availability. In addition, dugongs feed both diurnally and nocturnally depending on the region (Ichikawa et al. 2006), with feeding generally constrained by tidal range (Anderson & Birtles 1978) rather than light availability. Research reporting direct effects of artificial lighting on dugongs is lacking.

Since mammals use variations in the length of day to anticipate environmental changes and time their reproduction, light pollution which affects day length perception could lead to changes in biological functions. However, since both marine mammals and survey vessels will be transient in the survey area, individuals are not expected to be exposed to artificial light for durations sufficient to impact biological functions or behaviour.

7.3.2.9 Credibility of impact pathway for light emissions

The credibility of an impact pathway between light emissions associated with survey vessels and the receptors identified above is summarised in Table 7-42. Those receptors that an impact pathway has been identified for are discussed further in the impact evaluation section.

Table 7-42: Credibility of impact pathway between survey vessel light source

Receptor	Life stage/ behaviour	Impact pathway
Zooplankton	All	No
Invertebrates	All	No
Fish	All	No
Seabirds - diurnal	All	No
Seabirds -nocturnal	Fledging, migrating, foraging	Yes
Migratory shorebirds	Breeding, roosting, foraging	No
	Migrating	Yes
Sea snakes	All	No
Marine turtles	Foraging, migrating, mating, internesting	No
	Nesting, hatchling emergence, hatchling dispersal	Yes
Marine mammals	All	No

7.3.3 Predicted Level of Impact

7.3.3.1 Marine Turtles

As outlined in Section 7.3.2.7, marine turtles may be vulnerable to impacts of artificial light from survey vessels during nesting, hatchling emergence and hatchling dispersal life stages.

While the behavioural response of marine turtles to light is relatively well understood (Section 7.3.2.7), there is currently no agreed intensity limits for determining what the impact of a given light might be. Studies suggest that hatchling turtles are the most vulnerable life stage to potential impacts from artificial light (e.g., Witherington 1992). A large range of factors influence the visibility and impact of light on hatchlings including light intensity, visibility (a function of lamp orientation and shielding), spectral power distribution (wavelength and colour), atmospheric scattering, cloud reflectance, spatial extent of sky glow, duration of exposure, horizon elevation, lunar phase, hatchling swimming speeds, tide and current speeds and flow direction.

Impacts to hatchling emergence from artificial light sky glow has been observed at 15 km and 18 km from nesting habitat (Kamrowski et al. 2014; Hodge et al. 2007), leading the National Light Pollution Guidelines (CoA 2020) to recommend an environmental impact assessment to be undertaken for project lighting within 20 km of important habitat. In the absence of specific details of the survey vessel light sources it is not possible to estimate distances from the source at which artificial light is visible, either directly or as sky glow. Combined with the lack of impact thresholds for light intensity for marine turtles of any life stage, it is conservatively assumed that artificial light from survey vessels may be received at nesting beaches at intensities that could result in behavioural impacts within 20 km of the source.

The Recovery Plan for Marine Turtles (CoA 2017) outlines habitat critical to the survival of a species (“habitat critical”) for marine turtle stocks. In addition, biologically important areas (BIAs) occur in areas where marine turtles display biologically important behaviour, such as breeding, foraging, resting and migration. At the time of writing, all marine turtle BIAs were inclusive of areas identified as habitat critical.

One key difference between BIAs and habitat critical is the size of the internesting buffer around flatback nesting beaches; BIAs include an 80 km buffer whereas habitat critical is 60 km. For all other species, the internesting buffer is 20 km for both habitat critical and BIAs. Since impacts to internesting females is not considered credible (Table 7-42), the size of the internesting buffer has no relevance when assessing impacts to marine turtles from light emissions. Accordingly, for the purpose of assessing impacts of light emissions of marine turtles, all areas within 20 km of nesting beaches identified as habitat critical are considered “sensitive habitat” for all marine turtle species.

Details of sensitive habitat within 20 km of the CSEP OA are detailed in Table 7-43. Figure 7-58 presents the areas of overlap between the CSEP OA and sensitive habitat. Note that the 60 km internesting buffer for flatback turtles is also presented and may overlap the CSEP OA, however, only the area within 20 km of the beach is considered sensitive habitat, as described above.

The consequence rating for impacts to marine turtles is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years.

Table 7-43: Sensitive habitat occurring within 20 km of the CSEP Operational Area

Sensitive habitat	Distance to CSEP OA at closest point	Species present (genetic stock)	Peak nesting*	Peak hatchling*
Exmouth Gulf and Ningaloo Coast	5 km Muiron Islands	Loggerhead (L-WA)	Nov–Mar (peak Jan)	Jan–May
		Green (G-NWS)	Nov–Mar (Peak: Dec–Feb)	Jan–May (Peak: Feb–Mar)
Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island.	5 km Montebello Islands	Flatback (F-Pil)	Oct–Mar (Peak: Nov–Jan)	Feb–Mar
		Green (G-NWS)	Nov–Mar (Peak: Dec–Feb)	Jan–May (Peak: Feb–Mar)
		Hawksbill (H-WA)	All year (Peak: Oct–Jan)	All year (Peak: Dec–Feb)
Dampier Archipelago	11 km Rosemary and Legendre Islands	Flatback (F-Pil)	Oct–Mar (Peak: Nov–Jan)	Feb–Mar
		Green (G-NWS)	Nov–Mar (Peak: Dec–Feb)	Jan–May (Peak: Feb–Mar)
		Hawksbill (H-WA)	All year (Peak: Oct–Jan)	All year (Peak: Dec–Feb)
Scott Reef	13 km Sandy Islet	Green (G-ScBr)	Nov–Mar (Peak Jan–Feb)	Mar–Apr
Browse Island	5 km			

Sensitive habitat	Distance to CSEP OA at closest point	Species present (genetic stock)	Peak nesting*	Peak hatchling*
Cape Domett and Lacrosse Island in the Cambridge Gulf.	11 km	Flatback (F-CD)	All year (Peak: Aug–Sept)	All year
Key (genetic stocks):				
Loggerhead – Western Australia: Green – Northwest Shelf: Green – Scott Reef-Browse Island:	L-WA G-NWS G-ScBr	Flatback – Pilbara: Flatback – Cape Domett: Hawksbill – Western Australia:	F-Pil F-CD H-WA	

*Source: Commonwealth of Australia (2017)

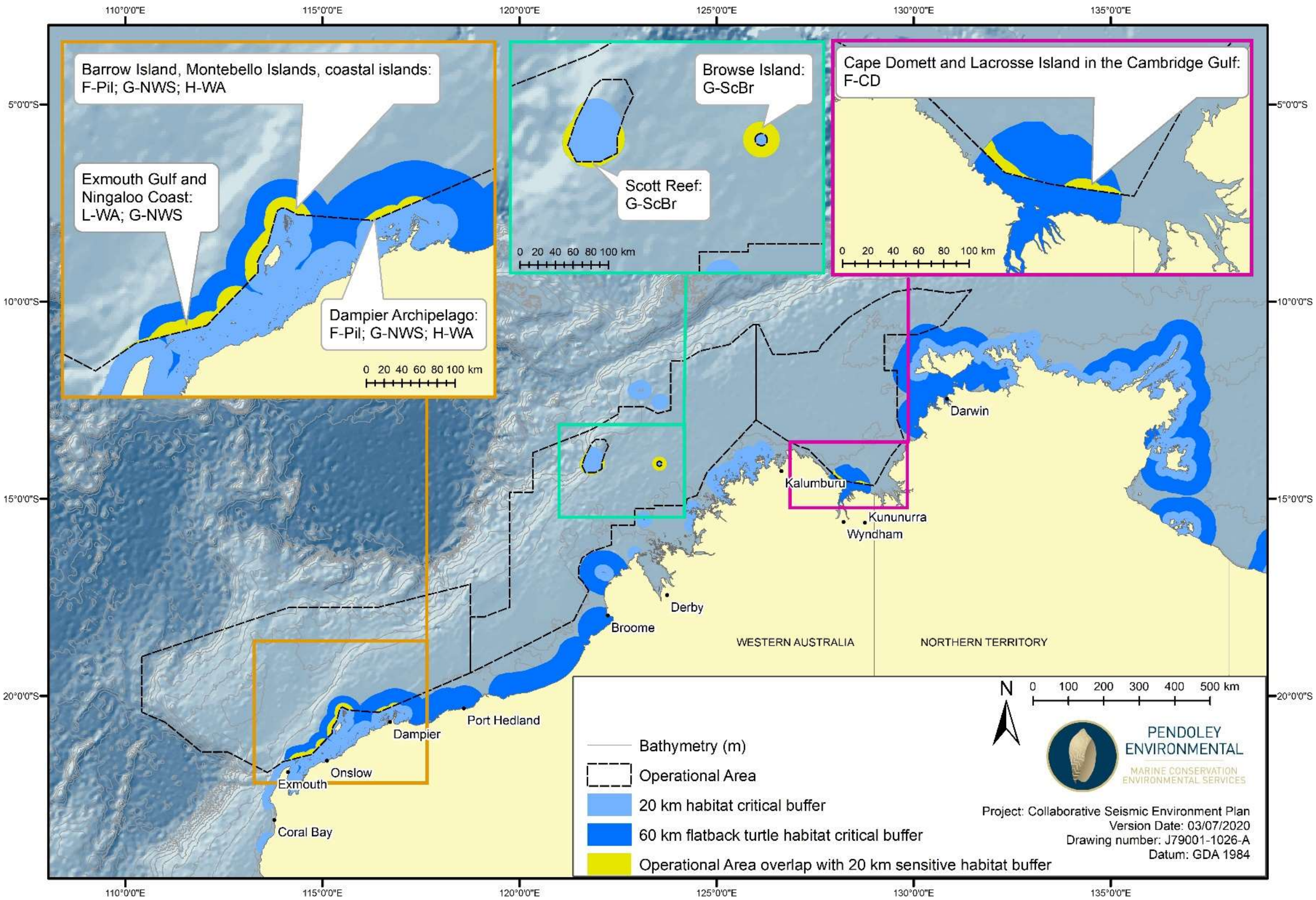


Figure 7-58: Sensitive marine turtle habitat in the vicinity of the CSEP Operational Area

7.3.3.2 Seabirds and Migratory Shorebirds

Nocturnal seabirds

As for marine turtles, light intensity impact thresholds, at which impacts to seabirds may occur, are not defined. The vulnerability of individuals is also related to behaviour of individuals, and abiotic factors including visibility and wind speed. A 20 km buffer around important habitat is suggested in the National Light Pollution Guidelines (CoA 2020) based on the observed grounding of short-tailed shearwaters in response to a light source associated with an onshore desalination plant at least 15 km away from the nearest colony (Rodriguez et al. 2014).

Nocturnal seabirds occurring in the CSEP OA include those belonging to the order procellariform. Of these, one species, the wedge-tailed shearwater, is known to breed in large numbers in proximity of, and forage within, the CSEP OA. Breeding colonies occurring within 20 km of the CSEP OA are shown in Figure 7-59 and include:

- Muiron Islands
- Serrurier Island
- Boodie and Double Islands (Barrow Island)
- Lowendal Islands
- Montebello Islands
- Islands of the coastal island chain
- Islands of the Dampier Archipelago, including Cohen Island, Collier Rocks, Conzinc Island, Delambre Island, Elphick Nob, Goodwyn Island, Hauy Island, Kendrew Island, Lady Nora Island, Legendre Island, Malus Island, Roly Rocks (CALM, 1990).

Foraging BIAs for wedge-tailed shearwaters occur within 100 km around these breeding colonies. In addition, foraging BIAs associated with Ashmore Reef and two offshore islands east of Point Sampson also overlap the CSEP OA.

Wedge-tailed shearwaters are highly synchronous in timing of breeding; all eggs within a colony are laid within a ten-day period. They lay their single egg during early November, which is then incubated until the chick hatches (after 53 days) in early January. Once hatched, adults leave the burrows to forage locally during the day returning at night to feed chicks until they are ready to fledge in mid-April (Nicholson 2002). Adults may not return to feed chicks each night; in Australia, wedge-tailed shearwater foraging trips have been recorded at 1 – 3 days (Peck, 2006). Dual foraging strategies, whereby parents alternate or mix short and long trips, have been recorded in several shearwater species (sooty shearwaters (Weimerskirch & Cheryl, 1998), little shearwaters (Booth *et al.,* 2000), Cory's shearwaters (Granadeiro *et al.,* 1998; Magalhães *et al.,* 2008), streaked shearwaters (Ochi *et al.,* 2010), Manx shearwaters (Shoji et al 2015)). It is possible that wedge-tailed shearwaters breeding on the NWS also exhibit the same foraging strategy.

Depending upon the intensity of light emissions, wedge-tailed shearwaters may be attracted to light source resulting in disorientation and the risk of collision resulting in injury or death. Fledgling wedge-tailed shearwaters undertaking their first flight from the colony are most vulnerable to impacts from artificial light associated with the survey vessels due to the naivety, the immature development of ganglions in the eye at fledging and the potential connection between light and food (Montevecci 2006; Mitkus et al 2011). Foraging adults may also be attracted to artificial light but to a lesser extent compared to fledglings. Peak fledgling occurs in April and foraging within the BIAs during colony attendance between September and April, inclusive (Nicholson 2002) (Table 7-44).

The consequence rating for impacts to nocturnal seabirds is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years.

Migratory shorebirds

The CSEP OA is within the East Asian-Australasian Flyway (EAAF); a spatially large area that is poorly defined (Figure 7-59). Several migratory shorebird species may migrate through the CSEP OA from overwinter grounds in Australia to breeding sites in the norther hemisphere. Internationally important sites for shorebirds within the vicinity of the CSEP OA (as defined in Bamford et al (2008)) are shown in Figure 7-59. Those within 20 km of the CSEP OA are:

- Ashmore Reef
- Barrow Island

Although migration routes are poorly defined, and formal designation of migration pathways (e.g., such as a BIA) are absent, the proximity of important sites to the CSEP OA increases the likelihood of migratory shorebirds passing through the CSEP OA. During migration shorebirds may be attracted to artificial light associated with the survey vessels. This may result in deviations to the migration pathway, increasing energy expenditure with impacts to body condition. This may reduce survival rate or, in the case of the northern migration, impact breeding success once they have arrived at breeding grounds. In the worst-case scenario, disoriented individuals may collide with survey vessel resulting in injury or mortality.

The consequence rating for impacts to migratory seabirds is assessed as Minor (2) based on impacts are predicted to be localised, short term effects with recovery in the timescale of months to <5 years.

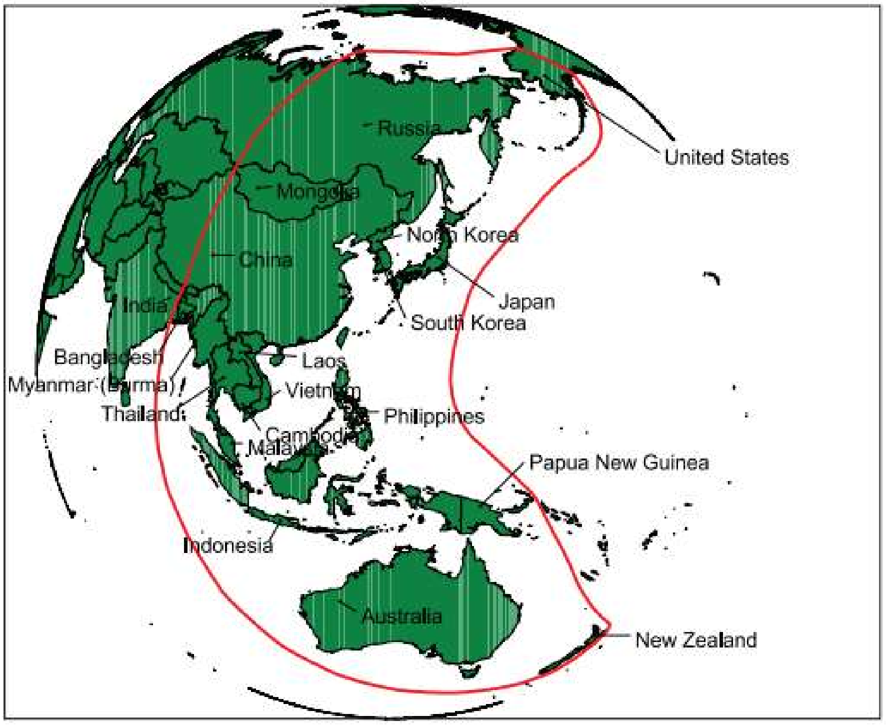


Figure 7-59: East Asian-Australasian Flyway (Source: Bamford *et al.,* 2008)

Seabird and migratory shorebird sensitive habitat

For seabirds and migratory shorebirds, "sensitive habitat" in relation to light emissions is defined as:

- areas within 20 km of wedge-tailed shearwater breeding colonies.
- wedge-tailed shearwater foraging BIAs.
- areas within 20 km of internationally important sites for shorebirds.

Periods of peak activity within these sensitive habitats is summarised in Table 7-44.

Table 7-44: Timing of identified seabird and shorebird sensitive periods

Receptor	J	F	M	A	M	J	J	A	S	O	N	D
Fledging wedge-tailed shearwaters												
Foraging wedge-tailed shearwaters												
Shorebird northern migration												
Shorebird southern migration												

7.3.3.3 Cumulative impacts

Cumulative light emissions are unlikely to occur from seismic surveys vessels operating under the CSEP and from other marine users within the CSEP OA based on:

- Though 20 km has been used to assess impacts this has been based on fixed light sources (CoA 2020) not vessels which are likely to have a much smaller light spill area that is unlikely to overlap with other vessels light spill area.
- Vessels are continuously moving and do not remain in the same area for an extended periods of time reducing the likelihood of vessel light spill impacting the same receptor.
- Controls identified for CSEP vessels ensure that impacts to sensitive receptors undertaking biologically important behaviours are unlikely and thus cumulative impacts are not predicted.

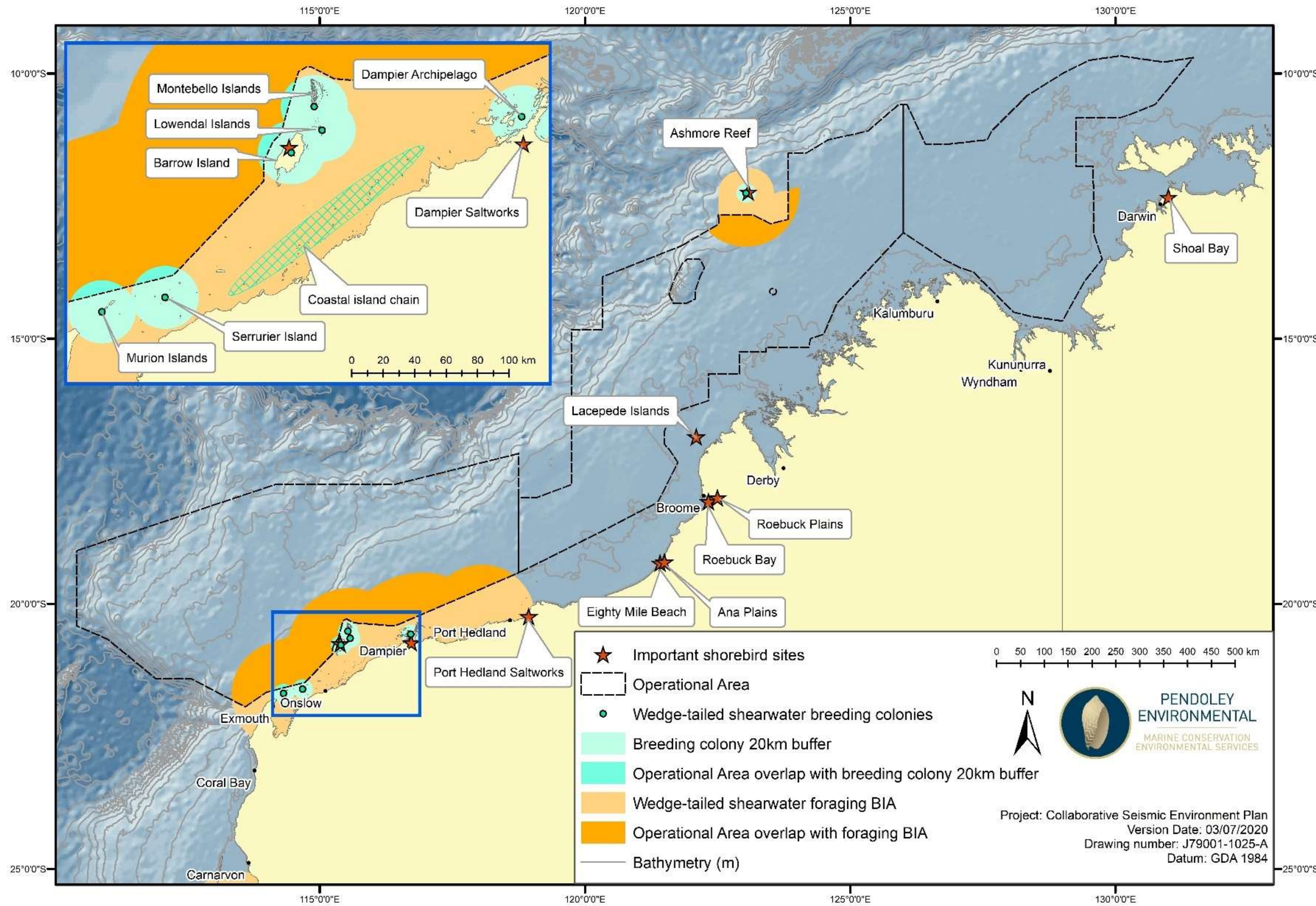


Figure 7-60: Identified sensitive habitat for seabirds and migratory shorebirds in the vicinity of the CSEP Operational Area

7.3.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-45: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is a low level of scientific uncertainty thus the precautionary principle is not required.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Management of the activity is consistent with legislation and other requirements as detailed in: CM#22: National Light Pollution Guidelines – Best Practice Lighting Management. CM#23 National Light Pollution Guidelines – Activity specific Lighting Management Plan. For marine turtles, the relevant plan is the Recovery Plan for Marine Turtles (CoA 2017a) which details for light pollution: • artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats. Based on the impact assessment undertaken and the requirement for an activity specific Light Management Plan for surveys in areas where sensitive receptors may be exposed to light emissions displacement of marine turtles from habitat critical to the survival of marine turtles is not predicted. The Wildlife Conservation Plan for Migratory Shorebirds (CoA 215) identifies artificial lighting as a threat and details:	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		• ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes. It refers to the EPBC Act Policy Statement 3.21 Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species (CoA 2017) that details that under the EPBC Act, approval is required for any action that has, will have, or is likely to have, a significant impact on a matter of national environmental significance, which includes migratory species. An 'action' is broadly defined as a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. Thresholds of significance impacts on migratory shorebirds relevant to light are: • increased disturbance leading to a substantial reduction in migratory shorebird numbers. The guidelines details that defining substantial reduction is made on a case-by-case basis. Factors to consider include: • the number of migratory shorebirds historically using an area (based on surveys and historical data) • likely resultant changes in bird numbers and species diversity • alterations to the value, quality, geographic extent of the area (for example, will the area still be classed as important habitat) • the function and role of the area (roosting, foraging) and likely changes in ecology and hydrology • the regional and local context of the area • the nature, extent, duration and timing of impacts, their likelihood and consequence. Based on the impact assessment undertaken and the requirement for an activity specific Light Management Plan for surveys that overlap shorebird migratory areas and periods of August to November and March to May a substantial reduction in migratory shorebird numbers is not predicted.	

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		There are no conservation advice, recovery plans and threat abatement plans for the wedge-tail shearwater and light is not recognised as a threat as per the species SPRAT profile (DAWE 2020a). The draft Wildlife Conservation Plan for Seabirds (CoA 2019) identifies the following recommended management actions relevant to light: • quantify impacts of fisheries interactions and human disturbance The draft Wildlife Conservation Plan for Seabirds (CoA 2019) identifies light pollution as a threat to seabirds but does not identify any actions specific to seabird species likely to be present in the CSEP OA. It does identify the action of implement measures to reduce the impact of light pollution near breeding colonies for those species not identified within the CSEP OA. This action has been implemented by the implementation of an activity specific Light Management Plan for surveys near seabird breeding colonies.	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the CSEP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	There have been no stakeholder objections or claims regarding light emissions.	Yes

7.3.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-46 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-46: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#22: National Light Pollution Guidelines – Best Practice Lighting Management	Best practice lighting management will reduce light emissions and ensure lighting is managed in line with relevant guidance outlined in the National Light Pollution Guidelines (CoA 2020). For all survey vessels, the following will be implemented where it does not contravene vessel lighting requirement for safe navigation: • Non-essential lights switched off when not in use. • Window blinds closed at night. • Shield lights and contain light spill on the deck unless required for safe operations. • Use of suitable light types recommended in the National Light Pollution Guidelines.	Yes
CM#23: National Light Pollution Guidelines – Activity specific Lighting Management Plan	In areas where sensitive receptors may be exposed to light emissions, a survey specific Lighting Management Plan will identify and implement additional controls in line with relevant guidance outlined in the National Light Pollution Guidelines (CoA 2020). A survey specific Lighting Management Plan will be developed and implemented for surveys which: • Occur within 20 km of nesting habitat critical to the survival of marine turtle species during peak nesting and hatchling emergence as defined in the Recovery Plan for Marine Turtles (CoA 2017a). • Occur within 20 km of a wedge-tailed shearwater breeding colony, as detailed in Figure 7-60, during April. • Overlap a wedge-tailed shearwater foraging BIA, , as detailed in Figure 7-60, between September and April. • Occur within 20 km of internationally important sites for shorebirds, as detailed in Figure 7-60, during the migratory periods of August to November and March to May.	Yes
Survey timing	Avoiding periods when sensitive receptors may be present would have a disproportionate cost without a significant environmental benefit. Avoiding periods when sensitive receptors may be present can result in a survey being undertaken in multiple phases over a longer duration. This increase in time results in increased environmental impacts (acoustic, air and marine emissions, and displacement of marine users) and risks (introduction of marine pests and vessel collision) and an increase in costs without a significant reduction in the potential consequence level as CM#23 requires an activity specific Lighting Management Plan to be in place if there is an overlap with sensitive receptor timing to ensure impacts are managed to an acceptable level. The activity specific Lighting Management Plan will assess if avoidance of periods when sensitive	No

Control Measure	Justification	Adopted
	receptors may be present is required to ensure impacts are managed to ALARP and an acceptable level.	
Surveys only undertaken during daylight hours	Undertaking surveys only in daylight hours would have a disproportionate cost without a significant environmental benefit. Undertaking surveys only in daylight hours would at best double the time taken to compete a seismic survey. This increase in time results in increased environmental impacts (acoustic, air and marine emissions, and displacement of marine users) and risks (introduction of marine pests and vessel collision) and a doubling in costs without a significant reduction in the potential consequence level as the vessels would still be required to have lighting to meet navigational and safety requirements.	No

7.4 Impact: Marine Discharges

7.4.1 Source of Impact

The survey vessels will generate marine discharges consisting of cooling water, brine, bilge water, deck drainage, food (also known as putrescible) waste, sewage, and grey water.

7.4.2 Impact Pathway

Planned marine discharges can result in changes in water quality such as increased temperature, salinity, nutrients, chemicals, and hydrocarbons which can lead to toxic effects to marine fauna.

Food waste discharges can result in changes in fauna behaviour if fauna habituate to this food source.

Discharges will occur when the vessels are moving, resulting in discharges dispersing rapidly in the open ocean. The extent of impacts is predicted to be localised to surface waters and in the immediate vicinity of the discharge location. Thus, sediments and benthic communities are not predicted to be impacted.

7.4.3 Predicted Level of Impact

Marine discharge impacts have been predicted based on the seismic vessel which could have up to 70 persons on board compared to the support vessels which would have between 5 and 15 persons on board. Marine discharge volumes and impact evaluation is provided in Table 7-47 and in summary:

- Nutrients levels may be intermittently elevated up to 500 m from the vessels when sewage, greywater and food waste discharged.
- Water temperature may be elevated up to 100 m from the vessels from the constant discharge of cooling water.
- Hydrocarbon levels may be intermittently elevated up to 100 m from the vessels when bilge waster or deck drainage is discharged.
- Salinity levels may be intermittently elevated up to 100 m from the vessels when brine is discharged.

Marine discharges will be small and, except for cooling water, intermittent. As the vessels will be moving the discharges are predicted to be dispersed and diluted rapidly, with concentrations of any contaminants dropping significantly within a short distance from the discharge point. This may result in a temporary (minutes to hours) localised reduction in water quality.

As impacts to water quality are predicted to be transient and temporary, impacts to other receptors such as fauna, marine parks and KEFs are not predicted.

Food waste discharges will be small and intermittent. As the vessels will be moving and the discharge is sporadic fauna habituating to this food source is not predicted.

The consequence rating for impacts to water quality is assessed as Slight (1) based on impacts are predicted to be localised and temporary effects.

7.4.3.1 Cumulative impacts

Cumulative impacts may occur if the discharge area of the survey vessels overlap. This will only occur when a support vessel is within 500 m of the seismic vessel for resupply which occurs for a short period of time. The small additional volumes that the support vessel will discharge, and intermittent nature of the discharges would be unlikely to increase the impact extent beyond 500 m or increase the level of impact to water quality while resupply is occurring.

As impacts are predicted to be temporary and within 500 m of a vessel cumulative impacts with other vessels are not predicted.

Table 7-47: Marine discharges volumes and impact evaluation

Discharge type	Predicted volume	Impact parameter	Predicted extent of impact	Extent	Impact duration
Food waste	280 kg/day (1-2 kg pp/day. NERA 2017)	Nutrient levels	A review of sewage, food wastes and grey water discharges to determine the extent of potential impact for the NERA (2017) Environment Plan Reference Case for Planned Discharge of Sewage, Putrescible Waste and Grey Water determined that sewage and greywater discharge volume up to 150 m^3/day is expected to remain within the nominal mixing zone boundary of 500 m around fixed facilities. As sewage, food wastes and grey water discharges will be from moving vessels they are likely to decrease to background levels in a shorter distance.	500 m	Intermittent discharge for period of survey
Sewage and grey water	31.5 m^3/day (0.45 m^3 pp/day. NERA 2017))				
Cooling water	Continuous	Temperature	Cooling water is used on vessels to cool engines. Seawater is extracted through intakes and circulated through heat exchanges and then discharged back to the sea. Modelling of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program predicted that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being < than 1°C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Woodside 2014). The Torosa South-1 well was in ~ 44 m water depth within a coral reef and hence cooling water discharges from a moving vessel are likely to decrease in temperature in a shorter distance.	100 m	Constant discharge for period of survey

Discharge type	Predicted volume	Impact parameter	Predicted extent of impact	Extent	Impact duration
Bilge water Deck drainage	Intermittent discharge treated to 15 ppm	Hydrocarbons	Treated bilge discharge is infrequent, being driven by the holding capacity of the bilge space onboard the vessel. Deck drainage occurs from rain, waves and washing down of equipment. In the absence of published literature on the potential extent of impact from vessel bilge and deck drainage discharges, treated bilge and drainage discharge plumes modelled for Prelude FLNG is used as a conservative estimate for this assessment. Modelling by Shell (2009) indicates that hydrocarbon and other chemical concentrations are rapidly diluted and expected to be below predicted no effect concentration within less than 100 m of the discharge.	100 m	Intermittent discharge for period of survey
Brine	Intermittent discharge typically 10% higher salinity than the seawater	Salinity	Brine is a by-product of freshwater generation using reverse osmosis or desalinisation onboard the vessels. Brine discharges are typically 10% higher in salinity than the intake seawater depending on the process used. Once discharged to the marine environment, the desalination brine, being of greater density than seawater, will sink and disperse in the currents. On average, seawater has a salt concentration of 35 ppt. The volume of the discharge is dependent on the requirement for fresh (or potable) water and the number of people on board the vessel. Most marine species can tolerate short-term fluctuations in salinity in the order of 20–30% (Walker and McComb 1990), and it is expected that most pelagic species would be able to tolerate short-term exposure to the slight increase in salinity caused by the discharged brine.	100 m	Intermittent discharge for period of survey

7.4.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-48: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Slight.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is a low level of scientific uncertainty thus the precautionary principle is not required.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Management of the activity is consistent with legislation and other requirements as detailed in: CM#24: Marine Order 96: Marine pollution prevention - sewage. CM#25: Marine Order 95: Marine pollution prevention – garbage. The North Marine Parks Network Management Plan 2018 and North-west Marine Parks Network Management Plan 2018 detail that under these plans waste from normal operations of vessels must be compliant with MARPOL requirements for all zones except for Sanctuary Zones where disposal is not allowed. The CSEP OA is not within a Sanctuary Zone. Within the CSEP OA vessels will implement the requirements of Marine Order 96 and Marine Order 95 which give effect under Australian law to MARPOL.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the CSEP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	There have been no stakeholder objections or claims regarding marine discharges.	Yes

7.4.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-49 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-49: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#24: Marine Order 96: Marine pollution prevention - sewage	Vessel will implement the following as per Marine Order 96: Marine pollution prevention – sewage: • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when ≥ 3 nm from land and when the vessel is moving at ≥ 4 knots; or • Sewage that has not been comminuted/ disinfected via an IMO-approved system will only be discharged when ≥ 12 nm from land and when the vessel is moving at ≥ 4 knots. Marine Order 96 gives effect under Australian law to MARPOL Annex IV: Regulations for the prevention of pollution by sewage from ship.	Yes
CM#25: Marine Order 95: Marine pollution prevention - garbage	Vessel will implement the following as per Marine Order 95: Marine pollution prevention – garbage: • Food waste comminuted or ground to particle size less than 25 mm is permitted to be discharged while the vessel is moving and ≥3 nm from the nearest land; or • Food waste not comminuted, or ground is permitted to be discharged while the vessel is moving and ≥12 nm from the nearest land. • Oil and all oily mixtures retain onboard for on shore disposal; or • Vessels have in operation equipment of a design approved by the administration that ensures oil content less than 15 parts per million and discharge permitted when proceeding en route. Marine Order 95 gives effect under Australian law to MARPOL Annex V: Regulations for the prevention of pollution by garbage from ships.	Yes
CM#19: Preventative Maintenance System	Vessel equipment to treat marine discharges such as cooling water, brine, bilge water, deck drainage, food waste, sewage and grey water are maintained as per manufacturer's instructions to ensure efficient operation.	Yes

7.5 Impact: Displacement of Commercial Fisheries and Damage to Fishing Gear

7.5.1 Source of Impact

The limited manoeuvrability of the seismic survey vessel while towing the source array and streamers means that commercial fishing vessels may be asked to take measures to avoid the immediate vicinity of the seismic survey vessel and associated equipment. In addition, commercial fishing vessels may be asked to remove fishing gear such as traps and lines to avoid interaction with the seismic survey vessel and in-water equipment.

7.5.2 Impact Pathway

Potential impacts to commercial fisheries caused by a seismic vessel conducting a seismic survey under the CSEP range from operational inconveniences (e.g., manoeuvring around the seismic vessel and requested area of avoidance) to temporary loss of access to fishing areas (i.e., displacement). Displacement could result in reduced catches and income and/or increased costs to operate elsewhere (i.e., relocation costs).

The CSEP OAs overlaps with waters that have historically been fished by Commonwealth, WA and NT commercial fisheries as detailed in Section 5.

The potential for interaction is limited to the area near where the seismic survey vessel is operating. Commercial fishing vessels are requested to provide a wide berth of seismic surveys, in the order of 3 nm (5.6 km) around the seismic survey vessel and towed streamers. As the seismic survey vessel acquires seismic data along the sail lines in the racetrack formation described in Section 4.5 fishing vessels can potentially continue to access waters to fish in other areas of the Survey OA. However, it is acknowledged that anticipating the seismic survey vessel's movements to trawl nets, troll lines or deploy traps or long lines in the immediate vicinity of the survey activities could be challenging and, therefore, there is the potential for displacement or reduced fishing effort and catch levels to occur.

Commercial fishing vessels may be asked to remove fishing gear such as traps and lines to avoid interaction with the seismic survey vessel and in-water equipment, where this does not occur damage to fishing gear may occur if the seismic vessel cannot manoeuvre out of the way of the equipment.

Under Section 172 of the WA Fish Resources Management Act and Section 7 of the NT Fisheries Regulations it is an offence to remove fish from any fishing gear or interfere with any fishing gear.

7.5.3 Predicted Level of Impact

The consequence rating for displacement of commercial fishers is assessed as Moderate (3) based on impacts are predicted to be a moderate effect on economic values:

- The exclusion zone around the survey vessel where displacement would occur, is only required during deployment of the streamers and acquisition due to the limited manoeuvrability of the survey vessel.

- Displacement will not occur within the full Survey OA but from parts of the Survey OA until acquisition in an area is complete which, depending on the acquisition lines, may be several days rather than the whole survey period.
- Displacement could result in reduced catches and income if a commercial fisher is required to move to another area to fish, as fish stocks distribution is not evenly spread over the boundary of a fishery.
- Displacement of fishing activities can be reduced by coordinating each party's activities so as not to restrict either party.

The consequence rating for damage to fishing gear is Minor (2) based on impacts are predicted to be a minor effect on economic values with a probability of unlikely giving a risk rating of Medium (3):

- Damage to fishing gear can be avoided by coordinating each party's activities so as not to restrict either party.
- A support vessel will be used to scout ahead of the survey vessel to identify if fishing gear is in the water.

7.5.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-50: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below. Risk level is Medium or below.	Impact consequence for displacement is assessed as Moderate. Risk rating for damage to fishing gear is assessed as Medium.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is no scientific uncertainty associated with this impact.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Section 280 of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) requires that the activity must be carried out in a manner that does not interfere with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of the titleholder. Extensive consultation has been undertaken with commercial fisheries within the CSEP OA to ensure interference to commercial fishers can be managed to an acceptable level.	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		The development of the Operational Protocol (Control Measure #2) and Adjustment Protocol (Control Measure #5) with the commercial fishing industry is best practice. The WA Fish Resources Management Act details that it is an offence to remove fish from any fishing or interfere with any fishing gear. The Operational Protocol (Control Measure #2) detail the requirements for ensuring commercial fishers are notified of when and where a survey is being undertaken and the process for on water communication to ensure fishing gear is removed from a survey area.	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the requirements within the Operational Protocol (CM#2) and Adjustment Protocol (CM#5) developed with the commercial fishing industry and the controls identified within this section of the EP.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Commercial fishers have raised concerns in relation to loss of catch and additional cost when they are displaced from a fishing area because of a seismic survey or there is damage to fishing gear from a seismic survey. This resulted in the development of the Operational Protocol which details notification and engagement requirements and spatial and temporal controls to avoid displacement and gear damage costs to fishers (CM#2). In addition, an Adjustment Protocol was developed to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage where these impacts cannot be avoided (CM#5).	Yes

7.5.5 *Identification of Controls and Demonstration of ALARP*

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-51 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-51: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#2: Operational Protocol	The Operational Protocol has been developed in consultation with the commercial fishing industry. The protocol has the following requirements to ensure commercial fishers know when and where surveys will occur, provide input into survey planning and on-water communications to minimise displacements impacts and likelihood of gear damage. • Online portal for CSEP updates and seismic survey schedules. • Annual roundtable forum for CSEP consortium members and commercial fishers for information sharing. • Wherever possible and operationally feasible, and taking into consideration other critical timing factors, Petroleum Titleholders will work with commercial fishers to avoid seismic survey activities during the most active fishing periods of any directly affected managed fishery. • 3 month “Notification of Intent” to conduct a seismic survey. • Potentially affected commercial fishers will also be advised: • As soon as any changes to planned survey details or commencement timing become apparent, and • Survey commencement date estimate not less than 10 days prior to mobilisation. • Regular on-water vessel communications including daily updates. The protocol has the following spatial and temporal controls to limit the size, location and frequency of seismic surveys conducted under the CSEP to minimise displacements impacts. • The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP will not exceed 40,000 km^2 in any calendar year. • The Acquisition Area of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP will not exceed 10,000 km^2. • Seismic surveys conducted under the CSEP will not overlap the Regularly Fished Fishing Grounds of any individual managed fishery by more than 33% of the Regulated Fishing Season for each calendar year, throughout the 5-year duration of the CSEP validity. Except for the Pilbara Trap and Pilbara Fish Trawl Managed Fisheries whereby seismic surveys conducted under the CSEP will not overlap these smaller area fisheries by more than 25% of the Regulated Fishing Season per calendar year throughout the 5-year duration of the CSEP validity.	Yes

Control Measure	Justification	Adopted
	• The Active Source Area of any 3D or 4D seismic surveys conducted under the CSEP will not overlap other previously acquired 3D seismic survey Active Source Areas within the same Regulated Fishing Season of any surveys conducted under the CSEP. • Total combined 2D seismic surveys conducted under the CSEP will not exceed 50,000 survey line km per calendar year. • Any 2D survey lines that overlap, or partially overlap, a 3D Active Source Area that has been surveyed within the previous 12 months will be acquired at a grid line spacing of not less than 10 km. This control measure will reduce potential cumulative impacts and minimise 2D survey vessel presence in a previously 3D surveyed area.	
CM#5: Adjustment Protocol	The Adjustment Protocol has been developed in consultation with the commercial fishing industry. The CSEP titleholders commit to minimising potential impacts on commercial fishing and the fish stocks that support the industry primarily through avoidance of fishing activities. However, the titleholders recognise that their activities may, from time-to-time, take place in the same area and at the same time as commercial fishing. The purpose of the adjustment protocol is to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage.	Yes
CM#26: Support Vessel	At least one support vessel will accompany the seismic survey vessel when in operation to manage interactions with other marine users and look ahead for fisher gear.	Yes
CM#36: AIS Transponders	Vessels and streamer tail buoy will have functioning Automated Identification System (AIS). AIS transponders transmit key information to all vessels able to receive AIS data and will include details such as vessel GPS position, identity, type, speed, course and caution notes. The AIS system will also receive AIS information from other vessels in the area.	Yes
CM#28: Navigation Act and Marine Orders	Seismic survey vessel will adhere to the requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21 Safety and Emergency Arrangements, 30 Prevention of Collisions and 31 SOLAS and non-SOLAS certification including: • Appropriate lighting, navigation and communication to inform other users. • Use of radar and 24/7 watch.	Yes

7.6 Impact: Displacement of Other Marine Users

7.6.1 Source of Impact

The limited manoeuvrability of the seismic survey vessel while towing the source array and streamers means that other marine users may be asked to take measures to avoid the immediate vicinity of the seismic survey vessel and associated equipment.

7.6.2 Impact Pathway

Potential impacts to other marine users caused by a seismic vessel conducting a seismic survey under the CSEP are manoeuvring around the seismic vessel and requested area of avoidance.

The CSEP OA overlaps with waters that are used by other marine users such as shipping, defence, tour operators and recreational vessels as detailed in Section 5.

The potential for interaction is limited to the area near where the seismic survey vessel is operating. Other marine users are requested to provide a wide berth of seismic surveys, in the order of 3 nm (5.6 km) around the seismic survey vessel and towed streamers. As the seismic survey vessel acquires seismic data along the sail lines in the racetrack formation described in Section 4.5 other marine users can potentially continue to access waters to undertake their activities in other areas of the Survey OA.

7.6.3 Predicted Level of Impact

The consequence rating for displacement of other marine users is assessed as Slight (1) based on impacts are predicted to be a slight to negligible effect on aesthetic, economic or recreational values:

- The exclusion zone around the survey vessel where displacement would occur, is only required during deployment of the streamers and acquisition due to the limited manoeuvrability of the survey vessel.
- Displacement will not occur within the full Survey OA but from parts of the Survey OA until acquisition in an area is complete which, depending on the acquisition lines, may be several days rather than the whole survey period.
- Displacement of other marine users can be avoided by coordinating each party's activities so as not to restrict either party.

7.6.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-52: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Impact consequence is assessed as Slight.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is no scientific uncertainty associated with this impact.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Section 280 of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) requires that the activity must be carried out in a manner that does not interfere with other marine users to a greater extent than is necessary for the reasonable exercise of the rights and performance of the titleholder. Extensive consultation has been undertaken with other marine users within the CSEP OA to ensure interference to commercial fishers can be managed to an acceptable level.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the EP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Several marine users raised concerns in relation to displacement from Survey OAs within the broader CSEP OA and requested to be notified of upcoming surveys as per CM#29.	Yes

7.6.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-53 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-53: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted

CM#29: Marine Users Survey Notifications	The following will be implemented to inform and notify marine users of seismic survey to be conducted under the CSEP:
	• Online portal for CSEP updates and seismic survey schedules.
	• 3 month "Notification of Intent" to conduct a seismic survey.
	• Potentially affected marine users will also be advised:
	  ○ As soon as any changes to planned survey details or commencement timing become apparent, and
	  ○ Survey commencement date estimate not less than 10 days prior to mobilisation.
	• Ongoing consultation and survey notifications as per Section 6.4 Summary of Stakeholder Consultation
	• Appendix G provides a summary of the stakeholder consultation undertaken as part of the development of the CSEP. The summary provides details of the information sent to stakeholders and any response received. It also details the assessment undertaken of any objection or claims. Where an objection or claim was substantiated via evidence such as publicly available credible information and/or scientific or fishing data, it was assessed as per the impact and risk evaluation process detail in Section 2 and controls applied where appropriate to ensure impacts and risks are managed to ALARP and an acceptable level.
	Where an objection or claim was raised by a stakeholder, they were provided feedback as to:
	• whether the objection or claim was substantiated.
	• how the objection or claim was evaluated.
	• if additional controls were required to manage the impact or risk to ALARP and an acceptable level.
	• if the objection or claim was not substantiated and the reasons why.
	• Ongoing Stakeholder Consultation and Notifications.
	• Regular on-water vessel communications including daily updates.
		Yes

Control Measure	Justification	Adopted
CM#26: Support Vessel	At least one support vessel will accompany the seismic survey vessel when in operation to manage interactions with other marine users and look ahead for fisher gear.	Yes
CM#36: AIS Transponders	Vessels and streamer tail buoy will have functioning Automated Identification System (AIS). AIS transponders transmit key information to all vessels able to receive AIS data and will include details such as vessel GPS position, identity, type, speed, course and caution notes. The AIS system will also receive AIS information from other vessels in the area.	Yes
CM#28 Navigation Act and Marine Orders	Seismic survey vessel will adhere to the requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21, 30, 58 – safety and emergency arrangements, prevention of collisions, safe management of vessels, including: • Appropriate lighting, navigation, and communication to inform other users. • Use of radar and 24/7 watch.	Yes

7.7 Risk: Fauna Interaction

7.7.1 *Source of Impact*

The physical presence of the seismic and support vessels and towed equipment provides a risk of collision or entrapment of marine fauna potentially causing injury or mortality.

7.7.2 *Impact Pathway*

Marine fauna most susceptible to vessel strike, entanglement or entrapment are characterised by one or more of the following characteristics:

- commonly dwell at or near surface waters.
- often slow moving or large.
- frequents areas with a high levels of vessel traffic.

There have been no reported cases of marine fauna becoming entangled in seismic survey streamers in Australian waters. As the streamers are towed, they have a level of tautness that would not result in entanglement of fauna. Thus, there is no cause effect pathway for entanglement of fauna in streamers.

Historically turtles have been recorded as being trapped in the streamer tail buoys. Tail buoys are now of a design that does not represent an entrapment risk to turtles or turtle guards are used as standard equipment if the tail buoy is not of the newer design. Thus, there is no cause effect pathway for entrapment of turtles in streamer buoys.

The National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia, 2017c) identifies cetaceans, dugong, marine turtles, and whale sharks as being vulnerable to vessel collisions. These fauna are likely to be present in the CSEP OA as detailed in Section 5.

7.7.3 *Predicted Level of Impact*

Though vessel collisions with marine fauna occur within Australia they have not be reported during seismic surveys. The extent of the area of where the risk of a vessel collision with marine fauna may occur is within the CSEP OA and the risk could occur while the activity is undertaken. The worst potential impact from vessel collision would be mortality or serious injury of an individual.

Vessel speed has been demonstrated as a key factor in collisions with marine fauna such as marine mammals and turtles, and it is reported that there is a higher likelihood of injury or mortality from vessel strikes on marine mammals when vessel speeds are greater than 14 knots (Laist et al. 2001; Vanderlaan & Taggart 2007). During seismic surveys, the seismic vessel will be moving at low speed (4.5 knots), and the approaching seismic source and/or vessel noise will provide some level of warning to marine fauna.

The severity is assessed as Minor (2) and likelihood as Highly Unlikely giving a predicted risk level of Medium (3) based on:

- While the seismic source is in operation it is unlikely that marine fauna would come close enough for a collision to occur as the sound generated would act as a deterrent.

- The low operating speeds of the seismic and support vessels of ~4 – 5 knots during acquisition.
- The support vessels can manoeuvre to avoid collision with large marine fauna.
- Marine fauna observations during the survey.
- Though vessel collisions with marine fauna occur within Australia they have not be reported during seismic surveys.
- If an incident occurred, it would be restricted to individual marine fauna and is unlikely to affect species at a population level.

7.7.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-54: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below. Risk level is Low or Medium.	Risk rating is assessed as Medium.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is no scientific uncertainty associated with this impact.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	The requirements to manage interactions between vessels and cetaceans as detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be applied to vessels as per CM#18. The Approved Conservation Advice for the Fin Whale (TSSC 2015j) lists vessel strike as a threat with a minor consequence rating. The management action relevant to vessel strikes is ensure all vessel strike incidents are reported in the National Vessel Strike Database. Reporting of vessel strike incidents is detailed in Section 8.1.5. The Approved Conservation Advice for the Sei Whale (TSSC 2015i) lists vessel strike as a threat with a minor consequence rating. The management action relevant to vessel strikes is ensure all vessel strike incidents are reported in the National Vessel Strike Database. Reporting of vessel strike incidents is detailed in Section 8.1.5. The Approved Conservation Advice for the Humpback Whale (TSSC 2015k) lists vessel strike as a threat to the species. The management actions relevant to vessel strikes are:	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		• Maximise the likelihood that all vessel strike incidents are reported in the National Ship Strike Database. All cetaceans are protected in Commonwealth waters and, the EPBC Act requires that all collisions with whales in Commonwealth waters are reported. Vessel collisions can be submitted to the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike • 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. Reporting of vessel strike incidents is detailed in Section 8.1.5. The risk of vessel strike on humpback whales has been assessed and an additional control (CM14) has been implemented to avoid areas where humpback whales are undertaking biologically important behaviour to manage noise interference and the risk of vessel strike. The Conservation Management Plan for the Blue Whale (DoE 2015) details that vessel collisions will impede recovery of blue whale populations if a sufficient number of individuals in the population lose reproductive fitness or are killed. The management actions relevant to vessel strikes are: • 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	

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		required, appropriate mitigation measures are implemented. Reporting of vessel strike incidents is detailed in Section 8.1.5. The risk of vessel strike on blue whales has been assessed and an additional control (CM#14) has been implemented to avoid areas where blue whales are undertaking biologically important behaviour to manage noise interference and the risk of vessel strike. The Whale Shark Recovery Plan (DSEWPaC 2013) does not specifically identify vessel collision as a threat. The Recovery Plan for Marine Turtles (DoEE 2017) details boat strike is a highly visible threat because it more commonly occurs in highly populated areas. Although the outcome can be fatal for individual turtles, boat strike (as a standalone threat) has not been shown to cause stock level declines. In considering the cumulative impacts of threats on small or vulnerable stocks, it is likely to be a contributor to a stock level decline. The Australian Government is developing a National Strategy for Mitigating Vessel Strike of Marine Mega-fauna to provide guidance on reducing the risk of vessel collisions and the impacts they may have on marine fauna. No specific actions are identified in relation to vessel strikes to turtles. The National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna details the following actions relevant to vessel operators: • Identify and adopt best-practice mitigation measures and emerging technologies and encourage the development of new mitigation measures. • Develop and implement vessel strike management plans which identify appropriate mitigation measures in locations where the	

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		relative risk of vessel strike is higher, as determined by a risk assessment. • Adaptive management principles, including the use of regular reviews are used during the implementation of mitigation measures. The risk of vessel strike to turtles has been assessed and an additional control (CM#9: Turtle Exclusion Zone) has been implemented to avoid areas where turtles are undertaking biologically important behaviour to manage noise interference and the risk of vessel strike. Reviews of incidents, including vessel strike incidents, is undertaken as detailed in Section 8.1.5 this would identify any increase in incidents and a review of the controls to ensure the acceptable level is still being met or if further controls are required.	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the EP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	There have been no stakeholder objections or claims regarding fauna interactions.	Yes

7.7.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-55 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-55: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#18: EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	The requirements to manage interactions between vessels, helicopters and cetaceans as detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be applied to vessels. This includes: • Travel at less than 6 knots within the cautionary zone of a cetacean (150 m radius for dolphins, 300 m for whales. • Do not approach closer than the caution zones for a cetacean. • If a cetacean shows signs of disturbance move away at a constant speed less than 6 knots. The requirements of the EPBC regulations set out measures to reduce vessel speed and avoid approaching cetaceans, which also reduce engine in close proximity to cetaceans. The requirements of the EPBC regulations set out clear measures on altitudes above cetaceans and on approaching cetaceans, which reduce the risk of helicopter noise in close proximity to cetaceans. It is a legislative requirement for vessels to comply with the EPBC Act.	Yes
CM#10: Marine Fauna Observation	• Two marine fauna observers (MFOs) on board seismic vessel. • Constant bridge watch on support vessels. • MFOs will be in radio contact with support vessels. • MFOs will have proven experience in whale observation, distance estimation and reporting.	Yes
CM#27: Tail buoys guards	Turtle guards installed on tail buoys or tail buoys are of a design that are not an entrapment risk to turtles.	Yes
Surveys only undertaken during daylight hours	Though vessel collisions with marine fauna occur within Australia they have not be reported during seismic surveys. Undertaking surveys only in daylight hours would have a disproportionate cost without a significant environmental benefit. Undertaking surveys only in daylight hours would at best double the time taken to compete a seismic survey. This increase in time would result in increased environmental impacts (acoustic, air, light and marine emissions, and displacement of marine users) and risks (introduction of marine pests and vessel collision) and a doubling in costs without a significant reduction in the likelihood of a vessel collision with fauna occurring. To significantly reduce the likelihood of a vessel collision with fauna during the hours of darkness the survey and support vessels would need to be stationary. This is not feasible for the survey vessel when it has streamers in the water and during deployment and retrieval of the streamers. It is also not feasible for the support vessels to remain stationary as they are required to be with the survey vessel to reduce the risk of potential collisions with other marine users due to the limited manoeuvrability of the seismic vessel.	No

7.8 Risk: Loss of Equipment or Waste

7.8.1 Source of Impact

During a survey there is a risk that equipment or waste may be lost overboard which could result in seabed disturbance, ingestion or entanglement with fauna and interaction with other marine users.

7.8.2 Impact Pathway

The seabed and associated benthic habitat may be disturbed if equipment or waste lost overboard settles on the seabed. As detailed in Section 5 several different seabed types are identified within the CSEP OA including KEFs. No threatened ecological communities are present within the CSEP OA. The CSEP OA does not overlap any marine parks zoned as habitat protection zones.

In August 2003, 'Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris' was listed as a key threatening process under the EPBC Act. Harmful marine debris includes land-sourced garbage, fishing gear from recreational and commercial fishing abandoned or lost to the sea, and vessel-sourced, solid, non-biodegradable floating materials disposed of or lost at sea. The Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (Commonwealth of Australia 2018) details that marine mammals, seabirds, turtles, sea snakes and sharks are adversely impacted by marine debris. These fauna are likely to be present in the CSEP OA as detailed in Section 5.55.

Loss of large pieces of equipment such as streamers could result in entanglement with other marine user's vessel equipment or fishing gear. There has recently been a case where seismic streamers became entangled with a production platform. As detailed in Section 5 the CSEP OA includes marine users such shipping, production platforms and recreational and commercial fishing.

7.8.3 Predicted Level of Impact

Loss of equipment or waste has the potential to cause localised seabed disturbance with potential damage to benthic habitats. The CSEP OA includes several KEFs that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity. Given the size of equipment used for a survey, only a relatively small area of the seabed would be disturbed, maximum of 0.001 km^2 based on loss of a streamer that settled on the seabed, though this is unlikely as the streamers will have recovery units. Impacts to biodiversity or ecosystem function and integrity are not predicted. Lasting impacts are not predicted as the small area would quickly recover. The severity is assessed as Slight (1) and likelihood as Highly Unlikely giving a predicted risk level of Low (4) for benthic habitats.

Loss of equipment or waste has the potential to result in fauna mortality or injury through ingestion or entanglement. Marine turtles and seabirds are particularly at risk from entanglement. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fauna fatality. Floating, non-biodegradable marine debris has been highlighted as a threat to marine turtles, whales, whale sharks, and albatrosses and giant petrels in the relevant recovery plans and approved conservation advice. Marine debris causing entanglement and ingestion was recognised in 2003 as a key threatening process for marine vertebrates under the EPBC Act leading to the development of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife (DoEE 2018). The recovery plans and approved conservation advice, as well as the threat abatement plan, have specified several recovery actions to help combat this threat. Of relevance to the CSEP is the legislation for the prevention of garbage disposal from vessels which is adopted as CM#25.

Any impacts would be restricted to individual marine fauna and is unlikely to affect species at a population level. The severity is assessed as Minor (2) and likelihood as Highly Unlikely giving a predicted risk level of Medium (3) for marine fauna.

Loss of large pieces of equipment such as streamers could result in entanglement with other marine user's infrastructure or equipment. This could result in damage to infrastructure or equipment which may have a financial cost to the other marine user. Any impacts would be restricted to individual marine users. The severity is assessed as Minor (2) and likelihood as Highly Unlikely giving a predicted risk level of Medium (3) for other marine users.

7.8.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-56: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below. Risk level is Low or Medium.	The maximum impact consequence is assessed as Minor with a risk level of Medium.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is no scientific uncertainty associated with this impact.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	Floating, non-biodegradable marine debris has been highlighted as a threat to whale sharks, rivers sharks, sawfish, albatrosses and whales in the relevant recovery plans and approved conservation advice see Table 5-10, Table 5-14, Table 5-16. These recovery plans and approved conservation advice do not identify any actions specific to vessels. The Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE 2018) details the impacts of marine debris to marine fauna and does not identify any actions specific to vessels other than meeting legislative requirements. CM# details adoption of Marine Order 95 to manage vessel garbage.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the EP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	There have been no stakeholder objections or claims regarding loss of equipment or waste.	Yes

7.8.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-57 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-57: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#30: Simultaneous operations plan	A simultaneous operations plan will be developed for surveys that are within 3 km plus the length of the seismic spread (seismic vessel to streamer tail buoy) of an offshore platform or facility to ensure streamers are not entangled in the infrastructure. A distance of 3 km in addition to the seismic spread provides as safe distance to marine infrastructure.	Yes
CM #5: Adjustment protocol	The CSEP Commercial Fishing Industry Adjustment Protocol provides a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for displacement and/or fishing gear loss/damage because of a survey conducted under the CSEP.	Yes
CM#17: Streamer configuration	The streamer configuration will consist of: • steerable streamers to maintain consistent cable shape. • recovery units which are pressure-activated, self-inflating buoys that are designed to bring the streamer to the surface if lost during a survey, where it can be retrieved by the support vessel.	Yes
CM#26: Support vessel	• At least one support vessel will always accompany the seismic vessel and will assist in the recovery of lost equipment or waste if safe to do so.	Yes
CM#25: Marine Order 95: Marine pollution prevention - garbage	As per Marine Order 95: Marine pollution prevention – garbage vessels must have a garbage management plan, placards and maintain a garbage record book. Waste with potential to be windblown shall be stored in covered containers to minimise the risk of loss to the marine environment. Marine Order 95 gives effect under Australian law to MARPOL Annex VI.	Yes
CM#31: Stakeholder notification – loss of equipment	If a loss of equipment to the marine environment provides a navigational hazard it will be reported to AMSA and known marine users will be notified.	Yes

7.9 Risk: Introduction of Non-indigenous Marine Species

7.9.1 Source of impact

There is a risk of introducing non-indigenous marine species (NIMS) if they are present on a vessel or in-water equipment such as streamers or the sound source.

7.9.2 Marine Biosecurity Reference Case

This section relies on the Marine Biosecurity Management of Vessels Servicing the Offshore Resources Industry – An Environment Plan Reference Case- Version 2.0 (Marine Biosecurity Reference Case) that NOPSEMA provided a Regulatory Advice Statement dated 22 October 2020.

The Marine Biosecurity Reference Case considers the possible and variable risks of introducing and translocating NIMS associated with the movement of vessels and equipment deployed from those vessels into and/or within Australia for the purpose of providing services to the Australian offshore resources industry, and the measures vessel operators and titleholders should adopt to mitigate those risks to as low as reasonably practical (ALARP) and acceptable levels. Specifically, the reference case addresses the risks of NIMS associated with ballast water and biofouling.

To apply the reference case, titleholders need to demonstrate in their environment plans that the control measures detailed in the reference case are appropriate for the specific activity and circumstances being presented in the environment plan. Where vessels are mobilised from international or interstate waters and operations are proposed in or near shallow, sensitive environments titleholders will need to consider further control measures or provide additional information about how the biofouling management plan reduces associated impacts and risks to ALARP and acceptable levels.

Assessment of the Marine Biosecurity Reference Case identified that it is applicable to seismic surveys conducted under the CSEP as detailed in Table 7-58.

Table 7-58: Assessment of Applicability of Marine Biosecurity Reference Case to CSEP

	Reference Case	CSEP	Within Reference Case Scope
Operational Scope	All vessels providing services to the offshore resources industry and the management of the ballast water and biofouling of those vessels to minimise the marine biosecurity risk.	Seismic and support vessels	Yes
Geographical Scope	Australian waters including state and Territory waters, to the outer limits of Australia's EEZ, including of the JPDA.	Australian waters to the outer limits of Australia's EEZ, not including the JPDA.	Yes
	Does not apply to World Heritage Areas.	Does not overlap any World Heritage Areas.	Yes

7.9.3 Evaluation of Specific Circumstances and Characteristics

The Marine Biosecurity Reference Case details that titleholders should evaluate specific circumstances and characteristics of their project area and activities, considering sensitive areas, shallow waters and shoals and areas of known NIMS infestation and what additional controls would be necessary to ensure impacts and risks of the activity are ALARP and of an acceptable level.

The CSEP OA overlaps several Australian Marine Parks within the north and north-west networks. The North Marine Parks Network Management Plan 2018 and North-west Marine Parks Network Management Plan 2018 detail that under these plans ballast water discharge and exchange must be compliant with Australian ballast water management requirements for all zones except for Sanctuary Zones where discharge is not allowed. The CSEP OA is not within a Sanctuary Zone. Within the CSEP OA vessels will implement the requirements of Australian Ballast Water Management Requirements (CM#32).

There have been no stakeholder objections or claims regarding NIMS.

7.9.4 Identification of Controls

The Marine Biosecurity Reference Case describes the risks associated with the use of vessels to service offshore resource activities and an evaluation of each of the control measures applied to mitigate those risks. It details titleholders should note that there may be circumstances where risks specific to the location of the activity, vessel type and immersible equipment are such that additional control measures are required.

As the CSEP OA may occur in high risk areas such as shallow water (<50 metres), near shallow water shoals, KEFs, and AMPs, to ensure that risks are managed to acceptable and ALARP, the controls identified within the Marine Biosecurity Reference Case will be adopted with the more stringent requirement that all vessels are required to have a vessel risk status of 'low' before entering the CSEP OA (See Section 7.12 (EPOs, EPSs and MC).

An additional control (CM#35: In-water equipment check or an alternative risk assessment tool) was identified to managed potential NIMS risk associated with in-water equipment to ALARP and acceptable levels.

Since the Marine Biosecurity Reference Case was written the Biosecurity Amendment (Biofouling Management) has come into force and the associated Australia Biofouling Management Requirements (DAWE 2022) have been published. To ensure these requirements are met CM#33a: Australia Biofouling Management Requirements was identified to manage biofouling risks.

7.10 Risk: Loss of Containment

7.10.1 Source of impact

Loss of containment can result in a spill to the marine environment. Table 7-59 details the scenarios that could result in a spill to the marine environment during a seismic survey.

7.10.1.1 Spill scenarios

Based on the spill scenarios identified (Table 7-59) and described below the maximum credible worst-case scenario of a 2,000 m^3 MGO/MDO has been evaluated in more detail to identify the level of oil spill response required by titleholders when undertaking a survey.

Deck spill

Spills to the vessel deck can occur from the equipment (hydraulic oil) and storage and use of oils and chemicals. If spills are not noticed and cleaned up there is a potential for them to reach the marine environment. Vessel typically store chemicals and oils in small containers and drums in a locker or contained area. Spill volumes would range from 1 to 250 L.

Refuelling

A vessel refuelling failure was identified as a potential scenario which may result in a release of MDO/MGO to the environment. Using dry break couplings (which provide an automatic mechanism to seal off both the hose and the fixed pipe end when the hose is disconnected), the maximum credible spill volume from a refuelling failure is considered to be the maximum typical volume of a transfer hose. In the event dry break couplings fail, AMSA (2015) indicate the maximum credible spill volume from a refuelling incident with continuous supervision is equivalent to the volume of fuel transferred within a 15 minute period, which represents the estimated time required to shut down refuelling operations following discovery of a spill. Based on an estimated transfer volume of 100 m^3/hr for large diesel pumps, this may result in a maximum credible spill volume of up to 25 m^3.

Vessel Collision

There is a low probability possibility of a vessel collision occurring within the CSEP OA between a survey vessel and a passing third party vessel. The worst-case environmental incident resulting from a vessel collision is the rupturing of a vessel fuel tank resulting in the release of MDO/MGO to the environment. A vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or severe weather.

The maximum credible spill volume from a collision can be determined from AMSA (2015). The maximum credible spill from a collision can be determined from the usable volume of the largest single fuel tank. The CSEP is designed to address a range of seismic activities and consequently a range of vessel types and sizes. Fuel tank volumes of seismic vessels typically range from <100 m^3 to 1,500 m^3. However, to be conservative, the maximum credible (instantaneous) spill volume has been determined as being 2,000 m^3.

A tank rupture because of vessel grounding was discounted as a credible scenario as a criterion for use of the CSEP is that the minimum water depth of the seismic survey area is >25 m (Table 4-2) and there are no emergent features that present a risk of vessels grounding (Section 5).

Table 7-59: Credible Loss of Containment Hydrocarbon Spills

Scenario	Material Type	Release Location	Maximum credible worst-case scenarios
Equipment, storage or use of chemicals and oils	Hydraulic fluid Lubrication oil Chemicals	At surface	1 – 250 L
Vessel refuelling failure	MDO/MGO	At surface	1 to 25 m^3
Vessel tank rupture	MDO/MGO	At surface	100 to 2,000 m^3

7.10.1.2 Hydrocarbon Properties

MDO/MGO are products that contain a mixture of volatile and persistent hydrocarbons. The two products have very similar chemical properties. The properties of MGO include a density of 830 kg/m^3, API of 36.4, and viscosity of 2.5 cP (at 40°C). The MGO consists of 16.4% volatile and 80.9% semi- to low volatile components with only a 2.9% contribution of persistent hydrocarbons, which will not readily evaporate. Table 7-60 shows the physical properties and boiling point ranges of MGO and MDO.

When released to the marine environment, the MDO/MGO will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Due to its chemical composition, up to 65% will generally evaporate over the first two days depending upon the prevailing conditions and spill volume.

MDO/MGO has a strong tendency to entrain into the upper water column (0 m–10 m) and consequently reduce evaporative loss in the presence of moderate winds (> 10 knots) and breaking waves. However, the MDO/MGO can re-surface when the conditions calm.

Table 7-60: MDO and MGO Characteristics

Hydrocarbon type	Density (kg/m^3)	Viscosity (cP)	Component	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
			BP (°C)	**<180**	**180–265**	**265–380**	**>380**
MDO	829 (at 25°C)	4.0 (at 25°C)	% of total	6	35	54	5
MGO	830 (at 15°C)	2.5 (at 40°C)	% of total	16.4	49	31.9	2.7

7.10.1.3 Hydrocarbon Exposure Levels

Receptors may be contacted by hydrocarbons either at the surface or in the water column. The degree of impact will depend on the sensitivity of the receptor contacted, the duration of the contact (exposure) and the toxicity of the hydrocarbon mixture making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon. To determine the ecological effects of a spill, different exposure levels were considered for the risk assessment as follows:

- Surface (floating) hydrocarbon exposure levels, to assess physical effects on receptors offshore.
- Shoreline accumulation levels, to assess physical effects on receptors onshore.
- Water column exposure levels, to assess toxicity effects to receptors offshore from entrained and dissolved aromatic hydrocarbons.

These exposure levels are described in Table 7-61 and are consistent with those described in NOPSEMA (2019). The low thresholds have been used to describe the Environment that May Be Affected (EMBA) (Section 7.10.1.5).

Table 7-61: Hydrocarbon Exposure Levels

Exposure values		Description
Surface (floating) hydrocarbons		
Low	1 g/m^2	This value represents the area where a visible sheen may be present on the surface but is below concentrations at which ecological impacts are expected to occur. It predicts the potential for some socio-economic impact (visual/aesthetic) and establishes planning area for scientific monitoring.
Moderate	10 g/m^2	Lower limit for harmful exposure to birds, marine mammals, and other marine fauna at the sea surface.
High	50 g/m^2	Approximates surface oil slick and informs response planning.
Shoreline accumulations		
Low	10 g/m^2	Represents light oiling (equivalent to 2 teaspoons of oil per m^2) and predicts the potential for some socio-economic impact (visual/aesthetic).
Moderate	100 g/m^2	Potential for sub-lethal and lethal impacts to shorebirds, intertidal invertebrates, mammals, and reptiles. Acceptable minimum thickness for effective shoreline clean-up efforts.
High	1,000 g/m^2	Potential significant impacts to coastal vegetation, including mangroves and marshes. Likely to require intensive clean-up effort.
Dissolved hydrocarbons		
Low	10 ppb	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.
Moderate	50 ppb	Approximates potential toxic effects, particularly sublethal effects to sensitive species (e.g., fish larvae, plankton).
High	400 ppb	Approximates toxic effects including lethal effects to sensitive species.

Exposure values		Description
Entrained hydrocarbons		
Low	10 ppb	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.
High	100 ppb	Represents potential toxic effects, particularly sub- lethal effects to highly sensitive organisms and life stages.

7.10.1.4 Hydrocarbon Weathering Assessment

The mass balance forecast for the constant-wind case (5 knots/2.6 m/s) for MDO shows that approximately 41% of the oil is predicted to evaporate within 24 hours (Figure 7-61). Under these calm conditions most of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure 7-62), where the winds are of greater strength, entrainment of MDO into the water column is indicated to be significant. Approximately 24 hours after the spill, around 72% of the oil mass is forecast to have entrained and a further 24% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

The increased level of entrainment in the variable-wind case will result in a higher percentage of biological and photochemical degradation, where the decay of the floating slicks and oil droplets in the water column occurs at an approximate rate of 2.4% per day with an accumulated total of ~16% after 7 days, in comparison to a rate of ~0.2% per day and an accumulated total of 1.3% after 7 days in the constant-wind case.

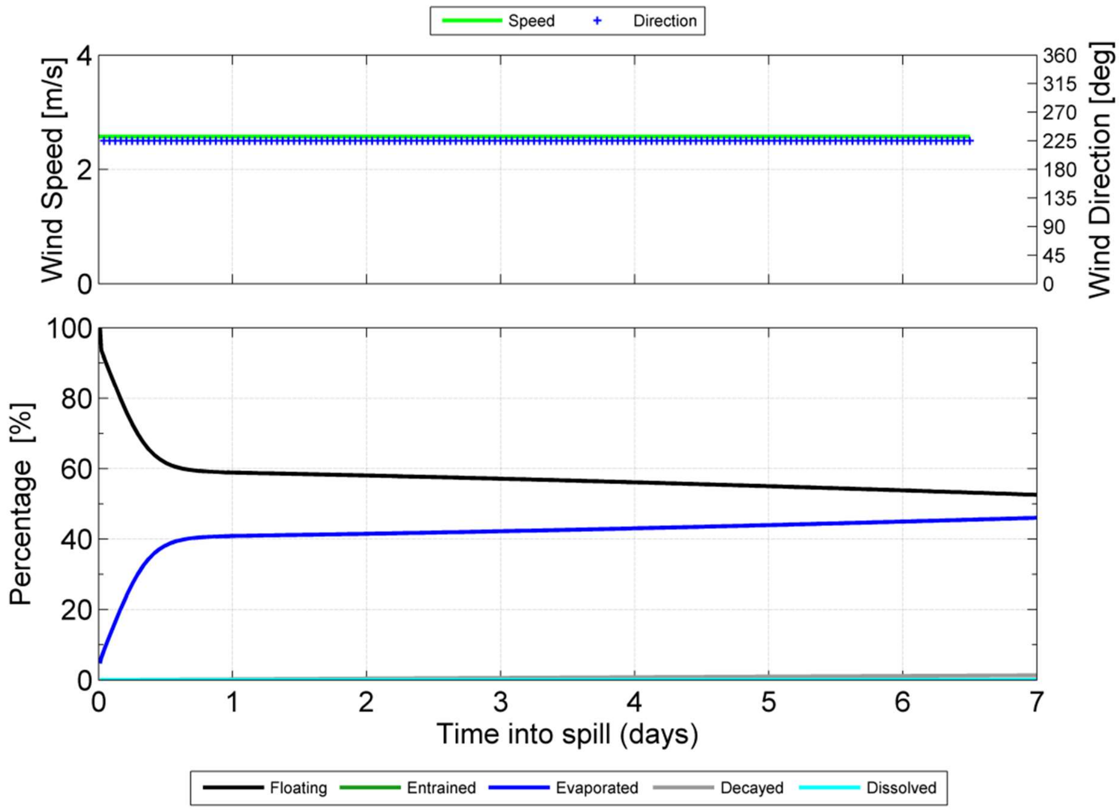


Figure 7-61: Proportional mass balance plot representing the weathering of MDO spilled onto the sea surface as a one-off release and subject to a constant 5 knot (2.6 m/s) wind at 27 °C water temperature and 25 °C air temperature

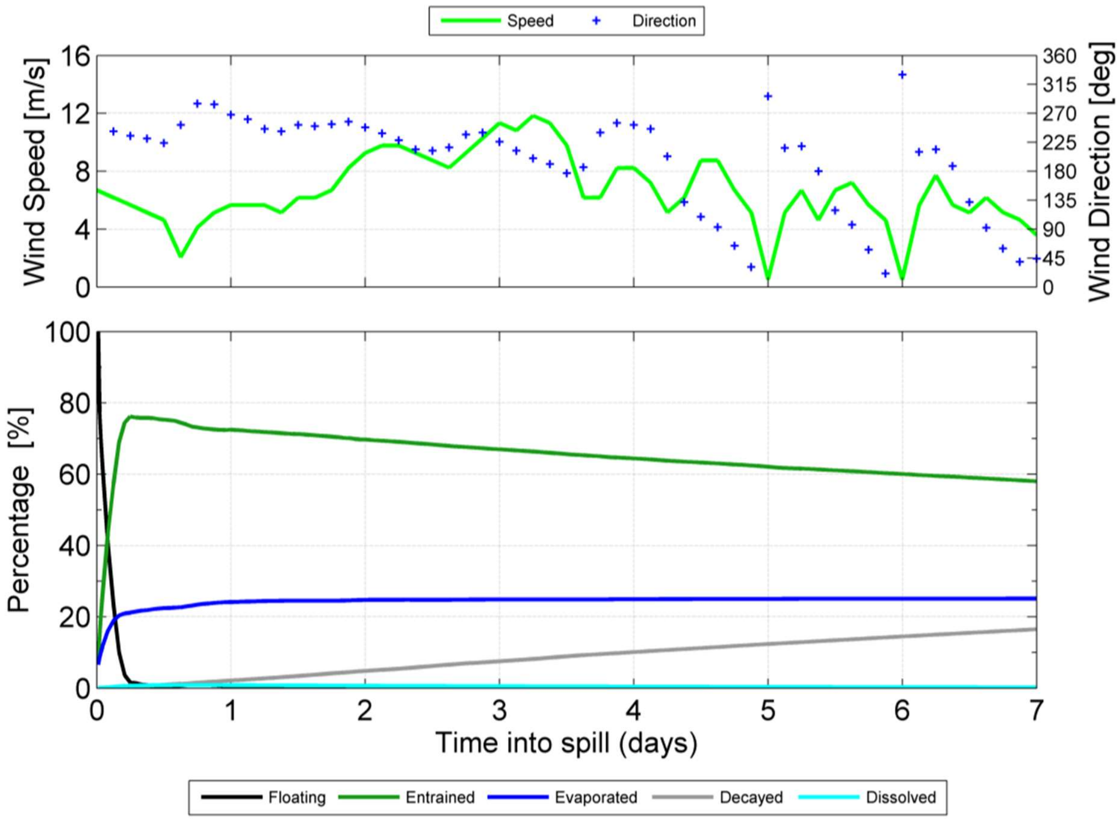


Figure 7-62: Proportional mass balance plot representing the weathering of MDO spilled onto the sea surface as a one-off release and subject to variable wind at 27 °C water temperature and 25 °C air temperature

7.10.1.5 EMBA

A review of all suitable publicly available (NOPSEMA website) and CSEP titleholder supplied Offshore Project Proposals (OPP) and Environment Plans (EP) was undertaken to determine the maximum modelled distance travelled by spilled hydrocarbons because of a hypothetical vessel collision within waters offshore northwest Australia. This area is the environment that may be affected (EMBA) by a spill from a vessel conducting a seismic survey within the CSEP OA. The review defined three spill EMBAs associated with the three CSEP OAs:

- Carnarvon EMBA
- Browse EMBA
- Bonaparte EMBA

The spill modelling review is available as in Appendix B.

The boundary of the Spill EMBAs was defined as including all modelled exposure at the 'low' exposure values (1 g/m ^{2} floating, 10 ppb dissolved and entrained) (Table 7-61). These low exposure values are not considered to be representative of a biological impact, but they are adequate for identifying the full range of environmental receptors that might be contacted by surface and/or subsurface hydrocarbons (NOPSEMA 2019) and a visible sheen.

To be conservative, the shoreline extent of each EMBA was defined as all coastal areas within the offshore spatial extent.

For the spill data available within each of the OAs, a screening assessment on the appropriateness of the data to use in the development the Spill EMBAs was undertaken. This screening assessment was based on the

- Availability of spatial data/maps.
- Appropriate thresholds (NOPSEMA 2019; Table 7-61) used.
- Spill volume.

Results of the screening assessment are in the spill modelling review in Appendix B.

Data that was screened as appropriate for use was then georeferenced into QGIS, a shapefile created to show the outer spatial extent of the specific spill, and then this specific spill spatial event was copied and translated to the boundary points of the OA. This process was completed for each of the relevant spill scenarios. Once all spill-specific boundaries had been created, a single spill EMBA for each OA was created that incorporated all the individual spill events.

The EMBAs for Carnarvon, Browse and Bonaparte are shown in Figure 7-63, Figure 7-64 and Figure 7-65 respectively. It should be noted that the EMBAs presented show a much larger area than the area that would be affected by a spill from an individual seismic survey.

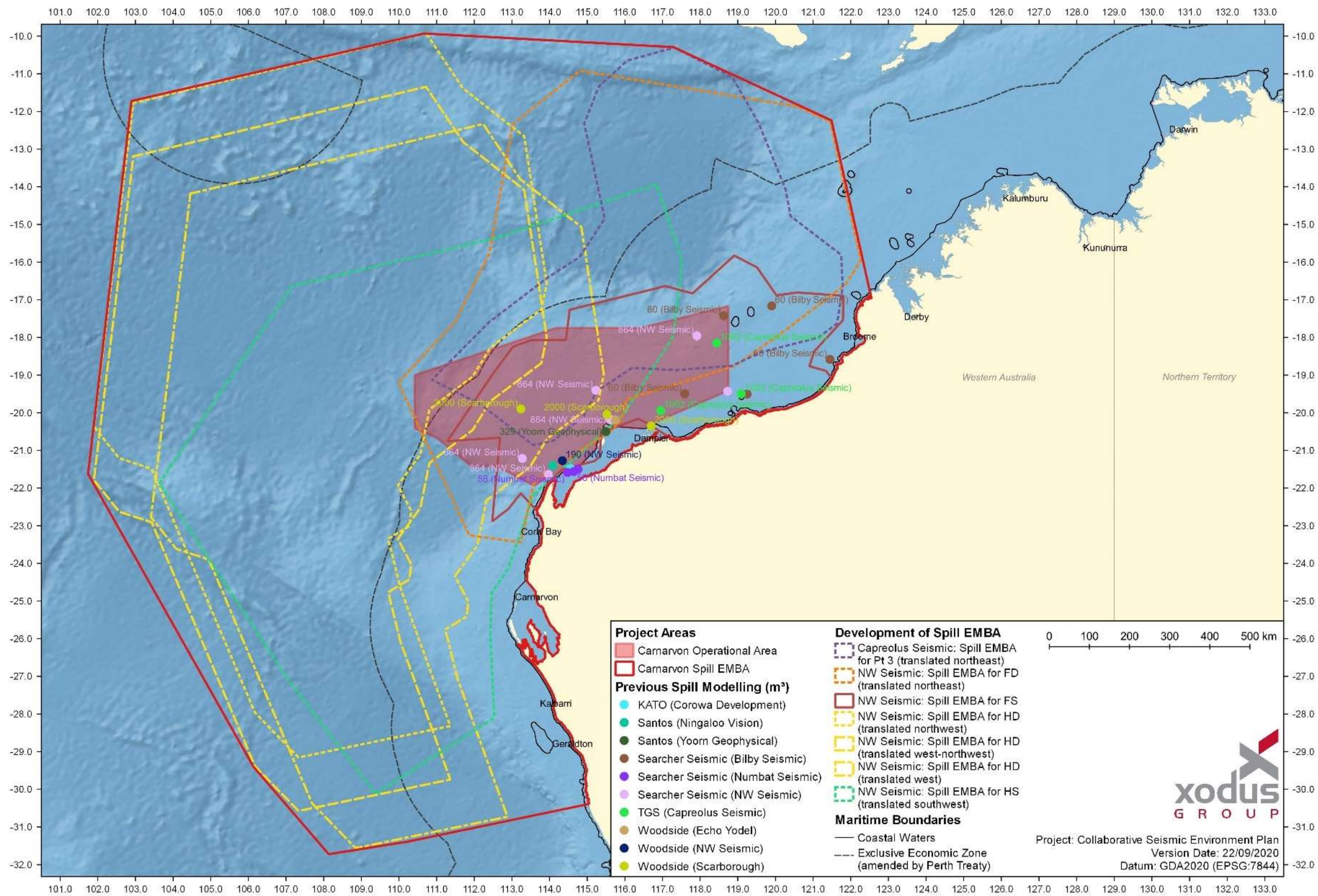


Figure 7-63: EMBA and Operational Area for Carnarvon Project Area

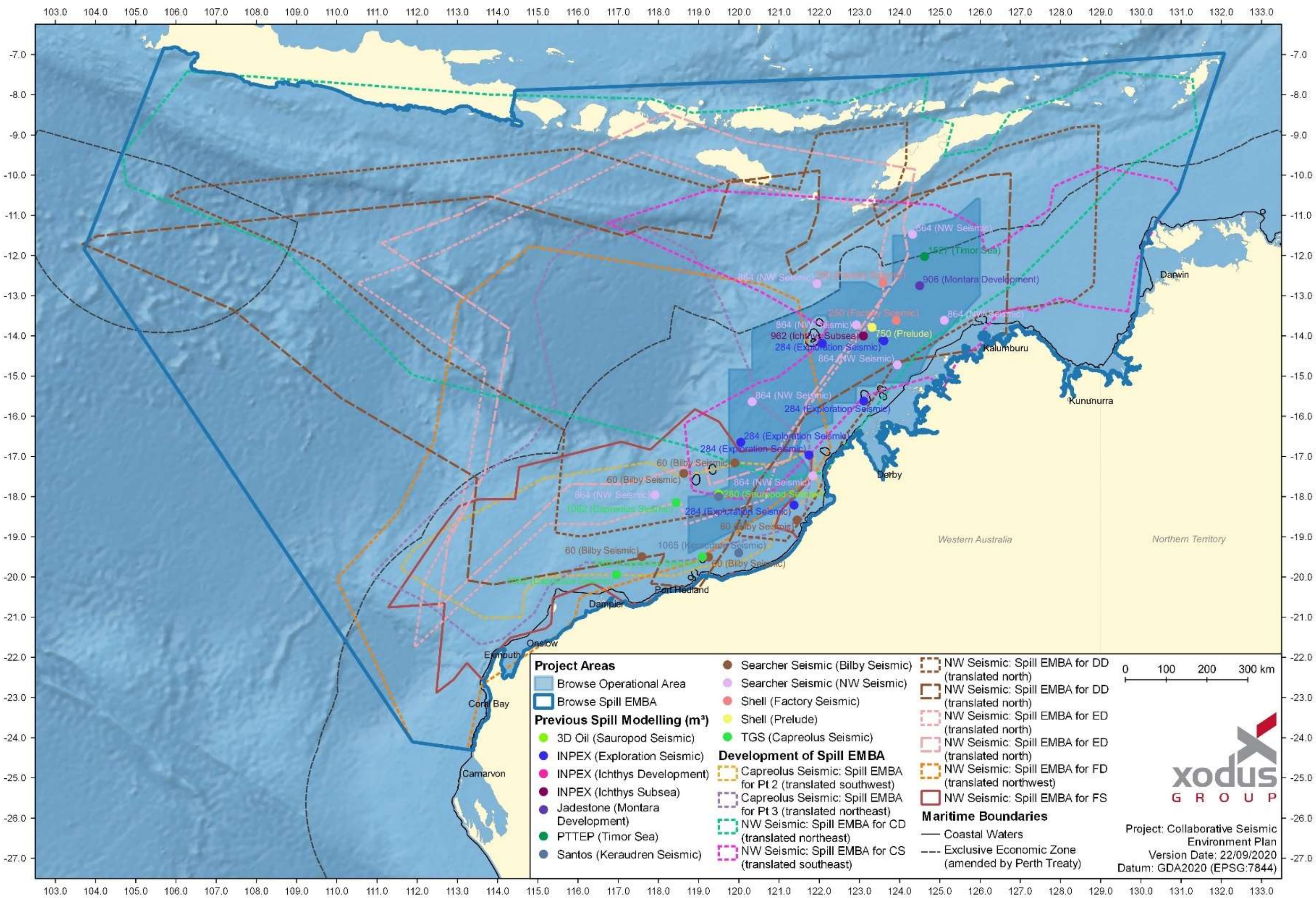


Figure 7-64: EMBA and Operational Area for Browse Project Area

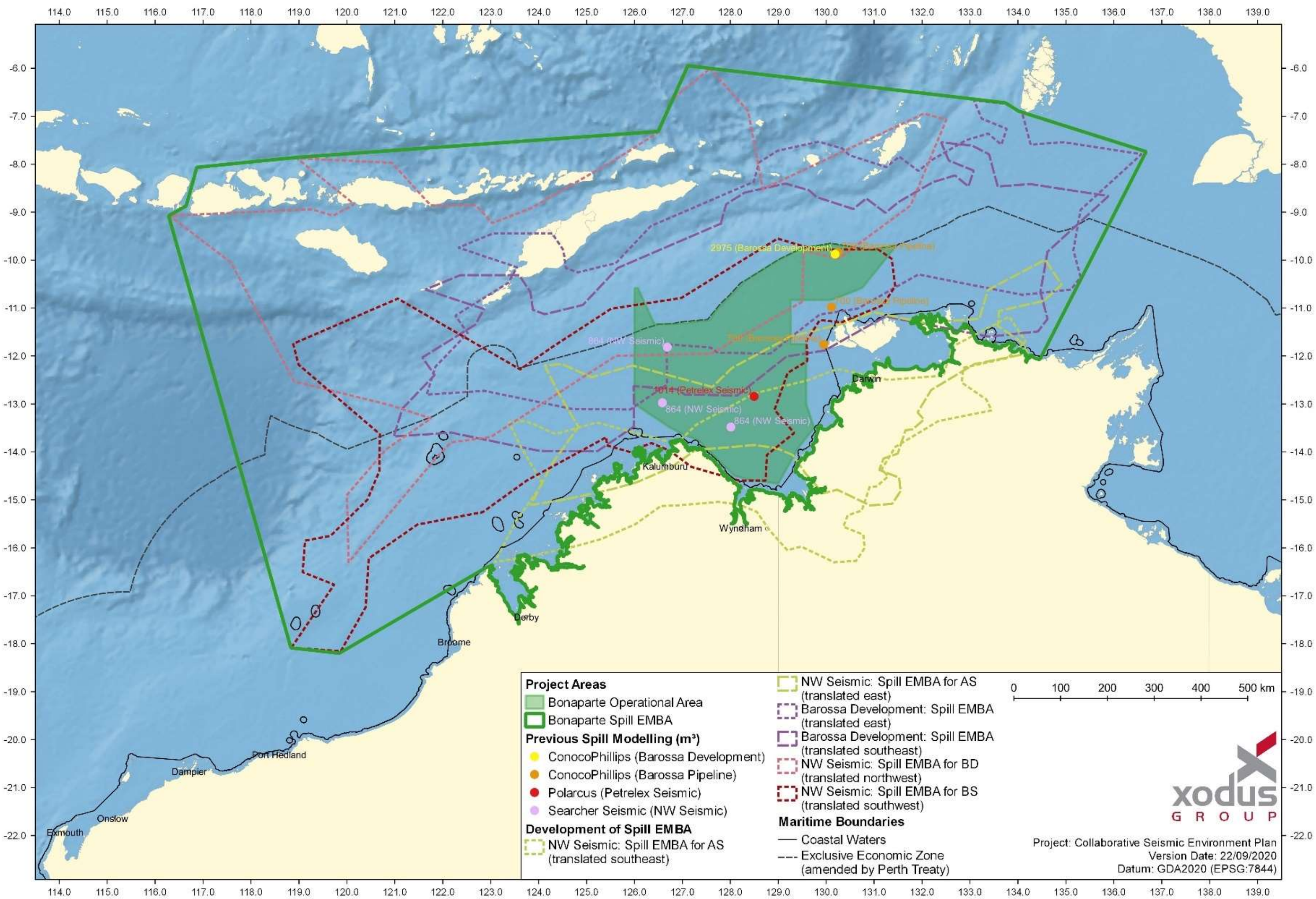


Figure 7-65: EMBA and Operational Area for Bonaparte Project Area

7.10.2 Predicted Level of Impact

7.10.2.1 Deck spill

Hydraulic fluids and lubricating fluids behave similarly to marine diesel when spilt in the marine environment. Hydraulic fluids are oils of light to moderate viscosity and have a relatively rapid spreading rate. Like diesel, they will dissipate quickly, particularly in high sea states, although lubricating oils are more viscous and so the spreading rate of a spill of these oils would be slightly slower.

Impacts associated with a spill of chemicals to the marine environment will depend on the nature of the liquid released, the volume and its behaviour in the marine environment (whether it sinks, floats, disperses, etc.). In the event of a spill to the marine environment, these liquids would be subjected to rapid dispersion and dilution by the open ocean water conditions and prevailing currents and would remain within the surface waters.

Potential impacts include a temporary and highly localised decline in water quality. This would have limited potential for toxicity to marine fauna, due to the likely short duration of exposure and rapid dilution of the released liquids in the marine environment. Impacts are likely to be limited to the immediate vicinity of the spill and would not affect population viability of contacted species or ecosystem function. The greatest potential for impact would likely be for passive or low mobility fauna such as plankton, pelagic invertebrates and small pelagic fishes which may be exposed for the greatest periods of time. More mobile fauna are likely to be transient within the OAs and toxic impacts are unlikely to occur to these species in the event of a small liquid release.

The severity is assessed as Slight based on impacts are predicted to be short-term (hours) and localised (within the Survey OA). The likelihood of this consequence with controls in place is Possible with a residual risk of Medium (3).

7.10.2.2 Refuelling

The accidental release of up to 25 m^3 of MDO/MGO to the marine environment from a refuelling incident may result in a temporary and localised reduction in water quality. The behaviour, weathering and fates of the spilt MDO/MGO are expected to be the similar to those described for a vessel fuel tank rupture (refer to Section 7.10.1.4) with the majority of the MDO/MGO forming a film on the surface and rapidly evaporating and dispersing following release, with a proportion becoming entrained in the upper water column by wind and wave action.

Potential impacts are expected to be limited both temporally and spatially due to the expected small volumes spilt and rapid evaporation and dilution of the spill in the offshore marine environment.

Surface exposures are expected to rapidly fall below the 10 g/m^2 moderate threshold considered representative of potential lethal and sub-lethal impacts to marine fauna (such as turtles, cetaceans and birds), with the greatest concentrations occurring for a brief period in the immediate vicinity of the spill (a few hours or less than a day). Entrained exposures are also expected to be low, resulting in limited interactions with small numbers of plankton, pelagic invertebrates and pelagic fishes in the upper water column that are largely incidental in nature.

The severity is assessed as Slight based on impacts are predicted to be short-term (hours or less than a day) and localised (within the Survey OA). The likelihood of this consequence with controls in place is Possible with a residual risk of Medium (3).

7.10.2.3 Vessel Collision

MDO/MGO are classified by ITOPF (2020) as Group 2 hydrocarbons and are considered to have a higher aquatic toxicity in comparison to heavier Group 3 to 4 hydrocarbons. This is due to their chemical characteristics and the resulting increased bioavailability of dispersed droplets of diesel to marine organisms. MDO/MGO have components with the potential to bio-accumulate in organisms and have high water solubility along with a higher potential to naturally entrain into the water column than Group 3 or 4 hydrocarbons.

The likelihood of predicted worst-case impacts occurring to marine receptors from a vessel fuel tank release depends upon the likelihood of a vessel collision occurring, the likelihood of a fuel tank being ruptured and releasing its full contents, plus the likelihood that a release occurs in a location and at a time where the worst-case exposures and impacts to receptors may occur.

AMSA have assessed the likelihood and risk of marine oil spill occurring in Australian waters (DNV 2011). The potential frequency of a spill from a vessel exceeding 100 tonnes in the Carnarvon OA was found to range from a 1 in 10 to a 1 in 100 year event within 50 nm of the coast where shipping traffic is greatest. These waters are representative of parts of the OA that overlap shipping fairways extending from the port of Port Hedland. The potential frequency of a similar spill occurring in waters in the Browse and Bonaparte OAs was found to range from a 1 in 100 to 1 in >10,000 year event (DNV 2011). However, these frequencies relate to a spill from any vessel during a year. The likelihood of a spill occurring from a seismic survey vessel would be lower due to the low speed and support vessel always in attendance with the seismic vessel to identify vessels coming close to the seismic vessel. To date there have no vessel collisions during a seismic survey in Australia. Therefore, the likelihood of a vessel collision resulting in a loss of a full tank of MDO/MGO is considered to be remote.

Potential impacts of MDO/MGO to receptors within the EMBA are provided in Table 7-62. For the purposes of this Section, 'EMBA' refers to the combined EMBAs and Operational Areas refers to the combined Carnarvon, Browse and Bonaparte OAs.

Table 7-62: Potential impacts to sensitive receptors within the EMBA

Receptor	Evaluation of Impacts
Plankton	Plankton are likely to be exposed to entrained hydrocarbons within the EMBA. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. Relatively low concentrations of hydrocarbon are toxic to zooplankton and fish eggs and larvae (ichthyoplankton). Plankton risk exposure through ingestion, inhalation, and dermal contact. The EMBA has the potential to overlap with spawning aggregations of some fishes and invertebrates. Given that different fish and invertebrates species spawn at different times of year, surveys covered by the CSEP have the potential to overlap with the spawning periods for some fish and invertebrate species. Plankton are numerous and widespread but do act as the basis for the marine food web, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have been re-established planktonic communities impacted by entrained hydrocarbons are expected to recover quickly (weeks/months) due to fast population turnover (ITOPF, 2011), and high rates of natural mortality. Given fast population turnover of open water planktonic populations it is considered that any potential impacts will be low and temporary in nature. The severity is assessed as Minor based on impacts are predicted to be short-term (weeks/months) and impact a small proportion of plankton. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Fishes and elasmobranchs	As detailed in Section 5.5.1 three sawfish species, whale shark and white shark were identified to undertake biologically important behaviour and/or have BIAs within the EMBA. River sharks, rays, syngnathid and commercial fish species were also identified as being present in the EMBA. Fishes and elasmobranchs may primarily be affected by dissolved and entrained hydrocarbons in the upper water column. Near the sea surface, fishes can detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from surface spills (Kennish 1997; Scholz et al.1992). In offshore waters near to the release point, demersal fishes are expected to be unaffected, as they will be at depths greater than near-surface hydrocarbons. Pelagic fish are potentially at risk of exposure to the more toxic aromatic components of marine diesel.

Receptor	Evaluation of Impacts
	The effects of dissolved and entrained hydrocarbon exposures to fishes may occur through ingestion or gill contamination. Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased incidence of irritation and infection (Couillard et al. 2005; Theodorakis et al. 2012). However, toxic effects to fishes are expected to be limited as pelagic are highly mobile species and mortalities resulting from hydrocarbon spills in open waters are generally rare (Burns et al. 2011). Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, mackerels, and sharks. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods of time, limiting the uptake of toxic aromatic compounds. Therefore, impacts to pelagic fishes from acute exposures to spilled hydrocarbons are expected to be limited. If pelagic fishes are affected, the effects are likely to be sub- lethal. The toxic components of the marine diesel would also rapidly weather and disperse so that concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. Demersal fishes surrounding offshore islands may be exposed to dissolved and entrained hydrocarbons. Large scale population level impacts to fish species, abundances, or assemblage composition, would be unlikely due to the wide geographical distribution of many Indo-Pacific fishes (Kuiter 1996, Allen 1997). Recovery would be dependent on the life cycle attributes of fishes. Species that are short lived, highly fecund and abundant (e.g., Scaridae and Acanthuridae) (Choat et al. 2004) may recover rapidly. However less abundant, long lived, predators (e.g., Serranidae) may take longer to recover. Sharks are long lived and produce relatively small number of young compared to bony fishes, meaning that populations may be slower to recover from the effects of oil than bony fish populations. Whale Sharks may be more susceptible to surface slicks compared to other shark species due to their feeding behaviour of filtering large amounts of water at the surface (Taylor, 2007). Individuals that have direct contact with hydrocarbons within the spill affected area may be impacted, but the duration of exposure to individuals will be temporary as they move through the spill area. Sawfish species have strong nearshore and estuarine habitat preferences, and although BIAs (foraging, juvenile, nursing, and pupping) for sawfish species exist within the EMBA, they are restricted to mainland coastal areas away from the OA where surface and water column concentrations are more likely to exceed the moderate thresholds.

Receptor	Evaluation of Impacts
	The severity is assessed as Minor based on impacts are predicted to be short-term (weeks/months) and impact a small proportion of fish and elasmobranchs. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Seabirds and shorebirds	As detailed in Section 5.5.2 numerous seabirds and shorebirds were identified to undertake biologically important behaviour and/or have BIAs within the EMBA. Seabirds and shorebirds can be exposed to hydrocarbons through direct contact and ingestion. Direct contact can compromise the insulation properties of their plumage, adversely affecting birds' ability to thermoregulate, resulting in hypothermia and pneumonia. Oiled feathers can also lead to a loss of buoyancy, resulting in drowning. If a bird is oiled, it instinctively tries to get the oil off its feathers by preening. This results in the animal ingesting the oil and damaging its internal organs. The focus on preening overrides all other natural behaviours, including evading predators and feeding, making the bird vulnerable to secondary health problems such as severe weight loss, anaemia and dehydration (International Bird Rescue 2017). These impacts are compounded if the bird is breeding, as it will tend to spend more time than usual to meet its own requirements, leaving eggs and chicks unattended and more susceptible to predation (Eppley 1992). Shorebirds are likely to be exposed to oil if the intertidal zone and onshore environment is oiled. Shorebird species foraging for invertebrates on exposed sand flats and intertidal platforms at lower tides will be at potential risk of both direct impacts through contamination of individual birds (ingestion or oiling of feathers) and indirect impacts through the contamination of foraging areas that may result in a reduction in available prey (Clarke 2010). The oiling of coastal habitat may also result in a loss of suitable nesting, roosting and/or foraging habitat and cause certain species to abandon nesting sites or to move and forage in other, potentially lower quality habitats (Henkel et al. 2012). Many seabird species spend much of their lives out at sea, coming into coastal areas to breed. Seabirds may be more vulnerable to offshore oil spills. Seabird species most at risk include those that readily rest on the sea surface and surface plunging species such as terns and boobies, which are found within the EMBA. Breeding seabirds may be directly exposed to oil via several potential pathways. Any direct impact of oil on terrestrial habitats, including the shorelines of islands and sandbanks has the potential to contaminate birds present at the breeding sites (Clarke 2010).

Receptor	Evaluation of Impacts
	Although numerous studies have shown such affects (including delayed breeding, reduced reproductive success and reduction on the proportion of breeding birds), data relating to the impacts of oil on seabirds or shorebirds in an Australian context is lacking. This is important to note, as subtle aspects of species biology and ecological interactions can determine the magnitude and direction of the impact on a species from an unplanned discharge. Sea surface exposures >10 g/m^2 are more likely to have the potential to impact seabirds present on the sea surface or foraging near the release site. Concentrations greater than this moderate threshold would be found closer to the spill source and only within 2-3 days of the spill, due to the rapid weathering of MDO/MGO. Low numbers of seabirds may be affected, and populations are not expected to be compromised. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Marine reptiles	As detailed in Section 5.5.3, the EMBA encompasses several BIAs and/or Habitat Critical for the survival of the species for marine turtles. No BIAs for sea snakes or salt-water crocodiles occur in the EMBA. The main pathways of hydrocarbon exposure to marine reptiles is through inhalation, ingestion, and physical contact. Marine reptiles surface regularly for respiration and to absorb solar radiation and recover from anaerobic activity (Hochscheid et al. 2010). Oil effects on turtles include negative impacts to the skin, blood, digestive and immune systems, and salt glands. All life stages of turtles are vulnerable to the effects of oil spills; however, eggs, embryos and hatchlings are likely to be more susceptible to volatile and water-soluble contaminants than adults. This is, in part, due to the metabolic machinery an animal uses to detoxify or cleanse itself of a contaminant is often not fully developed in younger life stages (Shigenaka et al 2010). Hydrocarbons that accumulate on the shore of nesting beaches may result in impacts to nesting adults, reduced hatching rates, or developmental abnormalities in hatchlings (French McCay 2016). Shoreline exposures of 100 g/m^2 or greater are considered to have the potential for lethal and sub-lethal effects, however due to the predicted weathering rates of MDO/MGO the lengths of coastline that may be impacted over this threshold is limited. Marine turtles take decades to reach maturity and females do not breed every season (Limpus 2007). Marine reptile biology and behaviour, including lack of avoidance behaviour, airbreathing requirements, low reproductive rates, and

Receptor	Evaluation of Impacts
	slow growth, predispose them to a high risk of impacts from unplanned discharges. Marine reptile species that may be particularly vulnerable to an unplanned discharge include those that have low dispersal abilities, highly restricted distributions, and specialist habitat preferences. The period between each successive clutch is known as the internesting period where they spend 2-3 months in the vicinity of the nesting beach (Guinea 2013). During internesting, turtles remain in shallow water close to the resting beach or rookery (DoEE 2017a). Turtles do not feed during the internesting period but will rest on the seabed (Plotkin et al. 1994, cited in Whiting et al. 2005). Towards the end of internesting, turtles spend less time resting on the seabed and more time near the surface (Hays et al., 1991; Hays et al., 1999; Houghton et al., 2002) during this period they maybe more susceptible from exposure to surface hydrocarbons, in particular the volatile components evaporating from the sea surface. During periods when turtles are at the sea surface, they may be more susceptible from exposure to surface hydrocarbons, in particular the volatile components evaporating from the sea surface. However, for MDO/MGO this is predicted to be with kilometres of the release location for the first day as the volatile components of the MDO/MGO evaporate. Any MDO/MGO that reached nesting beaches would be in a thin film and not predicted to be sticky and unlikely to move up the beach far enough to reach nesting sites. The greatest potential for lethal effects to turtles is limited to within a few kilometres of the release location for approximately the first day of the spill when surface exposures may exceed 50 g/m^2. Sub-lethal or lethal effects may also occur where surface hydrocarbon exposures exceed 10 g/m^2 which may occur up to 2-3 days after the spill. Turtles and sea snakes may also be exposed to dissolved and entrained hydrocarbons in the upper water column for short periods, which may cause eye irritation, but are unlikely to result in long term impacts given the relatively short exposure periods. Most sea snakes have low dispersal and slow swimming speeds, can be restricted to coastal and shallow water habitats and many also have small geographic ranges (Heatwole 1999, Sanders et al. 2015). Habitat specialisations are poorly known for sea snakes; however, many species are thought to be reef specialists (Sanders et al. 2015). As such, these species would be unable to avoid affected areas and disperse elsewhere during a spill. In addition, limited inter-population exchange would reduce the recovery potential for local populations that have experienced severe declines or have been lost (GBRMPA 2011).

Receptor	Evaluation of Impacts
	There is a significant lack of data available on the impacts of oil on the salt-water crocodile. Due to the migratory nature of the salt-water crocodile, it is unlikely that an oil spill would impact the entire species or result in long-term population impacts. The exception to this may be a large and prolonged discharge that affects breeding habitat. Beach sand temperature influences development and behaviour in marine turtle and saltwater crocodile eggs and hatchlings (Gilbert 2000). Hays et al. (2001) determined that subtle differences in sand colour or albedo can significantly affect underlying temperatures and could potentially change hatchling sex ratios. Even light surface oiling that does not necessarily penetrate directly to the eggs may affect the gender distribution in a population (Shigenaka 2010). The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Marine mammals (cetaceans)	As detailed in Section 5.5.4 the following cetaceans have a biologically important behaviour within the EMBA: • blue whale (Migration) • fin whale (Foraging) • humpback whale (Breeding) • Indo-Pacific humpback dolphin (Breeding) • sei whale (Foraging) As detailed in Section 5.5.4 BIAs were identified for the following cetaceans within the EMBA: • Australian snubfin dolphin (Breeding, Calving, Foraging) • blue whale (Foraging, Migration) • humpback whale (Calving, Nursing, Resting, Migration) • Indian Ocean bottlenose dolphin (Breeding, Calving, Foraging) • Indo-Pacific humpback dolphin (Breeding, Calving, Foraging) Additionally, the Omura's whale is reported to occur year round in the JBG (McCauley 2009, 2014). Cetaceans have a thickened epidermis that greatly reduces the likelihood of hydrocarbon toxicity from skin contact with oiled waters (Geraci and St Aubin, 1990). The main pathways of hydrocarbon exposure to cetaceans are likely to be from inhalation of volatiles during surfacing and from feeding. Baleen (mysticete) whale species, such as blue, fin

Receptor	Evaluation of Impacts
	and sei whales, are more at risk of ingesting hydrocarbons during feeding than toothed (odontocete) whales, due to their feeding techniques. Baleen whales are also susceptible to hydrocarbons which may foul their baleen fibres, impairing food gathering efficiency or resulting in the ingestion of hydrocarbons or prey that has been contaminated with hydrocarbons (Geraci and St Aubin, 1990). Baleen whales have several different feeding strategies, including gulping, skimming and bottom feeding. Different species feed at different depths of the water column and can be exposed to surface and dissolved hydrocarbons whilst feeding. Some baleen whales, particularly those with coastal migration and reproduction, display strong site fidelity to specific resting, breeding, and feeding habitats, as well as to their migratory paths (Jenner et al., 2001; DSEWPaC, 2012b). Of the key species in the EMBA, this behaviour is exhibited in humpback and pygmy blue whales. Additionally, the Omura's whale is reported to occur year round in the JBG (McCauley 2009, 2014). The most vulnerable toothed cetaceans are those that exhibit strong site fidelity. This includes the Indo-Pacific humpback dolphin, also found in the EMBA. There is conflicting evidence as to whether cetaceans can detect and avoid spilled oil. Matkin et al. 2008 indicated that whilst some cetaceans can detect spilled oil, studies indicate they do not avoid swimming through it. It is thought that the lack of an olfactory system may contribute to the difficulty cetaceans have in detecting oil (Matkin et al., 2008). Marine mammals are generally able to metabolise and excrete limited amounts of hydrocarbons, but acute or chronic exposure poses greater toxicological risks (Grant and Ross, 2002). Such impacts may include changes in behaviour and reduced activity, including inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci and St. Aubin, 1990). If spilled oil reaches biologically important habitats used for breeding, feeding, and resting, the pollution may disrupt natural behaviours, displace animals to less optimal areas, reduce foraging or reproductive success rates and increase mortality. If sufficiently high numbers are impacted, the greater population may experience reduced recovery and survival rates. MDO/MGO has a high evaporation rate and disperses rapidly in the marine environment, limiting the time whereby surface concentrations will exceed levels at the moderate threshold of >10 g/m2. The greatest potential for effects to cetaceans is limited to approximately the first day of the spill and no harmful exposures are expected after 2-3 days.

Receptor	Evaluation of Impacts
	Given the relatively localised and temporary areas exposed at concentrations that could impact cetaceans, only a limited number of cetaceans (e.g., individuals or small groups) may be exposed. The potential for lethal effects would be limited to significant inhalation or ingestion of hydrocarbons during the first few hours of the spill. Otherwise, effects are more likely to be sub-lethal, but may still result in tissue damage and disorders in some individuals. Low numbers of cetaceans may be affected, and populations are not expected to be compromised. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Marine mammals (dugongs)	As detailed in Section 5.5.4 dugong breeding and BIAs for breeding, calving, nursing and foraging occur within the EMBA. Little information has been published on the effects of oil on dugongs. There is some circumstantial evidence of approximately 150 dugong mortalities following an oil spill in the Arabian Gulf in 1983-84 and 14 reported dugong deaths during the 1991 Gulf War oil spill (Preen, 1988; Preen et al. 2012). Due to dugongs highly selective diet of specific seagrass species, impacts to seagrass availability may impact on dugong populations resulting in either displacement or reduction in reproductive potential (Preen and Marsh, 1995). The ability of a dugong population to recover from high levels of mortality, particularly in adults, is constrained by their population biology. Dugongs are long lived animals (they may live up to 70 years) and have a prolonged period until they reach sexual maturity (6-17 years), a long gestation (12-14 months), single offspring, and long intervals between births (more than 2.5 years) (Marsh et al. 1984). Fluctuations in the pregnancy rate and the age of the onset of reproduction are associated with the availability of seagrass (Sobtzick et al. 2012). This life history limits the reproductive potential of dugongs and high survival of animals, especially adults, is required for population growth or stability (Marsh et al. 2011). MDO/MGO has a high evaporation rate and disperses rapidly in the marine environment, limiting the time whereby surface concentrations will exceed levels at the moderate threshold of >10 g/m^2. The greatest potential for effects to dugongs is limited to approximately the first day of the spill and no harmful exposures are expected after 2-3 days.

Receptor	Evaluation of Impacts
	BIAs for dugongs exist within the EMBAs, however, they are restricted to mainland coastal areas away from the OA where surface and water column concentrations are more likely to exceed the moderate thresholds. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Marine mammals (pinnipeds)	As detailed in Section 5.5.4 Australian sea-lion breeding and BIAs for foraging, breeding and haul out occur within the Carnarvon EMBA. The New Zealand fur-seal may occur within the Carnarvon spill EMBA but has no BIAs. Pinnipeds are vulnerable to sea surface exposures given they spend much of their time on or near the surface of the water, as they need to surface every few minutes to breathe and regularly haul out on to beaches. Hook et al (2016) reports that seals appear not to be very sensitive to contact with oil, but instead to the toxic impacts from the inhalation of volatile components. Breeding colonies are particularly sensitive to hydrocarbon spills (Higgins & Gass, 1993). Pinnipeds are further at risk because of their tendency to stay near established colonies and haul-out areas and consequently are unlikely to practice oil avoidance behaviours. ITOPF (2011) report that species that rely on fur to regulate their body temperature (such as fur-seals) are the most vulnerable to oil as the animals may die from hypothermia or overheating, depending on the season, if the fur becomes matted with oil. MDO/MGO has a high evaporation rate and disperses rapidly in the marine environment, limiting the time whereby surface concentrations will exceed levels at the moderate threshold of >10 g/m^2. The greatest potential for effects to pinnipeds is limited to approximately the first day of the spill and no harmful exposures are expected after 2-3 days. BIAs for pinnipeds exist within the Carnarvon EMBA, however, they are restricted to coastal areas where surface and water column concentrations are not as likely to exceed the moderate thresholds. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).

Receptor	Evaluation of Impacts
Benthic communities	Benthic communities in water depths greater than 20 m are not predicted to be impacted by a MDO/MGO spill. As detailed in Section 5 the EMBA overlaps shoreline habitats, KEFs and marine parks that support a range of benthic habitats and communities which in turn support aggregations of marine life. A variety of benthic habitats occur within the spill EMBAs include: • seagrass habitats located in waters surrounding Shark Bay, Ningaloo Reef, Dampier Archipelago and Montebello and Barrow islands • coral reefs within located in waters surrounding Ashmore Reef, Cartier Island, Scott and Seringapatam reefs, Ningaloo Marine Park, the Montebello/Barrow/Lowendal islands, Shark Bay, Muiron Island, Dampier Archipelago, Glomar Shoals, Rankin Bank, Mermaid Reef, Rowley Shoals and the Abrolhos. • macroalgae throughout shallow areas. Shallow-water communities are generally at greater risk of exposure than deep-water communities (NRC 1985; WA DoT 2018). Exposure of entrained and dissolved hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate-to-high exposure thresholds (Loya & Rinkevich 1980; Shigenaka 2001; WA DoT 2018a), including increased mucus production, decreased growth rates, changes in feeding behaviours and expulsion of zooxanthellae (Peters et al. 1981; Knap et al. 1985). Adult coral colonies, injured by oil, may also be more susceptible to colonisation and overgrowth by algae or to epidemic diseases (Jackson et al. 1989). Lethal and sublethal effects of entrained and dissolved oils have been reported for coral gametes at much lesser concentrations than predicted for adult colonies (Heyward et al. 1994; Harrison 1999; Epstein, Bak & Rinkevich 2000). Goodbody-Gringley et al. (2013) found that exposure of coral larvae to oil and dispersants negatively impacted coral settlement and survival, thereby affecting reef resilience. A spill that occurred outside of a coral-spawning period may not affect coral planktonic stages. Studies undertaken after the Montara oil spill incident included diver surveys to assess the status of Ashmore, Cartier and Seringapatam coral reefs. These found that other than a region-wide coral bleaching event caused by thermal stress (i.e. caused by sea water exceeding 32°C), the condition of the reefs was consistent with previous surveys, suggesting that any effects of oil reaching these reefs was minor, transitory or sub-lethal and not detectable (Heyward et al. 2010). This is despite AMSA observations of surface slicks or sheen nears these shallow reefs during the spill (Heyward et al. 2010). Surveys in 2011 indicated that the corals exhibiting bleaching in 2010 had largely survived and

Receptor	Evaluation of Impacts
	recovered (Heyward et al. 2012), indicating that potential exposure to hydrocarbons while in an already stressed state did not have any impact on the healthy recovery of the coral. Entrained and dissolved hydrocarbons have the potential to affect seagrasses and macroalgae through toxicity impacts. The hydrophobic nature of hydrocarbon molecules allows them to concentrate in membranes of aquatic plants. Hence the thylakoid membrane (an integral component of the photosynthetic apparatus) is susceptible to oil accumulation, potentially resulting in reduced photosynthetic activity (Runcie & Riddle 2006). However, a layer of mucilage present on most species of seagrass prevents the penetration of toxic aromatic fractions (AMSA 2019). Although seagrass and macroalgae may be subject to lethal or sublethal toxic effects, including mortality, reduced growth rates, and impacts to seagrass flowering, several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al 1981; Burns et al. 1993; Dean et al. 1998; Runcie & Riddle 2006). For algae, this could be attributed to new growth being produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are lost. For seagrasses this may be because 50–80% of their biomass is in their rhizomes, which are buried in sediments, thus less likely to be adversely impacted by hydrocarbons (Zieman et al. 1984). It has been reported by Taylor and Rasheed (2011) that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Shoreline habitats	As detailed in Section 5 the EMBA overlaps a wide variety of shorelines along the WA, NT, Indonesian and Timor Leste coasts and offshore islands. Shoreline habitats which have the potential to be contacted by a MDO/MGO spill include coral reefs, cays, sandy shorelines, rocky shorelines, intertidal mud/sandflats, saltmarsh, mangroves and internationally (RAMSAR) and nationally important wetlands. The amount of MDO/MGO that may come ashore will be depended on the how far the seismic survey is from shorelines and the prevailing wind and currents. Sandy beaches are regularly exposed to wave action and have low sediment total organic carbon and therefore generally a low abundance of marine life (Hook et al. 2016). The low concentration of total organic carbon and large particle size of sand means that any MDO deposited on the beach would not be retained. However, sandy beaches are important socio-economically, so an MDO spill reaching this type of shoreline may attract attention that is disproportionate to its sensitivity (Hook et al. 2016).

Receptor	Evaluation of Impacts
	Depth of penetration in sandy sediment is influenced by: • Particle size - penetration is great in coarser sediments (such as beach sand) compared to mud (in estuaries and tidal flats). • Oil viscosity – MDO quickly penetrates sandy sediments. • Drainage – coarse beach sands allow for rapid drainage (it may reach depths greater than one metre in coarse well-drained sediments). • Animal burrows and root pores – penetration into fine sediments is increased if there are burrows of animals such as worms, or pores left where plant roots have decayed. Areas of heavy oiling (>1,000 g/m^2 threshold) would likely result in acute toxicity, and death, of many invertebrate communities, especially where oil penetrates sediments through animal burrows (IPIECA 1999). However, these communities would be likely to rapidly recover (recruitment from unaffected individuals and recruitment from nearby areas) as oil is removed from the environment. The results of exposure to oil may be acute (e.g., die off of amphipods and replacement by more tolerant species such as worms or chronic (i.e., gradual accumulation of oil and genetic damage) (Hook et al. 2016). Cracks and crevices, rock pools, overhangs and other shaded areas provide habitat for soft bodied animals such as sea anemones, sponges, and sea- squirts, and become places where hydrocarbons can become concentrated as it strands ashore. The same is true on stable boulder shores where the rich animal communities underneath the rocks are also the most vulnerable to hydrocarbon pollution. The vulnerability of a rocky shoreline to oiling is dependent on its topography and composition as well as its position. A vertical rock wall on a wave- exposed coast is likely to remain unoiled if an oil slick is held back by the action of the reflected waves (IPIECA-IOGP 2016). At the other extreme, a gradually sloping boulder shore in a calm backwater of a sheltered inlet can trap enormous amounts of hydrocarbons, which may penetrate deep down through the substratum. The complex patterns of water movement close to rocky coasts also tend to concentrate oil in certain areas. Some shores are well known to act as natural collection sites for litter and detached algae and oil is carried there in the same way. As on all types of shorelines, most of the oil is concentrated along the high tide mark while the lower parts are often untouched. As MDO/MGO is less sticky than other oils it is less likely to adhere to rocky shorelines and creates stains.

Receptor	Evaluation of Impacts
	Saltmarshes are considered to have a high sensitivity to hydrocarbon exposure. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are very variable. In areas of light to moderate oiling where oil is mainly on perennial vegetation with little penetration of sediment, the shoots of the plants may be killed but recovery can take place from the underground systems. However, many case studies have shown good recruitment of annual species in the year following a spill (IPIECA-IOGP 2016). Mangrove communities are susceptible to entrained oil exposure, with potential impacts, including defoliation and mortality. A study by Duke (2000), on the use of dispersant on surface spills, resulting in an increase in the entrainment of oil showed a positive benefit to mangroves. Therefore, the impacts of entrained/dissolved oil on mangroves is expected to be less than the impacts predicted from surface oiling (Burns et al. 1993; Duke et al. 2000). Exposure of entrained and dissolved hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Loya & Rinkevich 1980; Shigenaka 2001). Potential effects include increased mucus production, impaired respiration and photosynthesis by zooxanthellae, decreased growth rates, tissue decomposition, decline in metabolic rates, and expulsion of zooxanthellae (Peters et al. 1981; Knap et al. 1985; Negri and Heyward 2000). Adult coral colonies, injured by oil, may also be more susceptible to colonisation and overgrowth by algae or to epidemic diseases (Jackson et al. 1989). However, such effects occur as a result of prolonged exposure and corals are not considered to be acutely sensitive to short-term elevations in oil concentrations (IPIECA-IOGP 2015). Nationally and internationally important wetlands within the EMBA have continuity with the sea, including saline marsh areas and estuarine environments that support large numbers of water birds. Wetlands are considered to have a high sensitivity to hydrocarbon exposure. Wetland vegetation (which can include saltmarsh and other estuarine plants) typically have a large surface area for oil absorption and their structure traps oil. The degree of impact of oil on wetland vegetation are variable and complex, and can be both acute and chronic, ranging from short-term disruption of plant functioning to mortality. Spills reaching wetlands during the growing season will have a more severe impact than if oil reaches wetlands during the times when many plant species are dormant. Wetland habitat can be of particular importance for some species of birds, fish and invertebrates. As such, in addition to direct impacts on plants, oil that reaches wetlands also affects these fauna utilising wetlands during their life cycle. Refer to seabirds and shorebirds assessments.

Receptor	Evaluation of Impacts
	The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Key Ecological Features	As detailed in Section 5.3 the EMBAs overlap several KEFs. The majority of the KEFs are submerged features in water depths greater than 20 m so would not be affected by a MDO/MGO spill. KEFS based on islands and reefs such Ashmore Reef, Cartier Island, Rowley Shoals (Clerke, Imperieuse and Mermaid reefs), Scott and Seringapatam reefs provide hard substrates that support a range of benthic habitats and communities which in turn support aggregations of marine life. The values and sensitivities of the KEFs are generally related to benthic habitats and communities which support areas of enhanced diversity and productivity. A loss of MDO/MGO to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column and therefore impacts to the habitats of the KEFs is not considered likely. Impacts to sensitivities within shorelines and benthic communities in water depths less than 20 m are outlined in the receptors above. The severity is assessed as Moderate based on impacts are predicted to have a temporary effect on critical habitats/ activities with no threat to population viability. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Protected Areas	As detailed in Section 5.2 the EMBA overlap several Australian and State and Territory Marine Parks including the coastal areas of the Kakadu National Park World Heritage Area, Ningaloo Coast World Heritage Area and Shark Bay World Heritage Area. Marine protected areas may be vulnerable to oil exposure from a spill event. As the values and sensitivities of these protected places are a combination of quality, habitat, marine fauna and flora, and human use, the impact pathways are varied.
Heritage values	As detailed in Section 5.2.2 and 5.2.7 the EMBA overlap several Commonwealth and National Heritage Places and numerous shipwrecks in offshore and coastal waters. Heritage listed places may be vulnerable to oil exposure from a spill event. As the values and sensitivities of these heritage places are a combination of quality, habitat, marine fauna and flora, and human use, the impact pathways

Receptor	Evaluation of Impacts
	are varied. Refer to the impact assessments for related receptors, including benthic communities, shoreline habitat and marine fauna. The direct and indirect impacts of oil on shipwrecks is not well understood. The marine life supported by shipwrecks is often founded on microbial communities that not only have their own biodiversity value but can potentially help prevent the degradation of the material they grow on (Hamdan et al. 2018). However, Choi et al (2016) found that exposure to oil spurred microbes to increase metal corrosion, suggesting that the oil could potentially speed up degradation of steel-hulled wrecks. Shipwrecks located in in water depths greater than 20 m would not be affected by an MDO/MGO spill. For shipwrecks the severity is assessed as Slight based on impacts are predicted to have a slight to negligible effect on Slight to negligible effects on aesthetic, economic or recreational values. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Cultural heritage	As detailed in Section 5.2.3 and 5.2.4 the EMBA overlaps several coastal areas of Indigenous Protected Areas and areas within marine parks and outside of marine parks where the indigenous groups have responsibility for sea country. Coastal areas of northern Australia are used for fishing, hunting and the maintenance of maritime cultures and heritage through ritual, stories, and traditional knowledge. The level of activities undertaken by indigenous users is expected to be low, therefore interference due to an MDO/MGO spill are likely to be minimal. In the event there is a requirement for land based response activities or disturbances, the Titleholder will need to contact relevant representatives. The severity is assessed as Minor based on impacts are predicted to be localised, short-term (weeks/months) effects with full recovery. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Fisheries	As detailed in Section 5.8 the EMBA overlaps commercial fisheries for fish and invertebrates. MDO/MGO in the water column can have toxic effects on fish (as outlined in 'fish and elasmobranchs') reducing catch rates and rendering fish unsafe for consumption. However, many fish species can metabolize toxic hydrocarbons, which reduce the risk of bioaccumulation of contaminants in the food web (and human exposure to contaminants through the consumption of seafood) (NRDA 2012).

Receptor	Evaluation of Impacts
	The level of impact to a fishery would be dependent on seasonal performance of the fishery, and nature of impact (e.g., fresh oil v's weathered oil, concentrations of hydrocarbons). Due to the geographic scale of some fisheries, the level of impact would also not be consistent across the whole fishery. Commercial fisheries may be impacted via: • Fishing closures, which may occur at locations where hydrocarbons are below levels that cause environmental harm, but where visible sheens on the sea surface result in perceived impacts and closure as a precautionary measure. • Fouling of fishing gear and vessels with hydrocarbons in close proximity to the spill site. • Stakeholder and public perception that target fish and products may be affected by spilled hydrocarbons. Such events could potentially lead to subsequent economic impacts on commercial fishing and pearling operators and seafood distributors. Visible hydrocarbons on the sea surface may persist for several days so any potential closures will be temporary (for example 1-2 weeks). The extent of visible hydrocarbons will also be limited relative to the fishing grounds available to each of the fisheries. However, some temporary economic impacts are possible. The severity is assessed as Minor based on impacts are predicted to be localised, short-term (weeks/months) effects with full recovery. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Tourism and recreation	As detailed in Section 5.7.5 tourism is a significant industry across the EMBAs with several regions highly dependent on the revenue this industry generates as well as the direct and indirect contribution to employment. Important tourism sectors in the EMBA include nature/wildlife-based experiences, Indigenous experiences, festivals and events and fishing, sightseeing, snorkelling, and diving charters. The level of impact to tourism sectors would be influenced by existing seasonal performance and nature of impact (direct or indirect e.g., directly if unable to conduct charters due to oil on water or shorelines or indirectly due to reduced tourists to an area). Any disruption to activities such as vessel activities, fishing and diving can have follow-on effects on accommodation, tourism business and other companies who gain their livelihood from tourism. However, given the limited exposure and predicted impact to ecological receptors, this type of impact is not expected to occur.

Receptor	Evaluation of Impacts
	MDO/MGO has a high evaporation rate and disperses rapidly in the marine environment, Visible hydrocarbons on the sea surface may persist for several days so any potential closures will be temporary (for example 1-2 weeks). The severity is assessed as Minor based on impacts are predicted to be minor and temporary effects on aesthetic, economic or recreational values. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Shipping	As described in Section 5.7.1 shipping occurs within the EMBA from ports in Darwin, Derby, Cockatoo Island and Koolan Island, Port Hedland, Broome, and Dampier. Ships may be directed to avoid an area where there is a visible slick. As visible hydrocarbons on the sea surface may persist for several days potential diversions would be temporary. Oil spills can lead to a shutdown of port operations, resulting in disruption to the import and export of goods. This can have considerable flow on effects to the regional economy. Ports are also likely to be utilised for oil spill response operations, resulting in ongoing disruption to port operations after the immediate threat of the spill has passed. Oily water can also affect water intakes used to cool the vessel engines. It is unlikely that high concentrations of hydrocarbons will be found in port waters, due to the distance from the OA and rapid weathering of MDO/MGO. In addition, due to the short duration of the surface exposure, deviation of shipping traffic in open waters would be temporary. The severity is assessed as Minor based on impacts are predicted to be minor and temporary effects on aesthetic, economic or recreational values. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).
Defence Areas	As detailed in Section 5.7.7 there are several Department of Defence Training Areas and Practice Areas within the EMBA. Due to the nature of defence activities and rapid weathering of MDO/MGO, interference from a spill is likely to be temporary and localised. The severity is assessed as Minor based on impacts are predicted to be minor and temporary effects on aesthetic, economic or recreational values. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).

Receptor	Evaluation of Impacts
Industry	As described in Section 5.7.4 there are petroleum exploration activities and production facilities that operate within the EMBA. Oil spills are unlikely to have adverse impacts on offshore petroleum infrastructure as it is designed to operate safely in an environment where there is a risk, although low, of oil contaminating surrounding waters. The severity is assessed as Minor based on impacts are predicted to be minor and temporary effects on aesthetic, economic or recreational values. The likelihood of this consequence with controls in place is Remote with a residual risk of Low (4).

7.10.3 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-63: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Risk is ranked low to medium.	Highest risk ranking is assessed as low.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	The assessment is based on peer reviewed and published literature.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	The Recovery Plan for Marine Turtles in Australia (DoEE 2017) identifies oil ls spills as a threat, with the relevant management action of ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g., nesting habitat, seagrass meadows or coral reefs. Section 7.11 details the impact assessment of spill response options and considers the presence of turtles and turtle habitats. The conservation advice and management plans for blue (DoE 2015), humpback (TSSC 2015k), sei (TSSC 2015i) and fin (TSSC 2015j) whales identify hydrocarbon spills as threats, though there are no specific actions to address this. Several shorebird and seabird conservation advice identify pollution and oil spills as a threat, though there are no specific actions to address this. Legislative and best practice requirements in relation to unplanned hydrocarbon releases adopted are: • National Plan for Maritime Environmental Emergencies • Marine Order 21 (Safety and emergency procedures) • Marine Order 30 (Prevention of collisions) • Marine Order 31 (SOLAS and non-SOLAS certification)	Yes

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	Level		
		• Marine Order 91 (Marine pollution prevention – oil) • Navigation Act 2012	
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the EP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Consultation has been undertaken with the NT, WA, and Commonwealth government agencies responsible for a vessel oil spill and comments in relation to the OPEP have been addressed.	Yes

7.10.4 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-64 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-64: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted

CM#2: Operational Protocol
CM#29: Marine Users Survey Notifications
	The following will be implemented to inform and notify marine users of seismic survey to be conducted under the CSEP:
	• Online portal for CSEP updates and seismic survey schedules.
	• 3 month "Notification of Intent" to conduct a seismic survey.
	• Potentially affected marine users will also be advised:
	  ❍ As soon as any changes to planned survey details or commencement timing become apparent, and
	  ❍ Survey commencement date estimate not less than 10 days prior to mobilisation.
	• Ongoing consultation and survey notifications as per Section 6.4 Summary of Stakeholder Consultation
	• Appendix G provides a summary of the stakeholder consultation undertaken as part of the development of the CSEP. The summary provides details of the information sent to stakeholders and any response received. It also details the assessment undertaken of any objection or claims. Where an objection or claim was substantiated via evidence such as publicly available credible information and/or scientific or fishing data, it was assessed as per the impact and risk evaluation process detail in Section 2 and controls applied where appropriate to ensure impacts and risks are managed to ALARP and an acceptable level.
	Where an objection or claim was raised by a stakeholder, they were provided feedback as to:
	• whether the objection or claim was substantiated.
	• how the objection or claim was evaluated.
	• if additional controls were required to manage the impact or risk to ALARP and an acceptable level.
	• if the objection or claim was not substantiated and the reasons why.
	• Ongoing Stakeholder Consultation and Notifications.
	• Regular on-water vessel communications including daily updates.
		Yes

CM#37: Spill Containment	Materials and equipment that have the potential to spill onto the deck or marine environment are within a contained area.	Yes

Control Measure	Justification	Adopted
CM#38: Refuelling procedure	Vessels will have a refuelling procedure detailing: • weather conditions and locations where refuelling can occur such as outside of marine parks. • pre- and during refuelling checks to reduce spill events.	Yes
CM#26: Support Vessel	At least one support vessel will accompany the seismic survey vessel when in operation to manage interactions with other marine users.	Yes
CM#28: Navigation Act and Marine Orders	Seismic survey vessel will adhere to the requirements of the International Regulations for Preventing Collisions as Sea 1972 (COLREGS) and Chapter 5 of Safety of Life at Sea (SOLAS) as implemented in Commonwealth Waters through the Navigation Act 2012 and associated Marine Orders 21 Safety and Emergency Arrangements, 30 Prevention of Collisions and 31 SOLAS and non-SOLAS certification including: • Appropriate lighting, navigation, and communication to inform other users. • Use of radar and 24/7 watch.	Yes
CM#36: AIS Transponders	Vessels and streamer tail buoys will have functioning Automated Identification System (AIS). AIS transponders transmit key information to all vessels able to receive AIS data and will include details such as vessel GPS position, identity, type, speed, course, and caution notes. The AIS system will also receive AIS information from other vessels in the area.	Yes
CM#39: SMPEP or equivalent	Vessels hold an approved and tested SOPEP or SMPEP and crew are trained in its implementation. Spill response kits located in high spill risk areas and routinely checked to ensure adequate.	Yes
CM#40: Oil Pollution Emergency Plan (OPEP)	Oil spill response capability is maintained in accordance with the in-force OPEP. Oil spill response is implemented as per the in-force OPEP.	Yes
CM#41: Operational & scientific monitoring Plan (OSMP)	Operational and scientific monitoring capability is maintained in accordance with the OSMP. Operational and scientific monitoring is implemented as per the in-force OPEP.	Yes
Eliminate or substitute the use of MDO/MGO	MDO/MGO presents a lower risk to the environment than Heavy Fuel Oil or bunker fuel oil. No other lower risk alternative fuels are readily available.	No

7.11 Impact: Spill response activities

7.11.1 Source of impact

In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. Section 4 of the OPEP outlines the spill response strategies that may be employed (according to the nature and scale of the spill) in the event of a hydrocarbon spill;

- Source control
- Monitor and evaluate
- Protection and deflection
- Shoreline clean-up
- Oiled wildlife response
- Scientific monitoring.

The selection of strategies in the event of a spill will be confirmed through an Operational Spill Impact Mitigation Analysis (SIMA) process, outlined in Section 4 of the OPEP. The OPEP also provides detail on how response strategies will be implemented.

Whilst the aim of response strategies is to reduce impacts from the spill, there is the potential for response activities to exacerbate or create additional impacts. Poorly selected or implemented spill response activities may not have a net environmental benefit and create more harm than the hydrocarbon itself.

7.11.2 Impact Pathway

Spill response activities in offshore and nearshore waters will be undertaken using vessels with the impacts and risks consistent those assessed in in Section 7. Controls identified in Section 7 relevant to vessels will be implemented for spill response activities. Thus, impacts and risks associated with vessels are not discussed further in this section.

Spill response activities on shorelines, in addition to using vessels, will use vehicles and may utilise a range of equipment. Impacts associated with shoreline spill response activities are:

- Physical presence and disturbance
- Disruption to other users and townships
- Acoustic emissions
- Light emissions

7.11.3 Predicted Level of Impact

7.11.3.1 Physical presence and disturbance

The movement and operation of vehicles, personnel, and equipment, undertaking of clean-up activities and the set-up of temporary camp areas during spill response activities has the potential to disturb the physical environment and marine/coastal habitats and fauna, which may include those habitats and fauna within protected areas. Disturbance may also impact cultural and amenity values of an area. Vehicle and equipment movement could spread non-indigenous flora and fauna.

Oiled wildlife response activities may involve deliberate disturbance (hazing), capture, handling, cleaning, rehabilitation, and release of wildlife which could lead to additional impacts to wildlife.

Vehicles, equipment, personnel presence, and cleaning activities during shoreline response activities have the potential to damage coastal habitats such as dune vegetation, mangroves, and habitats important to threatened and migratory fauna including nests of turtles and birds and bird roosting/feeding areas. Shoreline clean-up may involve the physical removal of substrates that could cause impact to habitats and coastal hydrodynamics and alter erosion/accretion rates. As with vessel use, an assessment of appropriate vehicles and equipment to reduce habitat damage, along with the establishment of access routes/demarcation zones, and operational restrictions on equipment/vehicles use will limit sensitive habitat damage and damage to important fauna areas.

The deployment of booms to protect shorelines and intertidal environments could potentially cause physical damage to coral reefs/intertidal ecosystems through the movement of the booms and/or anchors. Booms can also create a physical barrier on the surface waters that has the potential to injure or entangle passing marine fauna that are either surface breathing or feeding.

The presence of camp areas, although relatively short-term, may disrupt normal behaviour of coastal species such as shorebirds and turtles, and could potentially interfere with nesting and feeding behaviours. Temporary camp areas will be established under the direction of the WA DoT, DBCA and/or NT IMT (depending on jurisdiction), with suitable advice sought if access is needed to culturally significant areas.

Oiled wildlife response may include the hazing, capture, handling, transportation, cleaning, and release of wildlife susceptible to oiling such as birds and marine turtles. While oiled wildlife response is aimed at having a net benefit, poor responses can potentially create additional stress and exacerbate impacts from oiling, interfering with life-cycle processes, hampering recovery and in the worst instance increasing levels of mortality.

Invasive terrestrial species can out-compete local species (for example, weeds) and interfere with ecosystem processes. Non-native species may be transported attached to equipment, vehicles, and clothing. Such an introduction would be especially detrimental to wilderness areas or protected terrestrial reserves which may have a relatively undisturbed flora and fauna community.

The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow on impacts to socio-economic values and industry (for example, tourism, fisheries).

The consequence rating for impacts to fauna is assessed as Minor (2) based on impacts are predicted to be localised, short term effect with recovery in the timescale of months to <5 years.

7.11.3.2 Disruption to other users and townships

Spill response activities may involve the use of vessels, aircraft, equipment and vehicles, and the establishment of temporary camps, in areas used by the public or industry. The mobilisation of spill response personnel into an affected area may also place increased demands on local accommodation and other businesses.

The use of vessels in the nearshore and offshore environment and the undertaking of spill response activities at shoreline locations may exclude the public and industry use of the affected environment. As well as impacting leisure activities of the public, this may impact on revenue with respect to industries such as tourism and commercial fishing. The mobilisation of personnel to small communities has the potential to affect the local community through demands on local accommodation and business, reducing the availability of services to members of the public.

The consequence rating for impacts to fauna is assessed as Slight (1) based on impacts are predicted to be localised and temporary effects.

7.11.3.3 Acoustic emissions

Onshore spill response activities will involve the use of equipment on coastal areas during clean-up of shorelines (e.g., pumps, generators and vehicles), and for accessing shoreline areas (e.g. vehicles).

Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna including protected and migratory species of shorebirds and seabirds. Noise and vibration may affect bird breeding and nesting behaviours and disrupt feeding activity. This could potentially impact reproductive success and for migratory shorebirds may negatively impact the ability to replenish energy reserves for migratory flights. However, if the shoreline is oiled, this may be beneficial by acting as a deterrent for coastal fauna and prevent oiling.

Noise impacts to fauna during spill response activities are unlikely to be significant enough to cause flow on impacts to reliant industries such as tourism and commercial fishing.

The consequence rating for impacts to fauna is assessed as Slight (1) based on impacts are predicted to be localised and temporary effects.

7.11.3.4 Light emissions

Shoreline response activities may require use of lighting which can cause disorientation, disruption to nesting and breeding behaviours in seabirds, shorebirds, and turtles.

Shoreline clean-up, shoreline protection and oiled wildlife staging areas will be managed to minimise impacts on turtles (including hatchlings) and birds through minimising disturbance to nesting and feeding sites. However, due to the safety implications associated with dangerous marine fauna (e.g., saltwater crocodiles) in much of the EMBA, it is unlikely that operations will be conducted at night. An assessment of the need to conduct night-time operations in sensitive areas will be made via and Operational SIMA and operational restrictions on lighting established if night-time operations are required.

The consequence rating for impacts to fauna is assessed as Slight (1) based on impacts are predicted to be localised and temporary effects.

7.11.4 Comparison of Predicted Level of Impact with Defined Acceptable Levels

This section reviews the predicted level of impact with the defined acceptable level.

Table 7-65: Assessment of Predicted Level of Impact with Defined Acceptable Level

Defined Acceptable Level		Predicted Level of Impact	Predicted Level of Impact Below Defined Acceptable level?
Criteria	**Level**		
Principles of ESD	Impact consequence category is Moderate or below.	Highest impact consequence is assessed as Minor.	Yes
	The precautionary principle is applied in the presence of scientific uncertainty.	There is no scientific uncertainty associated with this impact.	Yes
Environment requirements	Management of the activity is consistent with legislation and other requirements including conservation advice, recovery plans, management plans and industry best practice guidance.	The proposed response activities and controls are compliant with industry standards and relevant Australian legislation/guidance, including: • National Plan (AMSA 2020) • Western Australian State Hazard Plan – Maritime Environmental Emergencies (Government of Western Australia 2020) • DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: response and Consultation Arrangement July 2020 • ITOPF Technical Information Papers • IPIECA International Association of Oil and Gas Producers Good Practice Guide Series.	Yes
Internal Context	Management of the activity is consistent with the CSEP evaluation process and implementation strategy.	The activity will be managed as per the controls identified within this section of the EP and the implementation strategy.	Yes
External Context	Relevant persons objections or claims have been assessed, responded to and controls adopted for objections and claims which have merit.	Consultation has been undertaken with the NT, WA, and Commonwealth government agencies responsible for a vessel oil spill and comments in relation to the OPEP have been addressed.	Yes

7.11.5 Identification of Controls and Demonstration of ALARP

Control measures are adopted to ensure that environmental impacts will be of an acceptable level and ALARP. Table 7-66 details the controls that will be implemented and those that were reviewed and not adopted.

Table 7-66: Identification of Controls and Demonstration of ALARP

Control Measure	Justification	Adopted
CM#40: Oil Pollution Emergency Plan (OPEP)	The OPEP details that an Operational SIMA is to be developed to manage impacts and risks from the selected oil spill response strategies to ensure that the response strategies result in a net environmental benefit. The Operational SIMA will be prepared with the Control Agency and with input from other relevant departments depending on the predicted reports that may be impacted (i.e. Director of National Parks).	Yes
Use of noise reduction barriers for portable equipment on shorelines	Sound levels from portable equipment not expected to warrant additional costs and potential delays related to applying specialised sound control barriers	No

7.12 Environmental performance outcomes, standards and measurement criteria

Table 7-67: CSEP Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
EPO1: No change in sustainability of the fish stock associated with individual or cumulative seismic surveys. **EPO2:** No loss of catch to commercial fishers from individual or cumulative seismic surveys. **EPO3:** No increased cost or loss of income to fishers from displacement or damage to fishing gear. **EPO4**: Undertake the activity in a manner that will not interfere with other marine users to a greater extent than is necessary	CM#1: Annual Fisheries Review	The sustainability of commercial fisheries will be reviewed annually to identify changes to stock status. The review will be undertaken by reviewing the following reports: • Status of Australian Fish Stock Report. • Status of Key Northern Territory Fish Stocks Report. • Status Reports of the Fisheries and Aquatic Resources of Western Australia. The review of e ach report will be undertaken with a month of the report being publicly release. Where changes are identified consultation will be undertaken with the relevant fishery manager, licence holders and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant fishery fished area.	Documented sustainability of fisheries review Consultation record Application of additional controls	CSEP Consortium Steering Committee
		Where changes to a commercial fishing licence holder's catch are reported to a CSEP titleholder in connection with a seismic survey conducted under the CSEP, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to discuss and evaluate the available information.	Consultation record	Titleholder
	CM#2: Operational Protocol	The Commercial Fishing Operational Protocol (Appendix C) will be implemented for all seismic surveys conducted under the CSEP.	Operational Protocol implementation records	CSEP Consortium Steering Committee Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
for the exercise of right conferred by the titles granted.	CM#5: Adjustment Protocol	The Commercial Fishing Adjustment Protocol (Appendix D) will be implemented for all seismic surveys conducted under the CSEP.	Adjustment Protocol implementation records	CSEP Consortium Steering Committee Titleholder
	CM#3: Seismic Source	The acoustic modelling used in the impact assessment consisted of modelling with the maximum seismic source of 4,130 cui, thus this will be the maximum seismic source that can be used for a seismic survey conducted under the CSEP.	Survey records	Titleholder
	CM#4: Reef Fish Protection Areas	Seismic surveys will not be undertaken within Reef Fish Protection Areas during spawning periods as detailed in Table 4-1.	Survey records Reef Fish Protection Areas on survey acquisition maps and in vessels navigation system.	Titleholder Vessel Master
	CM#26: Support Vessel	At least one support vessel will accompany the seismic survey vessel when in operation to manage interactions with other marine users and look ahead for fisher gear.	Survey records	Titleholder
	CM#36: AIS Transponders	Vessels and streamer tail buoy will have functioning Automated Identification System (AIS).	Survey records Vessel records	Titleholder Vessel Master
	CM#28: Navigation Act and Marine Orders	Seismic survey vessel will adhere to Marine Orders 21 Safety and Emergency Arrangements, 30 Prevention of Collisions and 31 SOLAS and non-SOLAS certification including: • Appropriate lighting, navigation, and communication to inform other users. • Use of radar and 24/7 watch.	Vessel records	Vessel Master
	CM#29: Marine Users Survey Notifications	The following will be implemented to inform and notify marine users of seismic survey to be conducted under the CSEP:	Consultation records Online portal	Titleholder Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person

		• Online portal for CSEP updates and seismic survey schedules.
		• 3 month "Notification of Intent" to conduct a seismic survey using the standardised form in Appendix A of the Operational Protocol (also see CM#2: Operational Protocol).
		• Potentially affected marine users will also be advised:
		  ○ As soon as any changes to planned survey details or commencement timing become apparent, and
		  ○ Survey commencement date estimate not less than 10 days prior to mobilisation.
		• Ongoing consultation and survey notifications as per 6.5.
		• Regular on-water vessel communications including daily updates.		

EPO5: No death or injury to fauna, including listed threatened or migratory species, from the activity. **EPO6:** Noise emissions in BIAs will be managed such that any whale, including blue whales, continues to utilise the area without injury, and is not displaced from a foraging area.	CM#6 NCWHA Exclusion Zone	The acoustic source will not be operated within 70 km of the Ningaloo Coast World Heritage Area (NCWHA).	Survey records NCWHA Exclusion Zone on survey acquisition maps and in vessels navigation system	Titleholder Vessel Master
	CM#8: Exclusion Zone – banks and shoals	The seismic source will not be operated within 350 m horizontal distance of the 60 m contour of any bank and shoal. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the Group II fish mortality or injury criteria is less than 300 m. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. For a seismic survey: • A bank or shoal is defined as an identified banks or shoals as detailed in Figure 5-18, Figure 5-19 and Figure 5-20.	Survey records Banks and Shoals Exclusion Zones on survey acquisition maps and in vessels navigation system	Titleholder Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
EPO7: Biologically important behaviours within a BIA or outside a BIA can continue while the activity is being undertaken.		• The 60 m contour of a bank or shoal will be identified using the data from the most recent version of the Geoscience Australia Northern Australian High Resolution Bathymetry Model.		
	CM#9: Turtle Exclusion Zone	The seismic source will not be operated within 3 km of a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species during the periods when they are undertaking those activities within the BIA or habitat critical for the survival of the species as defined in the Recovery Plan for Marine Turtles in Australia (DoEE 2017) and/or National Conservation Values Atlas if the information is not available in the recovery plan. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the PTS, TTS or behavioural disturbance criteria is less than 3 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management.	Survey records Survey specific underwater acoustic modelling report Turtle Exclusion Zones on survey acquisition maps and in vessels navigation system	Titleholder Vessel Master

	CM#14: Marine Mammal Exclusion Zones	***Humpback whales***
		There will be no operation of the seismic source within 100 km of a humpback whale BIA during the following periods:
		• Exmouth Gulf BIA: August to end of November.
		• Kimberley BIA: August to the end of September.
		• Migration BIA:
		  o Carnarvon OA June to the end of November.
		  o Browse OA June to end of September.
		Pygmy blue whales
			Survey records
			MFO Records
			Survey specific underwater acoustic modelling report
			Marine Mammal Exclusion Zones on survey acquisition maps and in vessels navigation system
				Titleholder
				Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
		There will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December. These exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. ***Dugong and Dolphin*** There will be no operation of the seismic source within 20 km of a dugong or dolphin BIA. This exclusion zone may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a dugong or dolphin sound effect criteria is less than 20 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management.		
	CM#10: EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Operational Protocol	EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales: Industry Guidelines Part A will be applied to all seismic surveys conducted under the CSEP.	Survey records MFO Records	Titleholder
		Two dedicated marine fauna observers (MFO) will be on the seismic survey vessel to implement EPBC Act Policy Statement 2.1 and additional controls to manage impacts to marine fauna. • One MFO will be on watch during daylight hours. • MFOs will be trained in whale identification and behaviour, distance estimation, and be capable of making accurate	Survey records MFO Records MFO CV Vessel records	Titleholder Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
		identifications and observations of whales in Australian waters. • Constant bridge watch on support vessels. • MFOs will be in radio contact with support vessels.		
	CM#7: Whale shark shutdown zone	A seismic source shutdown zone of 200 m will be applied to whale sharks.	MFO Records	Titleholder
	CM#11: Turtle Shutdowns	A seismic source shutdown zone of 250 m will be applied to turtles.	MFO Records	Titleholder
	CM#12: Turtle night time and low-visibility procedure within BIAs	For surveys within a turtle internesting, nesting or mating BIA or habitat critical for the survival of the species EPBC Policy Statement 2.1 Procedure A.3.6 for whales, start-up of the seismic source (according to the A.3.2 Soft-Start Procedure) may only commence at night-time or at other times of low-visibility provided: • There have not been 3 or more shut-downs for turtles during the preceding 24 hour period; and • If operations were not previously underway during the preceding 24 hours, the vessel has been in the vicinity (10 km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period, and no turtles have been sighted.	MFO Records	Titleholder
	CM#13: Turtle Adaptive Management Procedure	The following adaptive management procedure will be implemented for seismic surveys within the turtle foraging BIAs within the Carbonate Bank and Terrace System of the Sahul Shelf KEF, Carbonate Bank and Terrace System of the Van Diemen Rise KEF and Pinnacles of the Bonaparte Basin KEF: • If there are 3 or more shut-downs for turtles within a 24-hour period, no operation of the seismic source will take place within 2 km of the Carbonate Bank and Terrace	MFO Records Survey specific underwater acoustic modelling report	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
		System of the Sahul Shelf KEF, Carbonate Bank and Terrace System of the Van Diemen Rise KEF or Pinnacles of the Bonaparte Basin KEF for 24 hours from the last turtle shutdown event. The 2 km buffer may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the behavioural disturbance criteria is less than 2 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management.		
	CM#15: Whale Adaptive Management Procedure	If a cow- calf pair are observed the seismic source will be shut down and not restarted until the mother- calf pair are not observed, or it has been 30 min since the last sighting. Soft start procedures will be applied.	MFO Records	Titleholder
		For surveys undertaken within a humpback or pygmy blue whale BIA outside of the exclusion zone timing (CM#14) the following will be implemented. For surveys undertaken within a humpback or pygmy blue whale BIA outside of the exclusion zone timing (CM#14) the following will be implemented. If observed numbers of whales are higher than expected, as determined by there being three or more humpback whales or three or more pygmy blue whales within the shutdown/powerdown zones in 24 hours the following will be implemented: • Shut-down zone will be increased from 500 m to 3 km for a humpback or pygmy blue whale*. * A humpback or pygmy blue whale sighting is defined as an observed whale that is either:	MFO Records	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
		a) positively identified as a humpback or pygmy blue whale. b) cannot be positively identified as a humpback or pygmy blue whale but is potentially a humpback or pygmy blue whale (i.e., a large baleen whale).		
		If an Omura's whale (confirmed, potential or suspected) is observed during the survey, the following extended shut down procedures will be implemented with immediate effect and will apply for the remainder of the survey: • The shut-down zone will be increased from 500 m to 2 km; and • The start-up delay / shut-down period will be increased from 30 minutes to 60 minutes. • If there are three Omura's whale (confirmed, potential or suspected) sightings, in a 24-hour period, the seismic source will be shut down for 24 hours. • If, during the 24-hour shutdown period, a Omura's whale (confirmed, potential or suspected) is sighted, then the seismic source will remain shut down until there has been 24 hours of no Omura's whale (confirmed, potential or suspected) sightings. Operations may recommence provided there has been no Omura's whale (confirmed, potential or suspected) sightings6 for 24 hours since the last sighting event, and start-up of the seismic source will commence according to CM#10 EPBC Act Policy Statement 2.1 – Interactions between Offshore Seismic Exploration and Whales Part A.	MFO Records	Titleholder
	CM#42: Seismic Survey Separation Distance	A 40 km separation distance will be implemented between seismic sources of simultaneous seismic surveys.	Survey records	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
	CM#18: EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	The requirements to manage interactions between vessels, helicopters and cetaceans as detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 interacting will be implemented for all surveys. • Travel at less than 6 knots within the cautionary zone of a cetacean (150 m radius for dolphins, 300 m for whales. • Do not approach closer than the caution zones for a cetacean. • If a cetacean shows signs of disturbance move away at a constant speed less than 6 knots. • Must not operate a helicopter at a height lower than 1,650 feet or within a horizontal radius of 500 m of a cetacean and must not allow the aircraft to approach a cetacean from head on.	Vessel records MFO Records	Vessel Master Titleholder
	CM#22: National Light Pollution Guidelines – Best Practice Lighting Management	Best practice lighting management will reduce light emissions and ensure lighting is managed in line with relevant guidance outlined in the National Light Pollution Guidelines (CoA 2020). For all survey vessels, the following will be implemented where it does not contravene vessel lighting requirement for safe navigation: • Non-essential lights switched off when not in use. • Window blinds closed at night. • Shield lights and contain light spill on the deck unless required for safe operations. • Use of suitable light types recommended in the National Light Pollution Guidelines.	Lighting inspection records	Titleholder
	CM#23: National Light Pollution Guidelines – Activity	A survey specific Lighting Management Plan will be developed and implemented in line with relevant guidance outlined in the National Light Pollution Guidelines (CoA 2020) for surveys which:	Lighting Management Plan Lighting inspection records	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
	specific Lighting Management Plan	• Occur within 20 km of nesting habitat critical to the survival of marine turtle species during peak nesting and hatchling emergence as defined in the Recovery Plan for Marine Turtles (CoA 2017a). • Occur within 20 km of a wedge-tailed shearwater breeding colony, as detailed in Figure 7-60, during April. • Overlap a wedge-tailed shearwater foraging BIA, as detailed in Figure 7-60, between September and April. • Occur within 20 km of internationally important sites for shorebirds, as detailed in Figure 7-60, during the migratory periods of August to November and March to May.		
	CM#27: Tail buoys guards	Turtle guards installed on tail buoys or tail buoys are of a design that are not an entrapment risk to turtles.	Survey records	Titleholder
EPO8: No injury to a diver.	CM#16 DMAC 12 Safe Diving Distance from Seismic Surveying Operations	Consultation will be undertaken with commercial fisheries that undertake diving (Pearl Oyster Managed Fishery, WA Sea Cucumber Fishery and Specimen Shell Fishery), research organisations and diving charters for seismic surveys where the acoustic source will be operated within 70 km of the areas identified where diving occurs in Section 7.1.10.2. If required, based on the distance to the acoustic source operation, or requested by the stakeholder, the DMAC guidance note requirement for a joint risk assessment and agreed planning/mitigation will be implemented to ensure divers are not impacted. The 70 km distance may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to the 145 dB re 1 µPa SPL safety criterion for recreational divers is less than 70 km. However, it will not be lessened to less than 45 km as per the DMAC guidance note requirement that where diving and seismic activities occur	Consultation records Joint risk assessment and agreed planning/mitigations Survey specific underwater acoustic modelling report	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
		within 45 km of each other, all parties should be made aware of the planned activity.		
	CM#6 NCWHA Exclusion Zone	The acoustic source will not be operated within 70 km of the Ningaloo Coast World Heritage Area (NCWHA).	Survey records	Titleholder

EPO9: Reduce impacts to air and water quality from planned discharges and emissions from the activities	CM#20: Marine Order 97: Marine pollution prevention – air pollution	Vessels will implement the following as per Marine Order 97: Marine pollution prevention – air pollution:
		• International Air Pollution Prevention Certificate where required by vessel class confirming:
		  ○ Incinerators are certified to meet prescribed emission standards.
		  ○ Diesel engines >130 kW are certified to meet prescribed emission standards.
		• Use of low sulphur fuel (0.50% m/m).
		• Ship Energy Efficiency Management Plan where required by vessel class.
			Vessel records	Vessel Master

	CM#19: Preventative Maintenance System	Combustion equipment maintained in accordance with manufacturer's specification as detailed in the preventative maintenance system. Vessel equipment to treat marine discharges such as cooling water, brine, bilge water, deck drainage, food waste, sewage and grey water are maintained as per manufacturer's instructions to ensure efficient operation.	Vessels Preventative maintenance system records	Vessel Master
	CM#21: Low carbon fuels	If within the life of this EP suitable vessels for seismic surveys that use low-carbon and zero-carbon fuel are available, they would be considered for use if the cost of using these vessels is not disproportionate to the environmental benefits.	Review of vessels that use low-carbon and zero-carbon fuel	Titleholder

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
	CM#24: Marine Order 96: Marine pollution prevention - sewage	Vessels will implement the following as per Marine Order 96: Marine pollution prevention – sewage: • Sewage will only be discharged via an IMO-approved sewage treatment plant; or • Comminuted/disinfected sewage via an IMO-approved system will only be discharged when ≥ 3 nm from land and when the vessel is moving at ≥ 4 knots; or • Sewage that has not been comminuted/ disinfected via an IMO-approved system will only be discharged when ≥ 12 nm from land and when the vessel is moving at ≥ 4 knots.	Vessel records	Vessel Master
	CM#25: Marine Order 95: Marine pollution prevention - garbage	Vessel will implement the following as per Marine Order 95: Marine pollution prevention – garbage: • Food waste comminuted or ground to particle size less than 25 mm is permitted to be discharged while the vessel is moving and ≥3 nm from the nearest land; or • Food waste not comminuted, or ground is permitted to be discharged while the vessel is moving and ≥12 nm from the nearest land. • Oil and all oily mixtures retain onboard for on shore disposal; or • Vessels have in operation equipment of a design approved by the administration that ensures oil content less than 15 parts per million and discharge permitted when proceeding en route.	Vessel records	Vessel Master
EPO10: No loss of equipment or waste to the marine	CM#25: Marine Order 95: Marine pollution prevention – garbage	Waste with potential to be windblown shall be stored in covered containers.	Vessel records	Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
environment.	CM#26: Support vessel	At least one support vessel will always accompany the seismic vessel and will assist in the recovery of lost equipment or waste if safe to do so.	Vessel records	Vessel Master
	CM#30: Simultaneous operations plan	A simultaneous operations plan will be developed for surveys that are within 3 km plus the length of the seismic spread (seismic vessel to streamer tail buoy) of an offshore platform or facility to ensure streamers are not entangled in the infrastructure.	Survey records	Titleholder
	CM#17: Streamer configuration	The streamer configuration will consist of: • steerable streamers to maintain consistent cable shape. • recovery units which are pressure-activated, self-inflating buoys that are designed to bring the streamer to the surface if lost during a survey, where it can be retrieved by the support vessel.	Survey records	Titleholder
	CM#31: Stakeholder notification – loss of equipment	If a loss of equipment to the marine environment provides a navigational hazard it will be reported to AMSA and marine users will be notified via VHF marine radio.	Notification records Vessel log	Titleholder
EPO11: No new introduction or translocation of non-indigenous marine species attributable to the activity.	CM#32: Australian Ballast Water Management Requirements	Approved methods of ballast water management adopted and implemented. Ballast water management activities undertaken in accordance with the Australian Ballast Water Management Requirements.	Ballast Water Management Certificate held on board and available for inspection. Approved Ballast Water Management Plan held on board and available for inspection. Ballast Water Record Book demonstrates compliance with the Ballast Water Management Plan, and records ballast water management activities held on	Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
			board and available for inspection. Ballast Water Record Book includes: • Time, date and location of each uptake, treatment, and discharge of ballast water. • Method of ballast water treatment used and relevant details (i.e., volume exchanged). • Details of any accidental discharges. • Signature of officer in charge.	
	CM#33: IMO Guidelines for the Control and Management of a Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species	A vessel specific Biofouling Management Plan is implemented that includes at least the content outlined in the IMO Biofouling Guidelines, highlighting areas of biofouling risk on the vessel and what measures have been taken to maximise efficacy of available biofouling technology. The Biofouling Management Plan is reviewed and updated when circumstances require it, such as when changes in recommended best practice occur, or structural changes to the vessel's underwater surfaces carried out that may have an impact on biofouling attachment.	Biofouling Record Book is held on board and includes at least the content outlined in the IMO Biofouling Guidelines, recording biofouling management activities, signed by the person in charge, held on board and available for inspection. Biofouling Record Book demonstrates compliance with the Biofouling Management Plan.	Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
	CM#33a: Australia Biofouling Management Requirements	Vessels entering Australian territorial waters must provide information relating to biofouling management through the mandatory pre-arrival report.	Pre-arrival report showing biofouling risk is acceptable.	Vessel Master
	CM#34: Vessel-check or an alternative risk assessment process	Risk assessment undertaken using input values related to biosecurity risk factors that may have a bearing on the marine biosecurity risk of a vessel. Vessels to have an IMS risk status of 'low' before entering the CSEP OA.	Risk assessment outcome documented and retained on board and available for inspection. Where actions have been undertaken to demonstrate low risk status, records of such actions retained on board and available for inspection.	Vessel Master
	CM#35: In-water equipment check or an alternative risk assessment process	Risk assessment undertaken using input values related to biosecurity risk factors that may have a bearing on the marine biosecurity risk of in-water equipment. In-water equipment to have an IMS risk status of 'low' before being deployed in the CSEP OA.	Risk assessment outcome documented and retained on board and available for inspection. Where actions have been undertaken to demonstrate low risk status, records of such actions retained on board and available for inspection.	Titleholder Offshore Representative
EPO12: No spills of chemicals or hydrocarbons to the marine environment.	CM#38: Refuelling procedure	Vessels will have a refuelling procedure detailing: • weather conditions and locations where refuelling can occur such as outside of marine parks. • pre- and during refuelling checks to reduce spill events.	Bunkering procedure and records	Vessel Master
	CM#36: AIS Transponders	• Vessels and streamer tail buoy will have functioning Automated Identification System (AIS).	Survey records Vessel records	Titleholder Vessel Master

Environmental performance outcome	Control measure #	Environmental performance standard	Measurement criteria	Responsible person
	CM#37: Spill Containment	Materials and equipment that have the potential to spill onto the deck or marine environment are within a contained area.	Vessel records	Vessel Master
	CM#28: Navigation Act and Marine Orders	Seismic survey vessel will adhere to Marine Orders 21 Safety and Emergency Arrangements, 30 Prevention of Collisions and 31 SOLAS and non-SOLAS certification including: • Appropriate lighting, navigation, and communication to inform other users. • Use of radar and 24/7 watch.	Vessel records	Vessel Master
	CM#39: SMPEP or equivalent	Vessels hold an approved and tested SOPEP or SMPEP and crew are trained in its implementation. • Spill response kits located in high spill risk areas and routinely checked to ensure adequate.	Vessel SMPEP Vessel exercise schedule Spill response kits inspection	Vessel Master
EPO13: Undertake oil spill response in a manner that will not result in additional impacts to marine environment, coastal habitat, and oiled wildlife.	CM#40: Oil Pollution Emergency Plan (OPEP)	Oil spill response capability is maintained in accordance with the in-force OPEP. Oil spill response is implemented as per the in-force OPEP.	Oil spill response capability records OPEP implementation records	Titleholder
	CM#41: Operational & Scientific Monitoring Plan (OSMP)	Operational and scientific monitoring capability is maintained in accordance with the OSMP. Operational and scientific monitoring is implemented as per the in-force OPEP.	Operational and scientific monitoring capability records OSMP implementation records	Titleholder

8. Implementation Strategy

In accordance with the OPGGS(E) Regulations, this section provides details on CSEP Implementation Strategy. The specific measures and arrangements that will be implemented in the event of an oil pollution emergency are detailed in the Collaborative Seismic OPEP and titleholder's survey specific Oil Spill Response and Monitoring Bridging Plan.

There are two components to the implementation strategy for the CSEP:

1. The environment management system for the activity for which the survey titleholder is responsible for. This component details the reporting, monitoring, recording, audit, management of non-conformance and review of the titleholder's environmental performance to ensure that environmental performance outcomes and standards in the CSEP are being met when they are undertaking a seismic survey. It also details the arrangements for ongoing consultation with relevant authorities, persons, and organisations prior to, during and at completion of the survey.
2. The environment management system for maintaining the CSEP for which the CSEP Consortium Steering Committee is responsible for. This component details the reporting, monitoring, recording, audit, management of non-conformance and review of the CSEP to ensure that environmental performance outcomes and standards in the CSEP are being met. It also details the arrangements for ongoing consultation with relevant stakeholders in relation to the CSEP.

Figure 8-1 show the relationship between the survey titleholder, CSEP Consortium Steering Committee and CSEP titleholders.

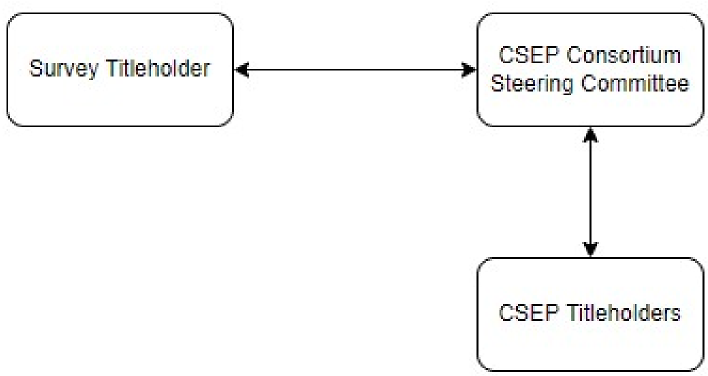


Figure 8-1: Relationship between the survey titleholder, CSEP Consortium Steering Committee and CSEP titleholders

8.1 Titleholder Implementation Strategy

This section details the responsibilities, practices, processes, and resources that will be implemented by a titleholder to manage the environmental components of their seismic survey.

8.1.1 Environmental Management Systems

Each CSEP titleholder has a Health, Safety and Environment (HSE) Management System, which details the responsibilities, practices, processes, and resources to systematically manage HSE risks, demonstrate compliance and seek continual improvement.

CSEP titleholder's HSE Management Systems align with AS/NZ Standard ISO 14001:2016, *Environmental management systems – Requirements with guidance for use* and are based on environmental leadership commitment and the management elements of plan, do, check and act.

The structure of this implementation strategy is consistent with each of the CSEP titleholder's HSE Management System and is designed to ensure that:

- Environmental impacts and risks continue to be identified for the duration of the survey and reduced to ALARP.
- Control measures are effective in reducing environmental impacts and risks to ALARP and acceptable levels.
- Environmental performance outcomes and standards set out in the CSEP are met.
- Stakeholder consultation is maintained throughout each survey as appropriate.

8.1.2 Environmental Policy

The Environmental Policy for each the CSEP titleholders is included in Appendix E. These policies outline each titleholder' commitment to environmental responsibility and expectations for environmental performance.

8.1.3 Roles and Responsibilities

Key roles and responsibilities for titleholders and contractor personnel in relation to the implementation of the CSEP for a survey are described in Table 8-1.

Titleholder and contractor personnel with specific responsibilities pertaining to the implementation of the CSEP shall be made aware of their responsibilities, and the specific control measures required to maintain environmental performance and legislative compliance.

Table 8-1: Key roles and responsibilities for seismic surveys

Role	Responsibilities
Onshore personnel	
Titleholder Survey Manager	Overall responsibility to ensure the survey is undertaken in accordance with the CSEP including that the EPOs, EPSs and control measures in the in-force EP are implemented effectively and environmental compliance is maintained at all times.

Role	Responsibilities
	Provide sufficient resources to ensure that the EPOs, EPSs and control measures in the in-force EP are implemented effectively and environmental compliance is maintained at all times. Ensures: • Titleholder survey is within the bounds of the CSEP. • Notification requirements and stakeholder consultation are undertaken as per the Operational Protocol and Section 6.4 • Compliance with regulatory and other requirements and the CSEP. • Survey specific Oil Spill Response and Monitoring Implementation Plan developed and tested. • Records associated with the activity are maintained as per Section 8.1.8 and Section 8.1.9 • Personnel who have specific responsibilities pertaining to the implementation of the CSEP or OPEP know their responsibilities and are competent to fulfil their designated role. • Environmental impacts and risks associated with the activity are identified and any new or increased impacts or risks are managed via the Management of Change process detailed in Section 8.1.10. • Incidents are managed and reported as per Section 8.1.5. • Survey reporting requirements are undertaken as per Section 8.1.6. • Any changes to equipment, systems, and documentation where there may be a new or change to an environmental impact or risk or a change that may impact the EP are assessed Management of Change process detailed in Section 8.1.10. • Audits and inspections are undertaken in accordance with Section 8.1.11. • Marine fauna management procedures are developed and communicated as per Section 8.1.12 and Section 8.1.4. • Applicable survey exclusion zones are on acquisition area maps and provided to Vessel Captain.
Contractor Vessel Manager	Ensures: • Vessel meets quarantine requirements to operate in Australian waters. • Subcontractors are communicated the EP requirements. • Survey risks are assessed and HSE Plan is created including the requirements of this CSEP.
Titleholder Environmental Advisor or delegate	Provides support to the Titleholder Survey Manager to ensure that the survey is undertaken as per the CSEP requirements. • Reviews the survey parameters to ensure it is within the bounds of the CSEP. • Determines the controls that apply to the survey and ensures through audits and inspections that controls are in place and effective in managing environmental impacts and risks. • Determines the controls that apply to the survey and ensures through audits and inspections that controls are in place and effective in managing environmental impacts and risks. • Communicate regulatory and other requirements and the requirements in the CSEP to persons who have specific responsibilities for implementation of the CSEP or OPEP.

Role	Responsibilities
	• Prepares the survey specific Oil Spill Response and Monitoring Implementation Plan and organises testing. • Reviews any management of change associated with a control in the CSEP or where there is the potential for environmental impact. • Prepare environmental induction material. • Assist with review, investigation, and reporting of environmental incidents. • Prepares regulatory reports as per Section 8.1.6. • Provide support to develop marine fauna management procedures as per Section 8.1.12.
Vessel personnel	
Vessel Master	Responsible for ensuring vessel activities comply with legislative requirements and the CSEP. Ensures: • Vessel operations are carried out in accordance with regulatory requirements and the CSEP. • Vessel personnel are competent to fulfil their designated role. • Vessel requirements detailed in the marine fauna management procedures (Section 8.1.12) are implemented. • Survey exclusion zones and in the vessel navigation system. • Environmental incidents are reported to the Titleholder Offshore Representative within required timeframes as per Section 8.1.5. • Emissions and discharges identified in Section 8.1.8 are recorded and provided to the Titleholder Offshore Representative. • Titleholder Offshore Representative is informed of any changes to equipment, systems, and documentation where there may be a new or change to an environmental impact or risk or a change that may impact the CSEP. • Oil spill response arrangements are in place and tested as per the vessel's SMPEP or equivalent.
Titleholder Offshore Representative	Ensures: • Survey is carried out in accordance with regulatory requirements and the CSEP. • Vessel personnel complete the environmental component of the survey induction. • Communicate and implement requirements detailed in the marine fauna management procedures (Section 8.1.12). • Applicable survey exclusion zones are on acquisition area maps and provided to Vessel Captain. • HSE issues are communicated via systems such as the daily report and daily pre-start meetings. • Environmental impacts and risks associated with the activity have been identified and any new or increased impacts or risks are managed via the Management of Change process detailed in Section 8.1.10. • Environmental incidents are managed and reported as per Section 8.1.5. • Emissions and discharges identified in Section 8.1.8 are recorded and provided to the Titleholder Survey Manager.

Role	Responsibilities
	• Titleholder Survey Manager is informed of any changes to equipment, systems, and documentation where there may be a new or change to an environmental impact or risk or a change that may impact the CSEP as per Section 8.1.10. • Monthly vessel inspections as detailed in Section8.1.11 are undertaken to ensure ongoing compliance with the CSEP.
Vessel Crew	• Comply with the CSEP and all regulatory requirements as applicable to assigned role. • Undertake work in accordance with accepted vessel HSE systems and procedures. • Identify HSE improvement opportunities wherever possible. • Complete survey induction. • Report fauna sightings. • Report any unsafe conditions, near misses or environmental incidents immediately to supervisors.
Marine Fauna Observers (MFO)	In addition to the requirements of vessel crew, the MFOs will: • Undertake visual observations for marine fauna as per the CSEP. • Record all sightings of marine fauna and provide reports to the Titleholder Survey Manager. • Advise when to delay or shut down the seismic source. • Provide additional training to crew in fauna observations as required. • Communicate and implement requirements detailed in the marine fauna management procedures (Section 8.1.12). • Ensure they know where and when survey exclusion zones are to be applied.

8.1.4 Training and Competency

Titleholders and contractors with responsibilities pertaining to the implementation of the CSEP shall have the appropriate competencies to fulfil their role.

To ensure that personnel are aware of the CSEP requirements all offshore personnel will complete a survey specific induction. The induction will at a minimum cover:

- Description of the environmental sensitivities and conservation values of the operational area and surrounding waters.
- Controls to be implemented to ensure impacts and risks are ALARP and of an acceptable level.
- Requirements for interactions with other marine users.
- Requirement for responding to and reporting environmental hazards or incidents including the definition of reportable and recordable incidents and know how they are reported.
- Overview of emergency response and spill management plans.
- Fauna sighting, including whale identification, fauna reporting and vessel interaction procedures.

- Overview of EPBC Policy Statement 2.1 procedures and controls associated with managing acoustic impacts including marine fauna management procedures.
- Location and timing of survey exclusion zones.

8.1.5 Incident Management and Reporting

CSEP titleholders will have a process for ensuring all environmental incidents, including near misses, are reported, investigated, and analysed to ensure that preventive actions are taken, and learnings are shared.

Regulatory reporting requirements for environmental incidents are detailed in Table 8-2.

Any incident reports provided to a regulator are required to be submitted to the CSEP Consortium Steering Committee as per Section 8.1.6.3, so that learnings can be shared and incorporated into the EP review process as detailed in Section 8.2.3.

8.1.6 Regulatory Reporting

8.1.6.1 Cetacean Sightings Report

In accordance with Part A.4 of EPBC Policy Statement 2.1, a report on the conduct of the survey and whale interactions will be submitted by the survey titleholder to DAWE within 2 months of survey completion.

Sightings and survey information will be submitted using the CSA software. Upon completion of the survey, the information entered in the CSA will be exported as an XML file and provided to DAWE and the CSEP Consortium Steering Committee. This data will be incorporated into the EP review process as detailed in Section 8.2.3.

Information on recording and reporting requirements are provided in:

- Part A.4 of EPBC Policy Statement 2.1.
- NOPSEMA Environment Bulletin: Recording and Reporting Marine mammal Observer Data.
- APPEA Industry Guideline for the Collection and Submission of Marine Mammal Observer Data from Marine Seismic Surveys.

8.1.6.2 Environment Performance Reporting

In accordance with the OPGGS (E) Regulations, the titleholder will report to NOPSEMA in relation to the titleholder's environmental performance for a survey.

The titleholder will submit an environmental performance report to NOPSEMA within 3 months of completion of a survey. Reports will provide sufficient information for NOPSEMA to be able to determine whether the EPOs and EPSs in the CSEP that are relevant to the titleholder's survey have been met.

A copy of the environmental performance report will be provided to the CSEP Consortium on submission to NOPSEMA.

Table 8-2: Regulatory Reporting Requirements

Requirement	Timing	Contact
Recordable incident As defined within the OPGGS (E) Regulation a recordable environmental incident is 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.		
As a minimum, the written monthly recordable report must include a description of: • all recordable incidents which occurred during the calendar month • all material facts and circumstances concerning the incidents that the operator knows or is able to reasonably find out • corrective actions taken to avoid or mitigate any adverse environmental impacts of the incident corrective actions that have been taken, or may be taken, to prevent a repeat of similar incidents occurring. Regulation 26B of the OPGGS(E)R requires a recordable incident report to be submitted if there is a recordable incident, thus nil reports are not required.	Before the 15th day of the following calendar month	• NOPSEMA - submissions@nopsema.gov.au
Reportable incident As defined within the OPGGS (E) Regulation, a reportable incident is an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage. For the CSEP moderate to significant environmental damage is defined as any incident of actual or potential consequence category Moderate or greater. These risks include: • vessel collision resulting in a loss of containment. • introduction of marine pest species.		
Verbal notification The notification must contain: • all material fact and circumstances concerning the incident • any action taken to avoid or mitigate the adverse environmental impact of the incident • the corrective action that has been taken or is proposed to be taken to stop control or remedy the reportable incident.	Within two hours of becoming aware of incident	• NOPSEMA – 1300 674 472

Requirement	Timing	Contact
A written notification must be provided as soon as practicable after the verbal notification. The written notification is to be provided to the regulator (NOPSEMA), Titles Administrator (NOPTA) and Department of the responsible State Minister (WA and/or NT).	ASAP after the verbal notification	• NOPSEMA - submissions@nopsema.gov.au • WA – petroleum.environment@dmirs.wa.gov.au • NT - DITTPetroleumOperations@nt.gov.au. • NOPTA – reporting @nopta.gov.au
Written notification Verbal notification of a reportable incident to the regulator must be followed by a written report. As a minimum, the written incident report will include: • the incident and all material facts and circumstances concerning the incident • actions taken to avoid or mitigate any adverse environmental impacts • the corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident • The action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	Within 3 days of first occurrence of the incident	• NOPSEMA – submissions@nopsema.gov.au
Written incident reports to be submitted to Titles Administrator (NOPTA) and Department of the responsible State Minister (WA and/or NT).	Within 7 days of written report submission to NOPSEMA	• WA – petroleum.environment@dmirs.wa.gov.au • NT - DITTPetroleumOperations@nt.gov.au. • NOPTA – reporting @nopta.gov.au
Vessel spill to marine environment All discharges /spills or probable discharges/spills to the marine environment of oil or oily mixtures, or noxious liquid substances in the marine environment from vessels. Reporting info: https://www.amsa.gov.au/marine-environment/marine-pollution/mandatory-marpol-pollution-reporting	Verbal notification as soon as practicable (ASAP)	Immediate notification by the Vessel Master to AMSA. Follow-up with Marine Pollution Report (POLREP). • Ph: 1800 641 792 • Email: rccaus@amsa.gov.au
Australian Marine Park (AMP) - in the event an AMP may be exposed to hydrocarbons from a spill.	Verbal notification ASAP	• Marine Park Compliance Duty Officer - 0419 293 465 Notification must be provided to the Director of National Parks and include: • titleholder details

Requirement	Timing	Contact
		• time and location of the incident (including name of marine park likely to be affected) • proposed response arrangement • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.
Vessel strike with marine mammals	Within 72 hours	• DAWE - online National Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike
	ASAP for injury assistance	• WA – 9474 9055 • NT – 0401 115 731
Injury to or death of EPBC Act-listed species	Within seven days	• DAWE - 1800 803 772 • EPBC.Permits@environment.gov.au
Suspected or confirmed Invasive Marine Species introduction	Verbal notification ASAP	• WA – FishWatch – 1800 815 507 • NT – Fishwatch – 1800 891 136
Identification of item of underwater cultural heritage such as vessel or aircraft remains and/or associated relics	Written notification within 1 week	• Written notification via the notification of discovery of underwater cultural heritage online submission form.

8.1.6.3 CSEP Consortium Steering Committee Notifications and Reporting

Table 8-3 detail the titleholder records to be provided to the CSEP Consortium Steering Committee. This data will be incorporated into the EP review process as detailed in Section 8.2.3.

Table 8-3: Titleholder Records to be Provided to the CSEP Consortium Steering Committee

Requirement	When
Details of proposed surveys to be conducted under the CSEP	6 monthly
Survey CSEP Review	No less than 3 months prior to commencement of a planned seismic survey
“Notification of Intent” to conduct a seismic survey under the CSEP	No less than 3 months prior to commencement of a planned seismic survey
Survey financial assurance confirmation	Within 5 working days from submission to regulator
Survey commencement and completion	10 days before the commencement and within 10 days after completion of a survey
Change in titleholder	Within 5 working days from becoming aware of the change
Regulator Incidents reports	Within 5 working days from submission to regulator
Survey fauna reports	Within 2 months of survey end
Survey environmental performance report	Within 5 working days from submission to regulator
Stakeholder objections and claims	Within 5 working days from receiving

8.1.7 Survey Notifications

In accordance with the OPGGS (E) Regulations, the titleholder will notify NOPSEMA and the relevant Department of the responsible WA State Minister (DMIRS) and/or the responsible Northern Territory Minister (DITT) at least 10 days before the commencement and within 10 days after completion of a survey. These notifications will also be provided to the CSEP Consortium Steering Committee as Detailed in Section 8.1.6.3.

Stakeholder and other survey notification requirements are detailed in Section 6.4.

8.1.8 Emissions and Discharge Records

In accordance with the OPGGS(E) Regulations the titleholder shall record emissions and discharges for the duration of the activity.

Discharges associated with a survey will limited to those allowed for under maritime law. Therefore, all discharges will be recorded and controlled in accordance with maritime monitoring and recording requirements. Any non-compliance with discharge requirements will be included in the monthly recordable incident report to NOPSEMA.

8.1.9 Document Management

In accordance with the OPGGS(E) Regulations, survey documents and records relevant to the CSEP implementation will be stored and maintained by the titleholder for a period of five years in a way that makes retrieval practicable. This includes records and documents that may assist in estimating or determining emissions and discharges. The titleholder will maintain and store the following types of records:

- Audit and inspection reports, checklist and records.
- Daily operational reports
- Incident records and reports
- MoC documents
- Marine fauna sighting datasheets
- Stakeholder consultation logs
- Survey reports

8.1.10 Management of Change

The titleholder will have a documented management of change (MoC) process that ensures the process and requirements in Section 8.3 is met.

8.1.11 Audits and Inspections

Each titleholder's HSE Management System has a process for monitoring and assessing environmental performance. This includes an ability to review environmental performance standards to ensure they are being met and identify any EP non-conformances and opportunities for continuous improvement.

Non-compliances and opportunities for improvements identified via audits, inspections or other means shall be communicated to an appropriate supervisor and/or manager to report and action in a timely manner. Tracking of non-compliances and audit actions shall be recorded in an Environmental Compliance Register, or equivalent, which will assign a responsible person for ensuring the action is addressed and closed out. Non-compliances will be reviewed by the Titleholder Survey Manager and Environment Advisor to determine if they trigger the recordable or any other incident reporting requirements in Section 8.1.5.

8.1.11.1 Pre-survey CSEP Review

To ensure that a titleholder survey will meet the requirements of the CSEP the titleholder will conduct a Pre-survey CSEP Review. This review will be provided to the CSEP Consortium Steering Committee, as detailed in Section 8.1.6.3, and is required to be approved by the CSEP Consortium Steering Committee prior to the titleholder providing a "notice of intent" to stakeholders (see Section 6.4).

Appendix F details the review form to be completed.

8.1.11.2 Pre-mobilisation Audit

The titleholder will undertake a pre-mobilisation audit of all vessels to be used for the survey prior to commencement of the survey. The audit will cover the EPOs and EPSs in the CSEP, oil spill response capability as per the CSEP OPEP and titleholder Oil Spill Response and Monitoring Implementation Plan and the requirements detailed in the CSEP implementation strategy to ensure they can be met during the activity.

8.1.11.3 Monthly Inspections

During a survey a monthly inspection will be conducted to ensure ongoing compliance with relevant CSEP requirements. Inspection will be documented and include, but not be limited to:

- Spill preparedness such as spill kit checks.
- Waste management.
- Lighting.
- Other checks to validate ongoing compliance with EPOs and EPSs relevant to the survey.

Any opportunities for improvement or corrective actions will be discussed during the inspection with the work area supervisor and/or crew.

A monthly inspection aligns with the NOPSEMA recordable incident month reporting requirements as detailed in Section 8.1.5.

8.1.12 Marine Fauna Management Procedures

As detailed in the Pre-survey CSEP Review a titleholder is required to identify the controls from Section 7.12 that are applicable to their survey. To ensure the controls are implemented the titleholder holder will develop appropriate tools, workflows, or procedures to guide MFOs and seismic crew in the implementation of controls applicable to marine fauna such as turtles, whale sharks and marine mammals.

8.1.13 Financial Assurance

Titleholders have a duty under Section 571 of the OPGGS Act to maintain sufficient financial assurance to meet obligations and duties established within the OPGGS Act and relevant legislative instruments.

The titleholder is responsible for the financial assurance requirements of the OPGGS(E)

The financial assurance confirmation for the survey that is supplied to NOPSEMA is to be provided to the CSEP Consortium Steering Committee as detailed in Section 8.1.6.3.

8.2 CSEP Implementation Strategy

This section details the responsibilities, practices, processes, and resources that will be implemented by a CSEP Consortium Steering Committee to manage the CSEP.

8.2.1 Environment Performance Reporting

In accordance with the OPGGS (E) Regulations, the CSEP Consortium Steering Committee will report to NOPSEMA in relation to the environmental performance for the CSEP.

The CSEP Consortium Steering Committee will submit an environmental performance report to NOPSEMA annually within 3 months of the date of CSEP acceptance. Reports will provide sufficient information for NOPSEMA to be able to determine whether the EPOs and EPSs in the CSEP that are relevant to the CSEP Consortium have been met.

8.2.2 Regulatory Notifications

The CSEP Consortium Steering Committee will provide an end-of-operation of EP notification to NOPSEMA detailing that the obligations under the CSEP are complete. This notification will be provided within 3 months of the CSEP ending, unless agreed otherwise with NOPSEMA.

8.2.3 Environment Plan Information Review

As the CSEP is valid for 5-years new or updated information will be available in this time.

The CSEP Consortium Steering Committee will be responsible for ensuring that the CSEP has been updated with new or changed information. This will include external information and survey information provided by the CSEP titleholders that can inform the CSEP or lead to continuous improvement in the manager in which surveys are undertaken.

New information will be reviewed and where applicable the CSEP will be updated. The updates to the CSEP will be assessed as per the management of Change process detailed in Section 8.3. If the CSEP is not required to be resubmitted to the regulator it will be reissued to the CSEP titleholders, so they have the latest version.

The type of information that will be reviewed and when is detailed in Table 8-4.

Table 8-4: CSEP Information Review

Information	When
Environmental requirement	Prior to a survey
Regulator policy or guidance	Prior to a survey
Conservation plans, management plans and advice	Prior to a survey
National Conservation Values Atlas	Prior to a survey
Protected areas, Key Ecological Features	Prior to a survey
Protected Matters Search	Annually

Information	When
ABARES Fisheries Status Report and map data	Within 1 month of public release
DPRID Status Reports of the Fisheries and Aquatic Resources of Western Australia	
DPIRD FishCube Data	
Northern Territory Government Status of Key Northern Territory Fish Stocks Report	
NT DIIT Fishery presence absence spatial dataset	
New or changes to relevant persons identified through ongoing consultation with stakeholders including peak industry bodies.	Prior to a survey
Scientific papers or reports relevant to the CSEP	Within 1 month of public release
New seismic source acoustic modelling	Within 1 month of public release
Titleholder survey fauna reports	Within 1 month of submission to CSEP Consortium Steering Committee
Titleholder survey Incident reports	
Titleholder survey environmental performance report	

8.3 Management of change

The titleholders and CSEP Consortium Steering Committee will have a documented management of change (MoC) process that ensures the process detailed in Figure 8-2 is met.

The MoC process provides a systematic approach to initiate, assess, document, approve, communicate, and implement changes to a survey and the CSEP in a manner that ensures any changes are within the bounds of the in-force CSEP.

The MoC process considers the OPGGS(E) Regulations and determines if a proposed change can proceed and the manner in which it can proceed. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP. Additional stakeholder consultation may be required depending on the nature and scale of the change.

If a change, from either a titleholder survey or CSEP information review, results in a revision of the CSEP but not a submission to NOPSEMA the CSEP Consortium Steering Committee will review the change, revise the CSEP and reissue to the CSEP titleholders. This will become the 'in-force' CSEP.

If a change, from either a titleholder survey or CSEP information review, results in a revision of the CSEP and a submission to NOPSEMA the CSEP Consortium Steering Committee will only revise the CSEP and submit to NOPSEMA with the unanimous support of the CSEP titleholders.

If the CSEP Steering Committee or CSEP titleholders do not support the titleholders proposed change to the CSEP the titleholder must change the survey to meet the in-force CSEP requirements or the survey cannot be conducted under the CSEP.

Approved MoCs become part of the in-force CSEP or OPEP. MoCs that are specific to a titleholder survey will be tracked on the titleholder's register and a copy provided to the CSEP Steering Committee. The CSEP Steering Committee will review a titleholder survey MoC to determine if a change to the CSEP is required for future surveys.

The MoC procedure also provides for the assessment of new or changed information that may become available post EP acceptance (refer to 8.2.3).

8.3.1 Change in Titleholder

The OPGGS(E) Regulations detail that if a change in the titleholder will result in a change in the manner in which the environmental impacts and risks of an activity under the CSEP are managed, the new titleholder must submit a proposed revision of the environment plan for the activity as soon as practicable.

If a CSEP titleholder changes the titleholder is to notify the CSEP Consortium Steering Committee as soon as practicable. The titleholder and CSEP Consortium Steering Committee will liaise with NOPSEMA to determine if the new titleholder can conduct surveys under the CSEP.

8.3.2 Change in Titleholder's Nominated Person or Contact Details

As per the OPGGS(E) Regulations the CSEP Consortium Steering Committee will notify NOPSEMA of a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person.

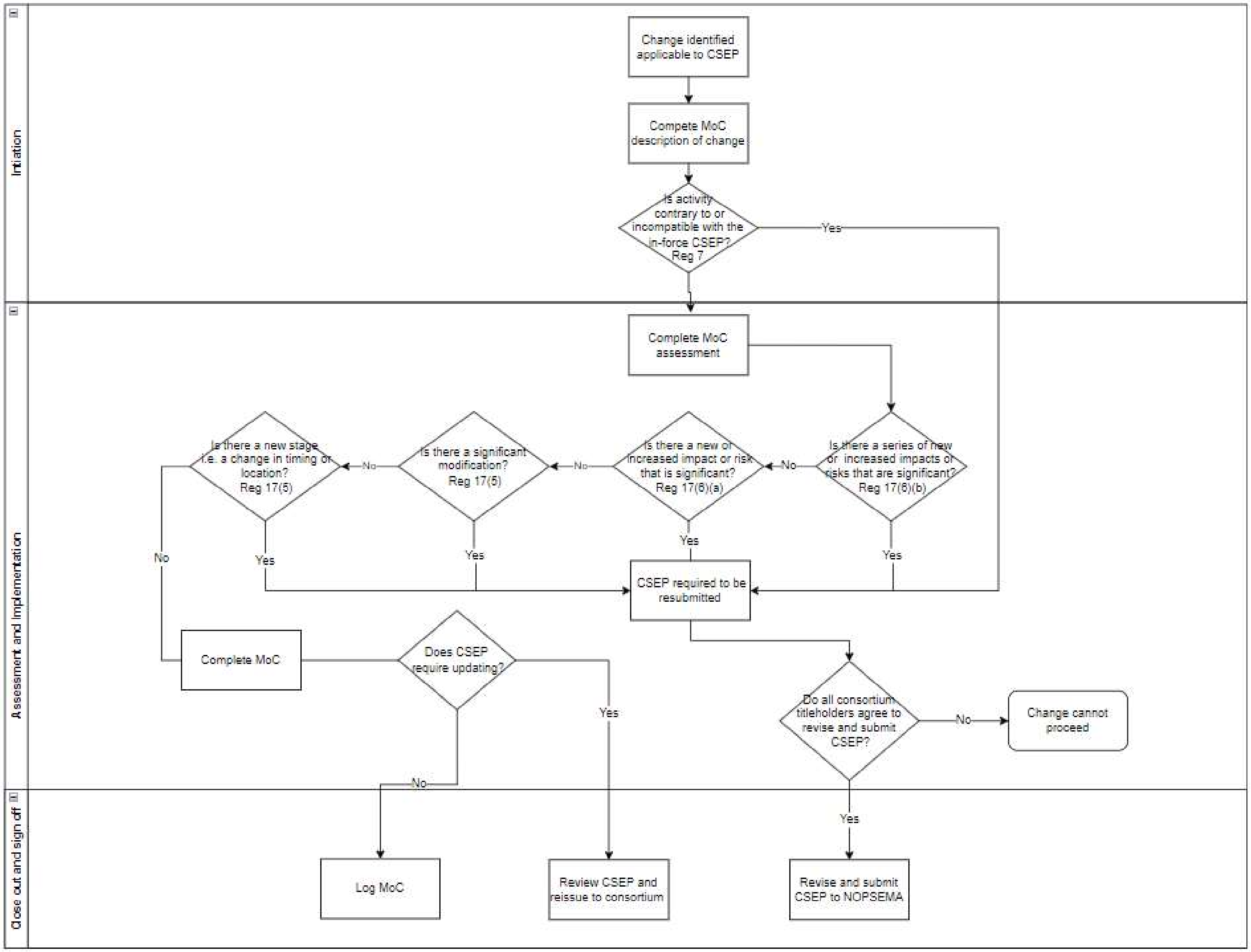


Figure 8-2: Environment Management of Change Process

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Appendix A: Relevant Studies: Seismic Acoustic Emission Impacts

Plankton including fish and invertebrate eggs and larvae

This section summarises the published studies in relation to seismic acoustic emission studies on plankton and fish and invertebrate eggs and larvae.

Some zooplankton can sense pressure changes to some degree. Swim bladders may also develop during the larval stages of some fish species, rendering larvae susceptible to pressure-related injuries such as barotrauma (Popper et al. 2014). Data on the effects of sound upon eggs and larvae containing gas bubbles is, therefore, largely focused on barotrauma rather than actual hearing. Very few publications have considered the effects of particle motion or vibration on plankton (Popper et al. 2014).

Few studies have found significant negative impacts on zooplankton, fish eggs, larvae, or fry, and most have reported that impacts occur within a few metres or tens of metres from the source (Kostyuchenko 1973; Dalen & Knutsen 1987; Holliday et al. 1987; Kosheleva 1992 cited in Parry et al. 2002; Pearson et al. 1994; Turnpenny & Nedwell 1994; Booman et al. 1996; Payne et al 2004; Payne et al. 2009). These studies included exposures to sound pressures up to approximately 242 dB SPL, comparable to those considered for the CSEP surveys. Larval stages of fish are often perceived to be more sensitive to stressors than adult stages, but exposure to seismic sound does not appear to result in any differences in larval mortality or abundance for fishes, crabs, or scallops (Carroll et al. 2017).

Kostyuchenko (1973) found up to a 17% increase in mortality of fish eggs of various species exposed to a seismic source, but no effect beyond 10 m. Kosheleva (1992, cited in Turnpenny & Nedwell 1994) also reported that eggs and larvae died within 1 m of a seismic source producing sound pressures of 220-240 dB SPL, but no injuries were reported at greater distances. Dalen and Knutsen (1987) exposed eggs, larvae and post-larval stages of cod exposed to seismic source elements with source levels of 222 – 231 dB SPL at 1 m. At ranges of 1 – 10 m from the source, some specimens indicated temporarily impaired balance following exposure but with rapid recovery. Mortality was only observed in just one of the three exposure experiments, with 90% mortality when exposed at 2 m from the seismic source, but no significant impacts at 6 m from the seismic source. Overall, there was no significant change in the survival of eggs.

Holliday et al. (1987) obtained mixed results during studies undertaken over a two-year period, with eggs and larvae exposed to sound pressures of 221 – 235 dB SPL at 1.5 m from a seismic source. Either no significant impact was observed or a 9% reduction in the survival of eggs. Pearson et al. (1994) reported no effects to crab larvae exposed to sound pressures up to 231 dB SPL at 1 m from a seismic source. Booman et al. (1996) exposed fish eggs and larvae to sound pressures of 220 – 242 dB SPL. High rates of mortality were observed at distances of 1.4 m from the seismic source, but low or now mortality rates at distances of 5 m.

In a review of the above studies, Payne et al. (2004) noted that injury and mortality to eggs and larvae is likely to be limited to within 5 m of the seismic source. Payne et al. (2009) found no statistical differences between controls and exposed larvae following exposure to mean sound pressure levels of 205 dB PK-PK, positioned 0.5 m from the seismic source element.

The effects of an operating 3D seismic array on plankton were investigated by Parry et al. (2002). Vertical plankton tows (0 – 20 m depth) were taken along transects running parallel and adjacent to seismic survey lines. Plankton tows along the impact transect were made within 30–60 minutes of the seismic pass. Parry et al. (2002) found no detectable impacts on plankton based on their species composition and live/dead state but did concede that their statistical power to detect any impacts was low, requiring decreases in abundance of >30–40% for copepods and >80–90% for most other taxa.

Day et al. (2016a) found no effects on the mortality, abnormality, competency, or energy content of lobster larvae after exposure of early embryonic stages to seismic exposure. In this study, egg-bearing female spiny lobsters (*Jasus edwardsii*) were exposed to signals from three air gun configurations, all of which exceeded sound exposure levels (SEL) of 185 dB re 1 $\mu Pa^2 \cdot s$ (209-212 dB PK-PK). Lobsters were maintained until their eggs hatched and the larvae were then counted for fecundity, assessed for abnormal morphology using measurements of larval length and width, tested for larval competency using an established activity test and measured for energy content. 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. (2016a) detailed that the results suggest that embryonic spiny lobster are resilient to air gun signals and highlight the caution necessary in extrapolating results from the laboratory to real world scenarios or across life history stages.

Pearson et al. (1994) exposed crab larvae to single pulses from a seismic source array. For immediate and long-term survival and time to moult, this study did not reveal any statistically significant differences between the exposed and unexposed larvae, even those exposed within 1 m of the seismic source.

Impacts to larvae have been identified following intense and lengthy periods of exposure to low-frequency sound. Tank experiments by Aguilar de Soto et al. (2013) showed evidence of morphological abnormalities in early-stage scallop larvae from simulated seismic signals. However, the lengthy exposure period of 3 second pulse intervals for an exposure duration of 90 hours and at 1 m distance from sound source is not realistic of an actual survey. Christian et al. (2003) found major developmental differences between control and treatment groups of snow crab eggs exposed to a peak pressure level of 216 dB SPL every 10 seconds for 33 minutes. Again, the exposure to a constant peak pressure level for a prolonged period is not realistic of an actual survey where the source is moving and so does not remain in one place.

Hawkins (2014) used continuous sonar to record zooplankton layers, comprising copepods, cladocerans, decapod larvae, gastropod larvae, and bivalve larvae, exposed to playback of pile driving sound (pile driving sound typically has a more rapid rise time, more frequent strike rates and therefore a greater sound exposure regime than a seismic survey). Zooplankton layers responded to sound by showing a 'dent' in the top of the layer at the onset of the sound sequence, although the change in depth often did not persist for the whole duration of the sound exposure and zooplankton distribution quickly returned to normal.

Based on the studies discussed above, physical impacts to planktonic organisms have typically been found to be limited to within approximately 10 m of the seismic source. Using this 10 m impact range, a study by McCauley (1994) calculated the impact in a seismic survey area, assuming plankton mortality of 100% within 10 m of a seismic source. This suggested that the total mortality due to seismic testing would impact less than 1% of plankton in the survey area.

DNV Energy (2007) and Hawkins & Popper (2012) conducted comprehensive reviews of a number of scientific studies, including those by Kostyuchenko (1973), Dalen & Knutsen (1987), Booman et al. (1996) and Saetre & Ona (1996); the effects of seismic activities on eggs and larvae were predicted to result in average and worst-case mortality rates of 0.0012% and 0.45% per day respectively, which were not deemed significant when compared to a natural mortality rate of 5-15% per day, as applicable to most species during early life stages.

However, a study by McCauley et al. (2017) received notable attention for suggesting the potential for zooplankton mortality to increase two- to three-fold out to 1.2 km from a single seismic source element, with an estimated decline in zooplankton abundance of up to 64% and a "hole" in the zooplankton backscatter observed via acoustic detection methods. The 1.2 km range corresponded with pressure levels of 178 dB PK-PK (McCauley et al. 2017). However, the extent of such impacts is inconsistent with previously and subsequently documented effects to plankton.

The authors highlight some limitations to the findings of this research that have raised further questions from industry and the scientific community (Richardson et al. 2017, IAGC 2017) particularly in relation to the following:

- There was no evidence of attenuation of impacts with distance from the source with no consistent decline in the proportion of zooplankton that were killed with increasing distance from the source.
- Sonar backscatter data indicated an immediate decline in zooplankton abundance (the "hole" in the data). However, if the zooplankton had been killed, they would not have sunk from the surface layers of the water column immediately, suggesting that some zooplankton may have moved, or they may have simply reorientated themselves to the sonar in response to the seismic pulses, which raises questions over the occurrence, magnitude, and extent of mortal impacts.
- The study was based on a relatively small number of tow samples on two separate days. On the second day, even before the use of the seismic source element, the zooplankton net tow abundance counts were significantly lower than the first day and, therefore, it is difficult to draw reliable conclusions from this data. On the second day almost all values at 80 metres range presented greater plankton abundance from exposed samples and lower abundance of control samples, indicative of a potential flaw in the sampling scheme and analysis protocol.

A recent study by Fields et al. (2019) exposed zooplankton (copepods) to seismic pulses at various distances up to 25 m from a seismic source. The source levels produced were estimated to be 221 dB SEL comparable to the far-field source levels associated with some commercial scale seismic surveys. The study observed an increase in immediate mortality rates of up to 30% of copepods in samples compared to controls at distances of 5 m or less from the seismic source. Mortality one week after exposure was significantly higher by 9% relative to controls in the copepods placed 10 m from the seismic source. Fields et al. (2019) also reported that no sublethal effects occurred at any distance greater than 5 m from the seismic source. The findings of the study are consistent with numerous other field studies, as referenced previously, indicating that the potential effects of seismic pulses to zooplankton are limited to within approximately 10 m from the seismic source. Fields et al. (2019) detailed that it is difficult to reconcile the high mortality reported by McCauley et al. (2017) with the low mortalities reported in other studies.

Invertebrates

Research is ongoing into the relationship between sound and potential effects on benthic invertebrates, including the relevant metrics for both effect and impact. Marine invertebrates lack a gas-filled bladder and are unable to detect the pressure component of sound waves (Parry and Gason 2006, Carroll et al. 2017) or "hear" sound in the way that mammals and fish can. Instead, invertebrates detect sound by sensing the particle motion component of sound in water and seabed sediments through physiological structures such as sensory hairs, statocysts and muscles, and therefore detect sound at close range (McCauley 1994, Parry and Gason 2006, André et al. 2016, Roberts et al. 2016, Edmonds et al. 2016, Carroll et al. 2017, Popper and Hawkins 2018). Statocysts, found in a wide range of invertebrates, are utilised by animals to maintain their orientation, direct their movements through the water and may play a key role in controlling the behaviour responses of invertebrates to a wide range of stimuli. Although directly sensitive to particle motion and not to sound pressure, most available research on seismic impacts to invertebrates characterises received sound levels in terms of the sound pressure. Therefore, available literature suggests particle motion, rather than sound pressure, is a more important factor for benthic invertebrates such as crustacean and molluscs.

A range of physiological responses have been identified in some studies, however, the received sound levels are typically at levels that would be received within tens or a few hundred metres from the sound source or have been from repeated exposure at the same sound levels, which is not typical of an actual seismic survey (Carroll et al. 2017, Edmonds et al. 2016, Salgado Kent et al. 2016, Webster et al. 2018).

The most recent critical review of the potential impacts of marine seismic surveys on fish and invertebrates by Carroll et al. (2017) summarised the impacts of seismic sound emissions on marine invertebrates based on a literature review of 70 studies, which comprised a total of 68 species of fish and 35 species of invertebrates, including several studies that were not differentiated. Carroll et al. (2017) conclude that:

"Our review has identified scientific evidence for high-intensity and low-frequency sound-induced physical trauma and other negative effects on some fish and invertebrates; however, the sound exposure scenarios in some cases are not realistic to those encountered by marine organisms during routine seismic operations. Indeed, there has been no evidence of reduced catch or abundance following seismic activities for invertebrates, and there is conflicting evidence for fish with catch observed to increase, decrease or remain the same."

Crustaceans

Specific studies examining the effect of seismic survey signals on crustaceans, including larval stages, are relatively rare, though recent Australian studies (e.g., Day et al. 2019; Carroll et al. 2017; Day et al. 2016b; Przeslawski et al. 2016b; Day et al. 2021), have aimed to narrow the knowledge gap. These are being supplemented by global research, including ongoing projects such as Canadian Healthy Oceans Network Project 2.1.4 (Anthropogenic Noise in The Ocean Soundscape: Effects on Fishes and Invertebrates).

To understand interactions between marine seismic surveys and marine invertebrates, the Commonwealth Government's Fisheries Research Development Corporation (FRDC), Origin Energy Ltd and the CarbonNet Project contributed funding to a research program assessing the impact of marine seismic surveys on southern rock lobsters (and commercial scallops). This program study was undertaken by researchers from the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania (Day et al. 2016b).

The research program involved exposure of cohorts of southern rock lobsters to multiple seismic acoustic source pulses at two sites (sandy substrate and limestone rock platform), both in 10–12 m water depths off the southern Tasmanian coast. The exposed lobsters were captive and control lobsters (no exposure) were also examined during subsequent analyses undertaken at 0-, 14-, and 120 -days post-exposure. Exposure experiments were undertaken in July 2013 (45 in^3 acoustic source, 2,000 psi), July 2014 (150 in^3 acoustic source, 1,300 psi and 2,000 psi) and February 2015 (150 in^3 acoustic source, 2,000 psi). The acoustic source was towed at approximately 5 m depth from 1 km away and at a speed of approximately 5.5–7.4 km/hr with a shot interval of 11.6 seconds. The seismic source circled near the lobster pots. The maximum calculated exposures were 212 dB re 1 μPa PK-PK, a per-pulse SEL of 190 dB re 1 $\mu Pa^2.s$, an accumulated SEL of 199 dB re 1 $\mu Pa^2.s$ and maximum peak magnitude of ground acceleration of 68 ms^{-2} though Day et al. (2016b) note this was an outlier.

Conclusions from the study are:

- Exposure to seismic sound did not result in any mortality any of the experiments comprising this study.
- There was no difference in fecundity between control and exposed lobsters.
- The ability of exposed lobsters, and one cohort of control lobsters, to right themselves, a complex reflex, was compromised in the long term (120 days post-exposure) in three of the four experiments. This response was linked to damage to sensory hairs of the statocyst, the primary mechano-sensory and balance organ in lobsters.
- Tail extension, a simple behavioural reflex response, showed reduction in exposed lobsters in one of the four experiments. Day et al. noted it is unclear how significant this finding is, as the warm summer water conditions during this experiment may be a contributing factor.
- Haemolymph (blood) biochemistry showed little effects on metabolic and respiratory stress, or vitality following exposure.
- Haemocyte count (indicative of immune response function) in exposed lobsters showed a long-term decline to 120 days post-exposure. However, haemocyte counts subsequently recovered to double the number of haemocytes in control lobsters at 365 days post-exposure, which may indicate a possible immune response to pathogens.
- Seismic exposure did not cause any mass mortality. The authors rejected the hypothesis that ‘exposure to seismic acoustic sources causes immediate mass mortality, defined as an increase in mortality rate of sufficient proportion to affect population size significantly’. Not considering when both the control and exposed groups suffered mass mortality, the experimental mortality rates at 120 days’ post-seismic acoustic source exposure were between 9.4% and 20%. These fall towards the low end of what might be expected from natural mortality rates. Even the highest levels of mortality recorded, 17.5% and 20% suffered by 4-pass treatments from the 2014 and 2015 experiments, were assessed by the authors to be modest compared to naturally occurring mortality rates.

Overall, no direct lethal effects to adult lobsters were observed and impacts were limited to statocyst condition, behavioural reflexes, and immune response functions in adult lobsters. Day et al (2016b) note that these could have some effect on longer-term survivability.

Subsequent to the Day et al (2016b) study, Day et al (2019) undertook additional work to determine whether southern rock lobsters with pre-existing damage to their mechanosensory statocyst organs as a result of exposure to anthropogenic sound, incur further damage from exposure to marine seismic surveys. For this study, southern rock lobsters collected from a site subject to high levels of anthropogenic noise (a high shipping traffic lane used by cargo vessels and cruise ships, as well as pumping stations) were exposed to an equivalent seismic air gun signal regime as the Day et al (2016b) study of lobsters, which was from an area of minimal anthropogenic sound ('noise-naïve' lobsters). Following exposure, both control and exposed treatments were found to have damage to the statocyst equivalent to that of noise-naïve lobsters following seismic exposure, leading to the conclusion that the damage was both pre-existing and not exacerbated by seismic exposure. Additional to the lack of further damage following marine seismic survey exposure, no disruption to the righting reflex was observed, demonstrating the lobster's ability to cope with or adapt to the mechanosensory damage (Day et al. 2020).

The lobsters from the high shipping site showed a pre-existing level of statocyst damage equivalent to that of lobsters exposed to the seismic signals. These lobsters also demonstrated a resilience to further damage, with exposure to seismic sound not increasing the level of cell loss in the statocyst hairs (Day et al. 2020). There were also no significant differences in the time taken to right themselves (from 'belly up' to 'belly down') between the control and exposed lobsters from the shipping site, though righting time was slower and more variable than the lobsters at the control site.

Day et al. (2021) undertook a study to determine whether early development and recruitment of southern rock lobsters puerulus and juveniles might be affected by exposure to seismic sound by assessing mortality rates following exposure; impairment of the righting reflex, and development through assessment of progression through the moult cycle. This study also undertook to respond to the finding by McCauley et al (2017) of increased mortality in zooplankton following exposure to air gun signals that suggests that planktonic, early life stages of marine invertebrates may be more vulnerable than adults or developing embryos.

The Day et al. (2021) study involved exposing puerulus and juvenile southern rock lobsters within oyster baskets on the seabed to a full-scale array (three 2,820 in^3 seismic sources with 2,000psi at a depth of 8 m) during a commercial seismic survey in 51-58 m of water. Day et al. (2021) identified that:

- Exposure did not result in any elevated mortality for puerulus or juveniles and thus, seismic surveys are unlikely to produce significantly increased mortality in puerulus and juvenile southern rock lobsters.
- An impact to righting reflex occurred in the immediate vicinity (directly below the sound source) for puerulus and out to at least 500 m for juvenile southern rock lobsters. However, juveniles exposed at 500 m recovered after the first moult, indicating that the impact range extended to at least 500 m from the source, the maximum range tested in the study. The results from the combined puerulus and juvenile treatments indicated that puerulus and juvenile below the sound source did not show the capacity for recovery whereas juvenile lobsters at 500 m form the source recovered from impairment after the first moult, providing evidence of a range threshold for recovery.

- The intermoult period was significantly increased in juvenile lobsters directly below the sound source and appeared to be increased in puerulus, though the latter could not be statistically analysed.
- Juveniles at 500 m showed a moderate, non-significant increase in moult duration.
- Increased intermoult duration suggested impacted development and potentially slowed growth, though the proximate cause was not identified.

Payne et al (2007) conducted a pilot study of the effects of exposure to seismic sound on various health endpoints of the American lobster *(Homarus americanus*). Adult lobsters were exposed either 20 to 200 times to 202 dB re 1μPa PK-PK or 50 times to 227 dB re 1μPa PK-PK, and then monitored for changes to survival, food consumption, turnover rate, serum protein level, serum enzyme levels, and serum calcium level. Lobsters were exposed to seismic pulses at very close range to the source (~2 m). The SEL that the lobsters were exposed to was not described in the report but can be estimated to be up to 207 dB re 1 μPa^2.s. Observations were made over a period of a few days to several months and found that:

- Results indicated no effects on delayed mortality or damage to the mechanosensory systems associated with animal equilibrium and posture (as assessed by turnover rate).
- There was a decrease in the levels of serum protein, serum enzymes and serum calcium in the haemolymph of animals exposed to seismic sound. Statistically significant differences were noted in serum protein at 12 days post-exposure, serum enzymes at 5 days post-exposure, and serum calcium at 12 days post-exposure. Serum enzymes are valuable in detecting major organ damage whereby enzymes leak into the blood upon cellular rupture. Within this study two enzymes, Aspartate transaminase and Creatine kinase, were not elevated in seismic-exposed animals, reflecting the absence of major cellular rupture or necrosis being affected by seismic sound, including high exposure conditions. Similar results were obtained in studies with snow crabs (Christian et al. 2003). However, there was evidence of decreased serum enzymes in some trials, indicating the possibility of hemodilution or uptake of excess water by the animals. A similar decrease in serum protein and calcium was noted in some trials indicating a potential for disturbance to osmoregulation (i.e., the process by which the body regulates the osmotic pressure of any organisms' fluids in order to keep the homeostasis of the organisms' water level constant). Altogether, the results suggest a potential for osmo-regulatory disturbance in lobsters exposed to seismic. This study did not provide evidence for delayed mortality in lobsters several months after exposure, with some observations extending to 9 months.
- During the histological analysis conducted 4 months post-exposure, no structural differences in hepatopancreatic tissues were noted, which would denote cell or tissue rupture, necrosis, or inflammation. There was also no evidence of tissue necrosis or inflammation in the ovaries. However, histology identified elevated deposits of carbohydrates, thought to be glycogen, in the hepatopancreas of seismic-exposed animals. Such abnormal accumulations are believed to be due to disturbance in cellular processes connected with synthesis and secretion, however, the report concludes that further research is required to assess whether this observation is due to organ stress. These studies are noted as being exploratory in nature, with the authors cautioning against over-interpretation.

In 2018, the CarbonNet Project undertook the Pelican 3D marine seismic survey in waters 15 m to 35 m deep located between 1 km and 13 km from the Gippsland shoreline in Victoria. Underwater sound and its potential impact on the marine environment was a key issue raised by stakeholders, particularly the commercial fishing industry. In response, and among other actions, CarbonNet undertook southern rock lobster surveys before and after the marine seismic survey to ascertain whether any differences in abundance could be attributed to the marine seismic survey. The design of the survey was overseen by an independent Advisory Panel to provide advice on the survey methodology and interpretation of the survey results and its implications.

Ten sites (in areas of reef) were monitored, including six sites within the survey acquisition area and four reference sites located more than 15 km to the north-east. At all sites, more southern rock lobster were retrieved during the post-survey assessment (4 months after the survey), with 81 individuals trapped during the pre-survey assessment compared to 122 trapped post-survey. This increase in numbers post-survey was most likely due to seasonal effects rather than any impact of the survey (CarbonNet, 2018). These results indicate no effect of the marine seismic survey on lobster abundance.

Morris et al. (2017) and Cote et al. (2020) undertook field studies in from 20215 – 2017 into the effects of marine seismic surveys on the behaviour of the snow crab (*Chionoecetes opilio*) on the shelf and slope habitats of Atlantic Canada using a Before-After-Control-Impact (BACI) study design to assess the behavioural responses of snow crab to seismic exposure. A 4,880 in^3 seismic source operated at 2000 psi, 9 m depth and fired at a frequency of 10 s (approximately 25 apart). Animal movements were tracked using an acoustic positioning array consisting of 50 acoustic receivers. The study concluded that while effects of seismic exposure on snow crab movement could not be ruled out completely, effects were at most quite small relative to natural variation. In contrast, snow crab exhibited much clearer responses to handling, temperature, and time of day. Overall, the results suggest that seismic effects, specific to the behaviour of adult male snow crab, are at most subtle and are not likely to be a prominent threat to the fishery.

A pilot study on snow crabs (*C. opilio*) (Christian et al. 2003; 2004) exposed captive adult male snow crabs, egg-carrying female snow crabs, and fertilised snow crab eggs to variable SPLs (191–221 dB re 1 μPa PK) and SELs (<130–187 dB re 1 μPa^2.s) under controlled field experimental conditions. The crabs were exposed to 200 discharges over a 33-minute period and found that:

- Neither acute nor chronic (12 weeks post-exposure) mortality was observed for the adult crabs.
- There was a significant difference in the development rate noted between the exposed and unexposed fertilised eggs/embryos in this study with the egg mass exposed to seismic energy demonstrating a higher proportion of less-developed eggs than the unexposed mass. However, this experiment was performed on eggs stripped from a single berried female and cultured in a laboratory for six weeks prior to exposure and eighteen weeks following exposure. Subsequent work on larvae that had been exposed to seismic array signals as embryos but could hatch normally without being stripped from berried females did not suffer any negative effects (Payne et al., 2008).
- Stress indicators in the haemolymph of adult male snow crabs were monitored immediately after exposure of the animals to seismic survey sound (Christian et al. 2003; 2004) and at various intervals after exposure. No significant acute or chronic differences

between exposed and unexposed animals in terms of the stress indicators (e.g., proteins, enzymes, cell type count) were observed.

Christian et al (2003) also investigated the behavioural effects of exposure to seismic survey sound on snow crabs. Caged animals on the ocean bottom at a depth of 50 m were monitored with a remote video camera during exposure to seismic sound and did not exhibit any overt startle response during the exposure period. Eight animals were equipped with ultrasonic tags, released, and monitored for multiple days prior to exposure and after exposure. None of the tagged animals left the immediate area after exposure to the seismic survey sound. Five animals were captured in the snow crab commercial fishery the following year, one at the release location, one 35 km from the release location, and three at intermediate distances from the release location.

In 2003, a collaborative study was conducted in the southern Gulf of St. Lawrence, Canada, to investigate the effects of exposure to sound from a commercial seismic survey on egg-bearing female snow crabs (DFO 2004). Caged animals were placed on the ocean bottom at a location within the survey area and at a location outside of the survey area. The maximum received SPL was ~195 dB re 1 µPa PK. The crabs were exposed for 132 hours of the survey, equivalent to thousands of seismic shots of varying received SPLs. The animals were retrieved and transferred to laboratories for analyses. Neither acute nor chronic lethal or sub-lethal injury to the female crabs or crab embryos was indicated. DFO (2004) reported that some exposed individuals had short-term soiling of gills, antennules and statocysts, bruising of the hepatopancreas and ovary, and detached outer membranes of oocytes. However, they were found to be completely cleaned of sediment when sampled five months later and any differences could not be conclusively linked to exposure to seismic survey sound.

In a field study, Pearson et al (1994) exposed Stage II larvae of the Dungeness Crab (*Cancer magister*) to single discharges from a seven-acoustic source array and compared their mortality and development rates with those of unexposed larvae. For immediate and long-term survival and time to moult, this study did not reveal any statistically significant differences between the exposed and unexposed larvae, even those exposed within 1 m of the seismic source (with a mean sound pressure level as high as 231 dB re 1 µPa).

Molluscs

Molluscs include benthic invertebrates such as marine bivalves (e.g., scallops, oysters, mussels and clams) and gastropods (e.g. sea snails/trochus, sea slugs and nudibranchs). Like crustaceans, the mechanism of impacts for molluscs are unlikely to be from sound pressure, but rather from particle motion. The physiology and sensory structures of different marine bivalves and gastropods is similar and so results of studies on the effects of seismic sound are broadly representative for species other than those studied.

Wardle et al. (2001) monitored molluscs and echinoderms on a shallow water reef exposed to seismic sound with peak sound pressure levels of 218, 210 and 195 dB re 1 µPa at distances of 5 m, 16 m and 109 m respectively. Video observations made over two weeks indicated that the sound did not result in invertebrates moving away from the reef and there was little effect on their day-to-day behaviour.

Kosheleva (1992; cited in Parry & Gason 2006) identified no detectable effects to marine bivalves and gastropods (mussels and periwinkles) after exposure to a single seismic source element of source level 233 dB re 1μPa at 0.5 m or greater from the source. Conversely, Matishov (1992; cited in Parry & Gason 2006) reported a single scallop shell splitting in a sample of three scallops, but this was located 2 m beneath a seismic source and therefore exposed to maximum sources levels.

Recent Australian studies (Przeslawski et al. 2016a,2016b, 2018; Day et al. 2016b, 2017) have focussed on commercial scallops (*Pecten fumatus*). Przeslawski et al. (2016a, 2016b, 2018) examined the short-term impacts on scallops and other marine invertebrates from a 2,530 cubic inch seismic array and found no evidence of mortality or change in condition following exposure to a seismic survey. Analysis of images and samples revealed some site-specific differences in scallop abundance, size, condition, and assemblages, but these were not related to seismic operations.

From 2013-2015, a long-term study evaluated the acoustic impacts from seismic exposure on scallops in Australia (Day et al. 2016b, 2017). The experimental field research maintained the scallops in mesh enclosures while a vessel with the acoustic source passed close to the animals. Day et al. (2016b, 2017) exposed scallops to maximum received sound exposures of up to 213 dB re 1μPa PK-PK, 181 to 188 dB re 1 μPa^2.s per-pulse SEL, and SELcum of 188 to 198 dB re $1\mu Pa^2$.s. The study also predicted ground acceleration of up to 37.57 m/s^2.

Day et al. (2016b, 2017) concluded that exposures did not result in any immediate mass mortalities, however, repeated exposures, not representative of typical survey conditions, resulted in a chronic increase in mortality over timeframes of approximately four months post-exposure, though not beyond naturally occurring rates of mortality. Separate experiments undertaken in 2013 and 2014 yielded mortalities of 3.6-3.8% in control scallops (no seismic exposure), 9.4-11.3% mortality in scallops exposed to a single pass of the seismic source, 11.3-16.1% mortality in scallops exposed to two passes of the seismic source, and 14.8-17.5% mortality in scallops exposed to four passes of the seismic source. The mortality rates were at the low end of the range of naturally occurring mortality rates documented in the wild, which range from 11-51% with a 6-year mean of 38% (Day et al. 2017). A third experiment in 2015 resulted in 100% mortality to both control scallops and exposed scallops, and accordingly was attributed to other causes and not to seismic exposure (Day et al. 2016b, 2017).

Sub-lethal effects to exposed scallops were also observed by Day et al. (2016b, 2017) indicating a compromised capacity for homeostasis and potential immunodeficiency over acute (hours to days) and chronic (months) timescales post exposure. Exposures did not elicit energetically expensive behaviours (i.e., extensive swimming or long periods of valve closure), but scallops showed significant changes in behavioural patterns during exposure, through a reduction in classic behaviours and demonstration of a non-classic “flinch” response to seismic signals. Furthermore, following exposure scallops showed an increase in recessing into sediment following exposure (Day et al. 2017).

Though Day et al. (2016b) recorded increased mortality with repeated exposure to a seismic source, it has not been established as to whether this was due to the seismic source exposure or other mechanism related to the study design (Przeslawski et al. 2016). Using a precautionary approach, if the increased mortality was due to the seismic source, then the increased mortality identified translates to an annual increase of between 9.4% and 20%. These fall towards the low end of what might be expected when compared with natural mortality rates in wild scallop populations, which range from 11-51% with a six year mean of 38% (Day et al. 2016b).

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. (2016a, 2016b) however cautioned that it was unclear from the study whether the observed physiological (and behavioural) impairments would result in mortality beyond the timeframes considered in their study.

Przeslawski et al. (2018) concluded that 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 from an actual seismic survey. The authors concluded that the 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. (2018) further concluded that the study provided a robust and evidence-based assessment of the potential effects of a seismic survey on some fish and scallops.

Corals

A literature review conducted for Woodside by Dr Mardi Hastings stated that the primary mechanisms for injury of hermatypic corals from seismic sound emissions are: (1) breaking of the external coral skeleton which could also damage the polyp tissue, and (2) rupture or tearing of polyp tissues inside the corallites (Hastings 2008).

Although injury to corals is theoretically possible as described by Hastings (2008), studies on the actual impacts were limited prior to the Maxima and Gigas studies at Scott Reef (see below). A survey of coral reefs in Brunei that were subjected to seismic noise did not detect any damage to hard or soft corals, sponges, or other sessile benthic organisms (IEC 2003).

The most relevant data currently available are results from exposure studies that Woodside conducted during the Maxima 3D and Gigas 2D Pilot ocean bottom cable marine seismic surveys at Scott Reef in Western Australia.

In the Maxima 3D experiments corals in and around the lagoon were exposed to seismic signals (both experimental seismic lines and a full seismic survey) using a 2,055 in^3 source over a 59-day period. The experimental lines passed directly over the coral communities (source at 7 m depth, corals at ~60 m depth) whereas the full seismic survey passed within tens to 100s of metres (horizontal offset). The maximum estimated received seismic signal levels at coral impact sites were 226–232 dB PK-PK, 214–220 dB SPL, 197–203 dB SEL, and a maximum cumulative SEL of 197–203 dB (Salgado Kent et al. 2016).

For plate corals, *Lobophytum* spp., and various soft corals including *Sarcophytum* spp., the proportion of dead and bare coral cover and the % cover of red algae were documented, and no detectable effect was found from one or multiple passes of the seismic source (Battershill et al. 2008). Further, there was no evidence of coral breakage, no signs of physiological impairment in the corals (polyp withdrawal or reduction in soft coral rigidity) and no long-term change in coral community structure related to the experimental or full seismic survey activities (Battershill et al. 2008).

The Gigas 2D Pilot Ocean Bottom Cable coral monitoring study (SKM 2008) examined the potential for physical damage to a range of shallow water corals in north Scott Reef lagoon from seismic source emissions. This study used several sub-lethal indicators of stress and mortality (partial and whole colony mortality) to determine the effects of seismic source emissions on corals. The conclusion from this study was that emissions from the seismic source did not cause significant injury, tissue damage, sublethal stress or mortality to coral colonies, even when colonies were within a few metres of the seismic source (SKM 2008). This survey had a measured at source SEL of 206 dB (McCauley 2008).

Heyward et al. (2018) reviewed the research undertaken at Scott Reef and the analysis detected no effect of seismic activity measured as coral mortality, skeletal damage, or visible signs of stress immediately after and up to four months following the 3D marine seismic survey. Maximum received levels were 226 dB PK.

Fish

Although hearing ranges and sensitivities vary substantially between species (e.g., Ladich and Fay 2013), all fish species tested to date can detect sound and vibration to some degree (Dale et al. 2015). Fishes have developed two sensory mechanisms for detecting, localising, and interpreting underwater sounds and vibrations: the inner ear, which is tuned to sound pressure detection, and the lateral line system, which allows a fish to detect vibration and water flow. Inter-specific variations in hearing range and sensitivity result from the different adaptations in these systems for perceiving sound pressure and particle motion information (Popper and Fay 2011).

Based on their morphology, Popper et al. (2014) classified fishes into three categories comprising:

- Fishes with swim bladders whose hearing does not directly involve the swim bladder or other gas volumes.
- Fishes whose hearing does directly involve a swim bladder or other gas volume.
- Fishes without a swim bladder that can sink and settle on the substrate when inactive.

The Popper et al. (2014) classifications can be assigned to the following families or species of commercial fish species, common in Australian waters:

- Fishes with swim bladders or other gas volumes, but whose hearing does not directly involve the swim bladder, e.g. snappers, emperors, groupers and rock cods (Lutjanids and Lethrinids such as *Pristipomoides* spp., *Lethrinus* spp., *Lutjanus* spp., and family Serranidae), and some species of tuna (*Thunnus* sp.) (Tavolga and Wodinsky 1963; Higgs et al. 2006; Braun and Grande 2008; Engineering-Environmental Management, Inc. 2008; United States Department of the Navy 2008; Caiger et al. 2012; Bertrand and Josse 2000; Song et al. 2006).
- Fishes whose hearing does directly involve a swim bladder or other gas volume e.g., family Clupeidae (herrings, sardines, pilchards, and shads) and some Haemulidae (grunters and sweetlips) (Nedwell et al. 2004; Braun and Grande 2008; Popper et al. 2014).
- Fishes without a swim bladder (e.g., mackerel, Scomberomorus spp., some species of tuna, Thunnus sp. and sharks) (Casper et al. 2012, Popper et al. 2014, Carroll et al. 2017).

Underwater noise levels significantly higher than ambient levels can have a negative impact on fish, ranging from physical injury or mortality to temporary effects on hearing and behavioural disturbance effects.

The effects of underwater sound on fish within the vicinity of a seismic sound source array 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 sound duration. The effect of noise on a receptor may be either physiological (e.g., injury or mortality) or behavioural, as described in the following sub-sections.

Mortality/Potential Mortal Injury

It is noted that while thresholds for fish mortality have been included for consideration in this assessment based on the Popper et al. (2014) guidelines, no studies to date have demonstrated direct mortality of free-swimming adult fish in response to seismic source emissions, even when at close proximity (within 1– 7 m) (DFO 2004; Boeger et al. 2006; Popper et al. 2016; Carroll et al. 2017). Although some fish deaths have been reported during cage experiments, these were more likely caused by experimental artefacts of handling fish or confinement stress (Hassel et al., 2004). For free swimming fish that can move away from seismic sources as they approach, the potential for lethal physical damage from airgun emissions is even further nullified. However, reef or bottom-dwelling fish that show greater site attachment may be less inclined to flee from a seismic sound source and experience greater effects.

Despite mortality being a theoretical possibility for fish exposed to seismic source emissions, Popper et al. (2014) did not reference an actual occurrence of this effect. At the time of developing the guidelines, no quantified data on injury and mortality from seismic sources on fish had been reviewed by the Working Group. Therefore, the Popper et al. (2014) exposure guidelines for mortality/potential mortal injury and recoverable injury for fish exposed to seismic source emissions are based solely on data from pile driving conducted on predominantly temperate, freshwater fish species. Although seismic surveys and pile driving both produce impulsive sound, their sound characteristics are markedly different; pile driving impulses result in a more rapid rise time in sound pressure than seismic pulses and it is this rapid rise time that has the greatest potential for trauma (Caltrans 2001, 2004; Hastings and Popper 2005; Popper et al. 2006).

Environmental Resources Management Australia (ERM) undertook a detailed literature review of potential fish mortality and physical injury because of exposure to seismic sources (ERM, 2017). Of the 28 studies reviewed, only three observed direct mortality and in each case, mortalities occurred to caged fish at very close proximity to the seismic source (<2 m), which is not representative of real-life exposures from seismic surveys because fish are free-swimming and are not likely to be exposed at such close range. The received sound levels that resulted in mortality ranged from 220 to 241 dB re 1 μPa PK, however, other studies reported no mortality or injury at levels as high as 246 dB re 1 μPa PK. Therefore, the sound exposure criteria proposed by Popper et al. (2014) for mortality and mortal injury are highly conservative.

Other than physiological stress responses or hearing loss, no other physical damage to adult fish or invertebrates have been directly attributed to exposure to seismic source emissions, even at close proximity (NSW DPI 2014). It should be noted that some reports of physical damage arise from studies undertaken using explosions and other high-pressure sound waves, and not from seismic source emissions that generate a lower maximum pressure and pressure change (Popper and Hastings 2009).

Bony fish apparently can regenerate the sensory cells in their hearing system to a fully functional state within weeks after a detrimental exposure. The processes involved in the recovery are not fully understood, and there is conflicting evidence from sound exposure studies, such as

McCauley et al. (2003). These findings could also suggest that the process of sensory hair cell death and regeneration is species-specific.

Recovery processes take a few days to a few weeks (Scholik and Yan 2001, Mackenzie and Raible 2012), and the time course for recovering from hearing loss likely depends on the species, its normal hearing sensitivity, the sound exposure intensity and duration, and the amount of sensory epithelial damage (Smith and Monroe 2016). Noise-induced PTS has not been reported for fishes yet, which may be explained by their apparent ability to recover hair cells.

Injurious effects caused by rapid pressure changes within the body are called 'barotrauma' (Stephenson et al. 2010, Halvorsen et al. 2011, Halvorsen et al. 2012b). The range of barotrauma effects in fishes mostly depends on the temporal pattern of the pressure changes and the physiological state of the exposed fishes (Stephenson et al. 2010, Halvorsen et al. 2012a, Halvorsen et al. 2012b); they range in severity from damages with full recovery to lethal injury (McKinstry et al. 2007).

Casper et al. (2012) showed that fishes can recover from less severe injuries under laboratory conditions, suggesting that minor injuries do not inevitably lead to mortality. Nevertheless, in open waters, they have the potential to reduce the animal's fitness to the extent that its ability to find food decreases and its risk of being predated increases (Halvorsen et al. 2011, Halvorsen et al. 2012b).

Mortality is either a direct effect of barotrauma (in the case of severe injury) or indirect if an animal is moderately injured. Data on sound-induced mortality in fishes are scarce and mainly related to underwater explosions (see review by Popper and Hastings 2009). California Department of Transportation (2001) documented fish mortality near underwater pile driving. There is no evidence for fish mortality caused by exposure to other sound sources such seismic source emissions, dredging, or vessel noise (Normandeau Associates Inc 2012).

Temporary Threshold Shift (TTS)

The following is sourced from Popper et al. (2014):

"Temporary threshold shift (TTS) is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS has been demonstrated in some fishes, and its extent is of variable duration and magnitude. TTS results from temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves innervating the ear (Smith et al. 2006; Liberman 2015). However, sensory hair cells are constantly added in fishes (e.g., Corwin 1981, 1983; Popper and Hoxter 1984; Lombarte and Popper 1994) and also replaced when damaged (Lombarte et al. 1993; Smith et al. 2006; Schuck and Smith 2009), unlike in the auditory receptors of mammals. When sound-induced hair cell death occurs in fishes, its effects may be mitigated over time by the addition of new hair cells (Smith et al. 2006, 2011; Smith 2012, 2015).

After termination of a sound that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of sound exposure (e.g., Popper and Clarke 1976; Scholik and Yan2001, 2002a, b; Amoser and Ladich 2003; Smith et al. 2004a, b, 2006, 2011; Popper et al. 2005, 2007). While experiencing TTS, fishes may have a decrease in fitness in terms of communication, detecting predators or prey, and/or assessing their environment."

McCauley et al. (2003) demonstrated that exposure to repeated emissions of a single airgun (source level of 222.6 dB re 1µPa PK-PK) from 5 to 15 m at the closest approach caused extensive damage to the sensory hair cells in the inner ear of caged pink snapper (*Pagrus auratus*). Although no mortality was observed, the damage was severe with no evidence of repair or replacement of damaged sensory cells up to 58 days post-exposure. However, the study did not investigate the effects on fish hearing. The study acknowledged that the fish were caged and therefore not able to swim away from sound source, and that the monitoring video suggested the fish would have fled the sound source if possible. The authors of the study also acknowledged that the impact of exposure on ultimate survival of the fish was not clear.

As part of Woodside's Maxima 3D MSS, an extensive field study was undertaken at Scott Reef. A component of this study investigated the potential physical, physiological, and behavioural noise-induced effects on fish assemblages. The results showed statistically more damage to the hearing in blue-stripe sea perch (*Lutjanus kasmira*) exposed to the seismic impulses than in control fishes. However, the damage found in these fishes was marginal, and—assuming a direct relationship between hair cell density and hearing capability—a negligible effect on the fishes' hearing capability. The damage was monitored through time out to 58 days post seismic exposure and did not increase significantly through time, with almost zero damage detected by 58 days (McCauley 2008).

A study of auditory sensitivity in four species of tropical reef fishes following exposure to emissions from the 2,055 in^3 array showed that none of the four species, including the pinecone soldierfish (a species with expected to have good hearing sensitivity) experienced any hearing sensitivity loss (i.e. TTS) following exposure to SELcum up to 190 dB re 1 $\mu Pa^2 \cdot s$ (Hastings et al. 2008; Hastings and Miksis-Olds 2012). No detectable gross physiological damage was found in individuals from any of the seven species (McCauley and Kent 2012). The results of the hearing tests are consistent with the sound exposure guidelines proposed in Popper et al. (2014), which indicated that TTS may occur at SELcum levels >186 dB re 1 $\mu Pa^2 \cdot s$ while other studies (Popper and Hastings 2009; Song et al. 2008) indicate that TTS may occur at levels as high as SPL 205-210 dB re 1µPa (PK).

Behaviour

The sound-related factors influencing behavioural reactions in fishes can include its frequency content, intensity above background noise and temporal sound characteristics. If exposed to the same stimulus over a prolonged period, an initial behavioural reaction might fade as the fish's habituate to the sound. Behavioural reactions that are usually observed in fishes in response to sound are dispersion, directed movements away from the sound source (leaving the area of the noise source, aggregation and descending closer to the bottom), startle response (fast start escapes, C-start response) at sound onset (Wardle et al. 2001; Slotte et al. 2004). Effects can be acute (such as acoustic masking), or chronic (including altered distribution), lasting from the immediate duration of sound exposure to several days or weeks if fishes are displaced from their preferred areas during a survey (Engås et al. 1996; Slotte et al. 2004; Løkkeborg et al. 2012; Streever et al. 2016).

The onset level of behavioural responses in fishes varies greatly between and within species, including between fishes of different ages and sizes, the behavioural and social context, and the motivation of the fishes. Existing data on behavioural responses do not provide a clear dose-response relationship and, consequently, it is currently impossible to determine single value thresholds for the onset of behavioural reactions. Instead, broad response and effect categories such as those proposed by Popper et al. (2014) seem most reasonable and may guide regulatory decisions in this context.

Strong 'startle' responses have been observed in some fish species at received sound levels of 200-205 dB re 1 μPa, indicating that sounds at or above this level may cause more severe behavioural reaction such as avoidance. Sound levels of this intensity are likely to occur 100 to 300 m from an acoustic array. Based on this, an approximate range of 200 m was estimated as the minimum distance at which fish may start avoiding the approaching seismic source (McCauley 1994). Wardle et al. (2001) documented that schooling reef fish swam past a seismic source array at received levels that would be received at about 20 m below a survey array consisting of 30 airguns.

Pearson et al. (1992) showed that that exposure to airgun sound can cause changes in schooling patterns and distribution. Løkkeborg et al. (2012) found changes in catch rates of fish species in Norwegian waters, indicating that these species all responded to seismic sound emissions. However, they also showed that gillnet catches were doubled for some fish species during seismic surveying and only longline catch rates fell slightly. Except for one species, they did not find any changes in abundance or displacement from fishing grounds. Hawkins et al. (2014) used synthetic impulsive signals in a behavioural response study; they documented that sprat and mackerel reacted to the impulsive sound exposure generally by dispersal and depth changes (which would make it difficult to detect the true scope of effects in a study relying on fisheries technology).

Some other studies looking at the behavioural response of sound pressure-sensitive Gadidae and Clupeidae species, such as whiting, Atlantic cod and herring, have reported changes in vertical position in the water column, potential avoidance responses and short-term changes in distribution. Chapman and Hawkins (1969) observed that the depth distribution of free-ranging whiting changed in response to an intermittently discharging stationary seismic source, which resulted in fish being exposed to an estimated SPL of 178 dB re 1 μPa. The fish school responded to the sound by shifting downward, forming a more compact layer at greater depth although temporary habituation was observed after one hour of continual sound exposure (Chapman and Hawkins, 1969).

Santulli et al. (1999) exposed caged European sea bass (a demersal species) to a 2,500 cubic inch seismic source. Limited response was observed at 2.5 km distance, a startle response was observed when the array was at a distance of approximately 800 m, but after passing within 180 m, fish behaviour appeared to return to normal within one hour. Increased biochemical stress levels were measured in some fish following exposure, returning to normal levels within 72 hours of exposure. It is noted that exposures of fish in the wild would likely result in avoidance of high sound levels prior to the seismic source approaching to as close a range and to as high sound levels as the captive fish in the experiment were exposed to.

The behavioural observations of free-swimming fish in Woodside's Maxima 3D survey at Scott Reef (Woodside 2011a, b, c; Miller and Cripps 2013) show that seismic source emissions did not cause lethal or sub-lethal effects on fish near the operating array. At close range, the vessel approach caused fishes to cease their behaviours and move towards the seabed, but the effect was short-lived, and fishes began to feed and behave normally again within 20 minutes after the passage of the seismic survey vessel. Caged fishes displayed startle responses too infrequently to analyse. However, agitation levels increased with increasing received sound exposure level for the three holocentrid species (squirrelfishes and soldierfishes, *Holocentroidei*) but were not detectable for the blue-stripe sea perch (*Lutjanus kasmira*). Sonar observations of free-swimming fishes indicated that individual animals tended to move towards the seabed on approach of the operating seismic source, consistently out to 400 m either side of the survey test line. Schools of fishes moved towards the seabed within 200 m of the survey test line in response to the passage of the operating seismic source and stayed significantly closer to the seabed up to 63 minutes post-exposure. The vocal behaviour of fishes was unaffected from the seismic activity; fish choruses remained unchanged with regards to timing and chorus level (at daily, lunar and seasonal scales); these findings suggest that in the long term the survey had little effect on the fish that produced the choruses. Visual census revealed that diversity and abundance of both Pomacentridae (damselfishes and clownfishes) and non-Pomacentridae fish species (inhabtiting shallow-slope regions) showed no significant changes after the seismic survey compared to the long-term temporal trend before the survey. Analysis of recordings from baited remote underwater video stations showed no detectable effects of the seismic survey on the diversity and abundance of deeper water fish communities at the spatial and temporal scales examined. Also, there were no signs of loss of individuals or of systematic re-distribution of individuals and species at any of the time scales examined.

The findings from the research at Scott Reef support those by Wardle et al. (2001), who exposed free ranging marine fish inhabiting an inshore reef to sounds from a seismic source (maximum received levels of 195-218 dB re 1 µPa PK). The study found that fishes exhibited a startle response to all received levels, but no avoidance behaviours were observed, they showed no signs of moving away from the reef and exposure to the seismic noise did not interrupt a diurnal rhythm of fish gathering at dusk. Slight changes were recorded to the long-term day-to-night movements of two tagged pollack (*Pollachius sp.*), particularly when positioned within 10 m of their normal living positions. However, the seismic sound had little effect on the day-to-day behaviour of the resident fishes and invertebrates.

Fewtrell and McCauley (2012) showed that fishes tended to remain lower in the water column and/or swim faster and form tighter schools during periods of close air-gun emissions. Fish populations can be potentially impacted if behavioural responses result in deflection from migration paths, feeding grounds or disturbance of spawning, thereby affecting recruitment of fish stocks.

Paxton et al. (2017) observed temperate reef fish, including snapper and grouper species, in 33 m water depths located 7.9 km from a seismic survey line using video recordings. The authors observed fish abundance and habitat use during the evening hours for three days prior to a seismic survey and then during the evening of the day when seismic activity occurred. The authors attempted to measure sound at two other reefs in closer proximity to the survey, but the hydrophones malfunctioned. No video recordings were made at the other reefs where hydrophone measurements were attempted. No hydrophone measurements were made at the reef where video recordings took place, but maximum sound levels were estimated to be more than 170 dB re 1 µPa SPL. Despite no clear visual evidence of behavioural responses in fish during the seismic survey, the authors noted a 78% decline in abundance in the evening following the survey. No further recordings were made to assess when fish abundance returned to pre-exposure levels or how far they may have moved. Therefore, with limited data, it is not clear from this study if reduced abundance is attributed to the seismic sound or other natural factors such as tidal influence or food availability. However, the study may indicate a possible avoidance response and temporary change in local abundance and distribution.

Bruce et al. (2018) tagged tiger flathead and two shark species, which were monitored during a seismic survey undertaken in Australian waters. Sharks moved freely in and out of the study area and exposed sharks did not show any indication of differences in behaviour or distribution compared with control areas. Minor behavioural effects were observed in exposed tiger flathead, which increased their swimming speed during the seismic survey and changed daily movement patterns after the survey but showed no significant displacement. Overall, there was little evidence for consistent behavioural responses (Bruce et al. 2018).

Davidsen et al. (2019) investigated the effects of seismic sound exposure on the physiology and behaviour of captive Atlantic cod (*Gadus morhua*) and saithe (*Pollachius virens*), both species from the family Gadidae with a swim bladder directly involved in sound detection. Experimental sound exposures were 18‑60 dB above ambient. The cod exhibited reduced heart rate in response to the particle motion component of the sound from the airgun, indicative of an initial flight response. No behavioural startle response to the airgun was observed despite some observed changes in swimming depth and position, and the fish seemed to habituate both physiologically and behaviourally with repeated exposure. The authors concluded that sound exposures induced over the three-day study period appear unlikely to be associated with long-term alterations in physiology or behaviour.

Hubert et al. (2020) also exposed captive Atlantic cod to one hour of playback of seismic airgun sound pulses with a 10-second shot point interval. Results indicated no strong overall pattern of change in swimming patterns or immediate, short-term behaviours during the exposure, compared to baseline periods without playback. However, several individuals changed their time spent in several behavioural states during the one hour sound exposure, which may be indicative of changes in energy expenditure.

Van der Knaap (2021) investigated the effect of a 3.5-day, full-scale, seismic survey exposure on the movement behaviour of free-swimming Atlantic cod, using acoustic telemetry. The closest point of approach to the tagging location was 2.25 km. The study found that during the experimental survey, cod did not leave the detection area more than expected from baseline data. However, cod left more quickly than expected, from two days to two weeks after the seismic survey. Furthermore, behavioural analyses indicated that during the exposure cod decreased their activity, with time spent being locally active (moving over small distances, showing high body acceleration) becoming shorter, and time spent being inactive (moving over small distances, having low body acceleration) becoming longer. Additionally, diurnal activity cycles were disrupted with lower locally active peaks at dusk and dawn‒periods when cod is known to actively feed.

Meekan et al. (2021) undertook a large-scale experiment that quantified the impacts of exposure of an assemblage of tropical demersal emperors (family Lutjanidae), snappers (family Lethrinidae) and groupers (family Epinephelidae) targeted by commercial fisheries to a commercial-scale seismic source on the North West Shelf off Western Australia. Dominant species included spangled emperor (*Lethrinus punctulatus*), red emperor (*Lutjanus sebae*), and brownstripe snapper (*L. vitta*). A combination of Baited Remote Underwater Video Systems (BRUVS) and acoustic tagging methods were used to measure the behaviours and movements of fishes at high, medium, and low exposure sites, as well as at control sites. The high, medium, and low exposure sites were located at horizontal distances from the path of the seismic source of approximately 0 – 300 m, 2 – 10 km and 11 km respectively. The maximum modelled SEL values received at the high, medium, and low exposure sites were in the order of 180 – 200 dB re 1 μPa^2·s, 130 – 160 dB re 1 μPa^2·s and 115 – 125 dB re 1 μPa^2·s respectively. There were no short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour, or movement of fishes at any exposure sites. The authors suggest that it is a reasonable assumption that the behavioural responses of demersal fishes to the bait cue provided by the BRUVS are a realistic proxy of the likely response of the same species to baited hooks or traps used by the commercial fisheries that target them. The acoustic tags and telemetry found little evidence that fish were displaced by the exposure to the seismic source. Movements of tagged fish occurred over a limited area focused on two or three acoustic receivers, and there was no evidence for the departure of tagged fish after exposure. These multiple lines of evidence suggest that seismic surveys have little impact on the behaviours of demersal fishes in this environment.

Acoustic Masking

Masking impairs an animal's hearing impairment with respect to the relevant biological sounds normally detected within the environment and can have long lasting effects on survival, reproduction, and population dynamics of fishes. The consequences of masking for fishes, however, have not been sufficiently examined to allow a thorough assessment of effects caused in the context of this survey. Popper et al. (2014) surmised that "*It is likely that increments in background sound within the hearing bandwidth of fishes and sea turtles may render the weakest sounds undetectable, render some sounds less detectable, and reduce the distance at which sound sources can be detected. Energetic and informational masking may increase as sound levels increase, so that the higher the sound level of the masker, the greater the masking*." If impulsive sounds are generated repeatedly by many sources over a wide geographic area there is a possibility that the separate sounds might merge and that the overall background noise be raised (Nieukirk et al. 2004). However, acoustic masking only occurs while the interfering sound is present, and therefore, masking resulting from a single pulse of sound (such as seismic source impulses) or widely separated pulses would be infrequent and not likely affect an individual's overall fitness and survival.

Sharks

Limited research has been conducted on shark responses to marine seismic surveys. Myrberg (2001) stated that sharks differ from bony fish in that they have no accessory organs of hearing such as a swim bladder and therefore are unlikely to respond to acoustical pressure. The study also suggested that the lateral line system does not respond to normal acoustical stimuli and is unable to detect sound-induced water displacements beyond a few body lengths, even with large sound intensities (Myrberg, 2001).

Other reports indicate that sharks are highly sensitive to sound between approximately 40 and 800 Hz, which overlaps with seismic sound frequencies. Klimley and Myrberg (1979) established that an individual shark will suddenly turn and withdraw from a sound source of high intensity (more than 20 dB re 1 μPa above broadband ambient SPL) when approaching within 10 m of the sound source.

Research by Bruce et al. (2018), which tagged two shark species and monitored their movements in response to a seismic survey in Australian waters noted that both control sharks and exposed sharks moved freely in and out of the study area which did not indicate any changes in behaviour or distribution as a result of seismic sound exposure.

Commercial Fishing Catch and Abundance Effect Studies

Some effort to relate fishing catch data to marine seismic survey effects has been undertaken, but to date none of the Australian efforts to relate catch data with marine seismic surveys have yielded significant results. Elsewhere, the potential effects of seismic operations on fish distribution, local abundance or catch have been examined for some teleost species with varying results (Carroll et al. 2017).

A range of behavioural responses have been observed in wild fish in the presence of anthropogenic sound. Studies suggest that fish will generally move away from a loud sound source to minimise their exposure, but this response may depend upon the animal's motivational state. Anthropogenic sound (including marine seismic surveys) has been shown to cause changes in schooling patterns and distribution (Engas et al. 1996; Engas and Lokkeborg 2002; Slotte et al. 2004; Lokkeborg et al. 2012; Popper at al. 2014; Streever et al. 2016) potentially altering the catchability of commercially valuable species or recreationally targeted species.

The following studies have relevance to commercial fish and invertebrate species with respect to their catchability:

- The effects of a marine seismic survey on demersal long-line and trawl catch rates of Atlantic cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) in Norway after a MSS were shown to fall by 45% and 70% respectively five days after survey completion (Engas et al., 1996). Based upon this decline Engas et al. (1996) hypothesised a reduction in catch rates due to fish avoidance behaviour, but this was not quantified. Similar reductions in catch rates (52% decrease in catch per unit effort (CPUE)) relative to controls) has been observed in the hook-and-line fishery for rockfish during controlled discharges of a single airgun (Skalaski et al. 1992). The authors suggest that the CPUE decline may not be dispersal but a decreased responsiveness to baited hooks from alarm response behaviour. A companion behavioural study showed the alarm and startle responses were not sustained following the removal of the sound source (Pearson et al. 1992; Skalski et al. 1992) suggested fishing effects may be transitory, primarily occurring during the sound exposure.
- Lokkeborg et al. (2012) observed, following airgun exposure, gillnet catches increased substantially for redfish (*Sebates norvegicus*) and Greenland halibut (*Reinharditius hippoglossoides*) by 86% and 132% respectively compared with pre-shooting levels, while longline catches of Greenland halibut and haddock decreased by 16% and 25% respectively compared with pre-survey catch. These contradictory results were explained by greater swimming activity versus lowered food search behaviour in fish when exposed to air-gun emissions. Changes in catch rates of all species studied, including saithe and ling, found all species responded to air-gun sounds. Except for saithe (a pelagic hearing sensitive fish), acoustic mapping of fish abundance did not suggest displacement from fishing grounds.
- Sonar observations by Pena et al. (2013) observing real-time behaviours of pelagic herring schools exposed to an acoustic source approaching from 27 km to 2 km over a

two-hour period found no changes in school size, swimming speed or direction. The lack of response was interpreted as a combination of a strong motivation for feeding, a lack of suddenness of the airgun stimulus and an increased tolerance to seismic shooting.

- Catch studies undertaken as part of a marine seismic survey in the Gippsland Basin found no clear evidence of adverse effects on scallops, fish or commercial catch rates (Przeslawski et al. 2016a; Bruce et al. 2018) The study followed 15 species caught by Danish seine and demersal gillnet and identified in the six months which followed the survey, six species showed increased catch. For Danish seine this included tiger flathead, goatfish and elephantfish. For demersal gillnet this included boarfish, broadnose shark and school shark. Three species showed decreased catch caught via Danish seine – gummy shark, red gurnard, sawshark. No change was observed in the remainder of species. No change to gummy shark catch was observed for demersal gillnet capture techniques. These results support previous studies in which the effects of seismic surveys on catch seem transitory and vary among species and gear types.

In October 2020, the Fish Research and Development Corporation (FRDC) released preliminary results of a Multiple Before-After Control-Impact (BACI) experiment that they funded to investigate the effects of a 3D marine seismic survey in eastern Bass Strait on Danish Seine catch rates (Fishwell Consulting, 2020). The key targets for this Danish Seine fishery in the areas of the MSS are flathead (*Platycephalus* sp.) and whiting (*Sillago* sp.). The October 2020 report (Fishwell Consulting, 2020) provided preliminary results of three phases of the four phase study and found that overall, the BACI analyses provide robust evidence for a negative impact of seismic acquisition on whiting catch rates in the Danish Seine Fishery up to ~100 days following the survey and on flathead rates up to ~200 days. Relative catch indices for both species in the years preceding the marine seismic survey were highly variable (temporally and spatially), and that relative catch index is a measure of catch per effort, not an absolute measure of abundance. As the relative catch indices for both species in the years preceding the marine seismic survey were highly variable it is difficult to determine the effect of the survey.

Specific studies examining the effect of seismic survey signals on invertebrate catch data are rare but include:

- Carroll et al (2017) undertook a critical review of the potential impacts of marine seismic surveys on fish and invertebrates. Carroll et al (2017) found no significant differences in any of the studies reviewed in catch rates from the potential effects of seismic signals (Christian et al. 2003; Parry and Gason 2006; Przeslawski et al. 2016a).
- Christian et al (2003) investigated the behavioural effects of exposure to seismic survey sound on snow crabs. Caged animals on the ocean bottom at a depth of 50 m were monitored with a remote video camera during exposure to seismic sound and did not exhibit any overt startle response during the exposure period. Eight animals were equipped with ultrasonic tags, released, and monitored for multiple days prior to exposure and after exposure. None of the tagged animals left the immediate area after exposure to the seismic survey sound. Five animals were captured in the snow crab commercial fishery the following year, one at the release location, one 35 km from the release location, and three at intermediate distances from the release location.
- Parry and Gason (2006) undertook a statistical analysis of catch per unit effort (CPUE) data collected over nearly 30 years in the Victorian SRL fishery (in southwest Victoria) that

showed no influence of historical 2D and 3D MSS activity. Analyses looked at short-term (weekly) and long-term variations (up to 7 years) in CPUE to determine whether changes were correlated with the MSS. The surveys occurred in water depths ranging from 10 m to 150 m. The study included surveys occurring during the SRL spawning period as well as during the lobster fishing season and so would have interacted with adult lobsters and larvae in the same way that the proposed Sequoia 3DMSS may. This study found no evidence that catch rates were affected in the weeks or years following the surveys, however Day et al (2016a) suggest that catch rates would have had to decrease by around 50% for this study to detect a result.

- Przeslawski et al. (2016a) monitored scallop populations and fish behaviour before, during, and/or after an April 2015 seismic survey in the Gippsland Basin, Commercial (*Pecten fumatus*) and doughboy (*Mimachlamys asperrima*) scallops were assessed using dredged samples and underwater imagery from an Autonomous Underwater Vehicle (AUV) before and two and ten months after completion of the seismic survey. The study provided no clear evidence of adverse effects on scallops or commercial catch rates due to the 2015 seismic survey undertaken in the Gippsland Basin. It was noted that there were limitations with some of the analyses (e.g., large variance in scallop catch).

Marine Turtles

Morphological studies of green sea turtles (*Chelonia mydas*) and loggerhead sea turtles (*Caretta caretta*) (Ridgway et al. 1969, Wever 1978, Lenhardt et al. 1985) found that the turtle ear is similar to other reptile ears but has adaptations for underwater listening. In-air electrophysiological and behavioural studies on green and loggerhead sea turtles found their hearing frequency range is approximately 50-2000 Hz, with highest sensitivity to sounds between 200 and 400 Hz (Ridgway et al. 1969, Bartol et al. 1999, Ketten and Bartol 2005, Bartol and Ketten 2006, Yudhana et al. 2010, Piniak et al. 2011, Lavender et al. 2012, 2014).

Underwater audiograms are only available for three species, all of whom have poor hearing sensitivity. Two of these species, the red-eared slider (*Trachemys scripta elegans*, semi-aquatic) (Christensen-Dalsgaard et al. 2012) and the loggerhead turtle (Martin et al. 2012), demonstrated highest sensitivity at around 500 Hz (Willis 2016). Piniak et al. (2016) found that green turtles have maximum underwater sensitivity between 200 and 400 Hz. Very little research has been performed on the hearing capabilities of hawksbill turtles (*Eretmochelys imbricate*). Yudhana et al. (2010) measured auditory brainstem responses from two hawksbill turtles in Malaysia and found that peak frequency sensitivity occurred at 457 Hz in one turtle and at 508 Hz in the other.

There is no robust information on the susceptibility of sea turtles to noise-induced effects. Most studies researching the effect of seismic noise on sea turtles focused on behavioural responses, as physiological impacts are more difficult to observe in living animals. Turtles avoid low-frequency sounds (Lenhardt 1994) and sounds from an airgun (O'Hara and Wilcox 1990), but these reports did not note received sound levels. Moein et al. (1995) found that penned loggerhead turtles initially reacted to an airgun but then showed little or no response to the sound (habituated to it). Caged green and loggerhead sea turtles increased their swimming activity in response to an approaching airgun when the received SPL was above 166 dB re 1 µPa, and they behaved erratically when the received SPL was approximately 175 dB re 1 µPa (McCauley et al. 2000).

The 166 dB re 1 µPa level has been used as the threshold level for a behavioural response to sea turtles by NMFS and applied in the Arctic Programmatic Environmental Impact Statement (PEIS) (NSF 2011) and the Recovery Plan for Marine Turtles in Australia (DoEE 2017). The 175 dB re 1 µPa level from McCauley et al. (2000) is recommended as the threshold for behavioural disturbance.

Injury/mortality/potential mortality impacts have not been reported to have occurred in turtles as a result of noise emissions during seismic surveys. Popper et al. (2014) suggested injury to turtles could occur for sound exposures above 207 dB re 1 µPa (PK) or above 210 dB re 1 uPa^2·s (SEL24h). However, Finneran et al. (2017) presented revised thresholds for turtle injury and hearing impairment from impulsive noise, considering both PK and frequency weighted SEL, suggesting that PTS may occur in response to 204 dB re 1 uPa^2·s (SEL24h) or 232 dB re 1 µPa (PK) and TTS may occur in response to 189 dB re 1 uPa^2·s (SEL24h) or 226 dB re 1 µPa (PK).

Cetaceans

The potential impacts of anthropogenic noise on marine mammals have been the subject of considerable research (see reviews by Nowacek et al. 2007; Southall et al. 2007; Weilgart 2007; Wright et al. 2007, Southall et al. 2021).

Southall et al. (2007), Finneran and Jenkins (2012), Wood et al. (2012), Finneran (2015) and more recently NMFS (2018) and Southall et al. 2021, reviewed available literature to determine noise exposure criteria, determined based on the onset levels of non-recoverable permanent hearing loss (PTS) and temporary hearing threshold shift (TTS) in cetaceans. The NMFS (2018) criteria incorporate the best available science to inform assessment of PTS and TTS. However, a lack of a quality low-frequency cetacean audiogram has made it difficult to precisely determine hearing sensitivity, and the criteria for low-frequency cetaceans are likely precautionary.

Hearing sensitivity

Current data and predictions show that marine mammal species differ in their hearing capabilities, absolute hearing sensitivity and frequency band of hearing (Richardson et al. 1995, Wartzok and Ketten 1999, Southall et al. 2007). While hearing measurements are available for a small number of species based on captive animal studies, direct measurements of many odontocetes and all mysticetes do not exist. As a result, hearing ranges for many odontocetes are grouped with similar species, and predictions for mysticetes are based on other methods, such as anatomical studies and modelling (Houser et al. 2001, Parks et al. 2007, Tubelli et al. 2012, Cranford and Krysl 2015), vocalizations (see reviews in Richardson et al. 1995, Wartzok and Ketten 1999, Au and Hastings 2008), taxonomy, and behavioural responses to sound (Dahlheim and Ljungblad 1990)

To better reflect the auditory similarities between phylogenetically closely related species, but also significant differences between species groups among the marine mammals, Southall et al. (2007) assigned the extant marine mammal species to functional hearing groups based on their hearing capabilities and sound production. This division into broad categories was intended to provide a realistic number of categories for which individual noise exposure criteria were developed. These groups were revised by NMFS (2018), but the categorisation as such has proven to be a scientifically justified and useful approach in developing auditory weighting functions and deriving noise exposure criteria for marine mammals.

Group	Studies	General hearing range
Low-frequency (LF) cetaceans	This functional hearing group comprises all baleen whale species (mysticetes); to this date, there has been no direct measurement of hearing sensitivity in any of these species. Instead, vocalization frequency ranges have been used as a proxy to determine the range of hearing for these species. However, it has to be noted that vocalisation frequencies not necessarily represent the full extent of the frequency range of best hearing and therefore are a poor predictor of best hearing thresholds (Houser et al. 2017). In the complete absence of direct data on auditory sensitivity in any baleen whale species, behavioural reactions provide further insight into the sound perception capabilities and sensitivities of mysticetes. Reviews or new studies presenting data on behavioural reactions of mysticetes have been published by Nowacek et al. (2007, 2015). However, behavioural reactions are strongly context specific (Ellison et al. 2012) and are consequently also of limited use in delineating hearing ranges or even predicting hearing sensitivity. The existing data so far suggest that some species (e.g., blue whale, fin whale) having better low-frequency sensitivity and others (e.g., humpback whale, minke whale) having better sensitivity to higher frequencies. In another approach, anatomical data are used to predict hearing ranges in mysticetes (e.g., Parks et al. 2007; Manoussaki et al. 2008). Most recently functional models were developed focussing on different components of the hearing system (Tubelli et al. 2012; Cranford and Krysl 2015) in combination with anatomical data on the hearing system, the audible frequency range of mysticetes – collectively treated as a single functional hearing group is approximately between 10 Hz to 30 kHz.	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans Dolphins, beaked whales and sperm whales	Based on the frequency range of their vocal emissions as well as the known hearing ranges, most dolphin species, all beaked whale species, and the sperm whale belong to this functional hearing group. These species produce a wide range of whistles, clicks, pulsed sounds and echolocation clicks. The frequency range of their sounds excluding echolocation clicks are mostly <20 kHz with most of the energy typically around 10 kHz, although some calls may be as low as 100 to 900 Hz, ranging from 100 to 180 dB re 1 μPa (Richardson et al. 1995). The sounds produced are very complex and appear to be used for communication between members of a pod during socialising and feeding activities.	150 Hz to 160 kHz

Group	Studies	General hearing range
High frequency (HF) cetaceans Porpoises, dwarf, and pygmy sperm whales	Porpoises, dwarf, and pygmy sperm whales (Kogia spp.) produce narrow-band high frequency echolocation signals. The few species out of this group which were tested for their hearing sensitivity have their best hearing sensitivity at higher frequencies and show a wider hearing range compared to all other cetaceans. Accordingly, this group of species have been collectively classified as high frequency cetaceans.	275 Hz to 160 kHz

Behaviour

Numerous studies on marine mammal behavioural responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate sound exposure metric for assessing behavioural reactions. Southall et al. (2007) presented a severity-index ranking the intensity of behavioural responses that was later amended by Ellison et al. (2012), Miller et al. (Miller 2012), and Sivle et al. (2015).

NMFS currently uses a step function with a 50% probability of inducing behavioural responses at an SPL of 160 dB re 1 μPa to assess behavioural impact. This threshold value was derived from the HESS (1999) report, which, in turn, was based on the responses of migrating mysticete whales to seismic sounds (Malme et al. 1983, Malme et al. 1984). The HESS team recognized that behavioural responses to sound may occur at lower levels, but significant responses were only likely to occur above an SPL of 140 dB re 1 μPa. An extensive review of behavioural responses to sound was undertaken by Southall et al. (2007, their Appendix B). They found varying responses for most marine mammals between an SPL of 140 and 180 dB re 1 μPa, consistent with the HESS (1999) report, but a lack of convergence in the data prevented them from suggesting explicit step functions. Absence of controls, precise measurements, appropriate metrics, and context dependency of responses (including the activity state of the animal) all contribute to variability.

In 2012, Wood et al. (2012) proposed a graded probability of response for impulsive sounds using a frequency weighted SPL metric. They designated behavioural response categories for sensitive species (such as harbour porpoises, *Phocoena phocoena*, and beaked whales) and for migrating mysticetes.

Marine Mammal Group	Probability of response to frequency -weighted SPL (dB re 1 μPa)			
	120	140	160	180
Sensitive species	50%	90%		
Other species		10%	50%	90%

McCauley et al. (2000) monitored the effects of seismic survey sounds on humpback whales in the Exmouth Gulf region of Western Australia. They documented rapid swimming on the surface, breaching and localised avoidance behaviour by migrating whales during the seismic operation, indicating that the ‘risk factor’ associated with the MSS was confined to a comparatively short period and small range displacement. During their migration and breeding season, humpback whales rarely display deep dives. This tendency to stay close to the surface has been interpreted as actively utilising the 'sound shadow' (Lloyd's Mirror effect) near the surface; irrespective of the motivation for this behaviour, it reduces the risk for noise-induced effects unless at very short range from a large seismic source array.

A comparison of behavioural observations of humpback whale behaviour during seismic surveys shows the variability and context dependence of these responses (Richardson et al. 1995). McCauley et al. 2000) estimated that humpback whales would avoid seismic surveys in key habitat (such as breeding, resting, or feeding areas) at distances between 7 and 12 km, whereas migrating individuals generally showed an avoidance range of around 3 km. Some males have even been recorded approaching seismic survey vessels to within 1 to 2 km (McCauley et al. 2000). It is considered that avoidance behaviour represents a temporary and minor effect, unless avoidance results in displacement of whales from breeding, resting, or feeding areas.

Humpback whales migrating from winter breeding grounds to summer feeding grounds showed moderate avoidance of an active seismic source at received levels >140 dB re 1µPa²·s (SEL) only when they were within 3 km of the source. The magnitude of response was measured as change in migration speed and course deviation (Dunlop et al. 2017). These results indicate that the proximity of the sound source has to be considered as another factor with regard to behavioural reactions in this species.

Blackwell et al. (2015) found evidence for two behavioural thresholds in migrating bowhead whales responding to seismic operations in the Beaufort Sea. A moderate cessation or modification of vocal behaviour (interpreted as compensation behaviour) was found at received SEL over a 10-minute period of 94 dB re 1µPa²·s (increase of calling rates) and 127 dB re 1µPa²·s (decrease in calling rates). At received levels of >160 dB re 1µPa²·s, however, whales were completely silent. Robertson et al. (2013) detected changes in surfacing, respiration, and diving behaviour of bowhead whales in response to seismic survey activity but did not provide any qualitative information on the received levels. Castellote et al. (2010) documented avoidance behaviour in fin whales in response to seismic survey activity in the Mediterranean Sea lasting over 10 days.

Observations of sperm whale behaviour during seismic surveys provided conflicting results: Stone (2003) identified that while sperm whales were frequently (visually) detected during seismic surveys, these animals did not show any observable behavioural reactions. Jochens et al. (2008) found sperm whales tolerant of seismic activity; however, a decrease in foraging activity was observed for a small number of animals but no horizontal avoidance was measured. In a tagging study, Jochens and Biggs (2003) found that sperm whales did not show any behavioural reaction (horizontal avoidance of the seismic vessel, change in feeding rates) at maximum received levels of 148 dB re 1µPa.

In the Gulf of Mexico, sperm whales were equipped with multisensory tags to investigate their behaviour in response to seismic surveys. The animals did not show any statistically significant changes in horizontal movement, diving and echolocation behaviour at received levels of approximately 118–131 dB re 1mPa²·s ($SEL_{M\text{-weighted}}$) (Miller et al. 2009).

The hearing of dolphins (MF cetaceans) is less sensitive in the low frequency range of airgun impulses (< 500 Hz) and seismic operators sometimes report dolphins and other small toothed whales near operating seismic source arrays. However, there is a component of seismic pulses in the higher spectrum and in general most toothed whales do show some limited avoidance of operating seismic vessels. Goold (1996) studied the effects of seismic surveys common dolphins

(*Delphinus delphis*) in the Irish Sea. The results indicated that there was a local displacement of dolphins around the seismic operation. This observation is consistent with visual data compiled by Stone (2003) from marine mammal surveys in the North Sea that shows small toothed whale species tend to move away from operating compressed air seismic sources. In a review of behavioural effects of seismic surveys on marine mammals in UK waters Stone et al. (2006) reported that small odontocetes (dolphins, LF cetaceans and porpoises, HF cetaceans) showed the strongest avoidance response to the seismic survey activity, were seen less often during periods of seismic acquisition, remaining further from the airguns and showing altered behaviour (e.g., less bow-riding, orienting away from the survey vessel, faster swimming). The same study documented that killer whales also showed some localised avoidance to seismic surveys.

A reduction in feeding activity in response to seismic survey activity has been documented for harbour porpoises at estimated received SEL of 150 – 165 dB re 1μPa^2·s (Pirotta et al. 2014). Due to the permanently high energy demands of harbour porpoises (Wisniewska et al. 2016) a prolonged cessation of feeding can have significant effects on the fitness of affected animals.

Masking

Masking is the process by which the threshold of hearing for one sound is raised by the presence of another (masking) sound (Erbe and Farmer 1998; Erbe 2008; Erbe et al. 2016). This describes the reduction in audibility for one sound (termed 'signal') caused by the simultaneous presence of another sound (termed 'noise'). For this to occur, the sound must be loud enough, have similar frequency content to the signal, and must happen at the same time. Masking depends on the spectral and temporal characteristics of signal and noise and is reduced if the signal and noise are separated in time, frequency, or direction (space); it can occur if the noise happens shortly before or after the signal (forward and backward masking). The zone of masking can maximally be as large as the zone of audibility, as a faint noise might mask a faint signal. The masking effect can be reduced or remedied by various active or passive mechanisms for masking-release, such as spatial or temporal release from masking, the Lombard effect, or co-modulation masking release.

Auditory masking can lead to disruption of a behaviour, lack of appropriate behavioural reactions, increased vulnerability to predators, reduced access to prey, reduced communication, changes in vocal behaviour, disruption of spawning activities, and stress. The biological significance of acoustic masking is directly linked to the duration of the masking sound. While masking can be detrimental to the fitness, reproduction, and survival of individuals, it ends immediately after the masking sound ceases. Both anthropogenic and natural marine sound can affect hearing and partially or completely reduce an individual's ability to effectively communicate; detect important predator, prey, and/or conspecific signals; and detect important environmental features associated with spatial orientation (Clark et al. 2009). This is true for all marine fauna; however, masking is most frequently associated with marine mammals. Masking in fishes has not been studied in detail.

Masking reduces the communication space of marine mammals (Clark et al. 2009, Hatch et al. 2012). A calculation of reductions in communication range can be a useful proxy for impact. So far, a direct assessment and quantification of masking effects in wild animals has proven impossible (Tougaard et al. 2015). It depends on the positions of the signalling and the receiving animal relative to the sound source and to each other. In humpback whales (*Megaptera* *novaeangliae*), tonal and grunting sounds acting as contact calls between a mother and its calf were recorded at comparatively low levels (Videsen et al. 2017). While there is controversy about the validity of conclusions, such low levels would create a small communication space (<100 m) which, in turn, would be sensitive to increases in ambient noise.

Most studies related to masking effects in marine mammals have investigated the auditory parameters that are most relevant in this context, such as auditory sensitivity, frequency-tuning (critical bandwidth and critical ratio), auditory integration time, and critical interval. Erbe et al. (2016) reviewed the current knowledge on masking in marine mammals, summarising data on marine mammal hearing as they relate to masking and discussing masking release processes of receivers. The variability seen in auditory sensitivity (see Hearing sensitivity) indicates the variability seen with respect to auditory masking.

Temporary Threshold Shift and Permanent Threshold Shift

In marine mammals, the onset level and growth of Temporary Threshold Shift (TTS) is frequency specific, depends on the temporal pattern, duty cycle, and the hearing test frequency of the fatiguing stimuli. Exposure to intense impulse noise might be more hazardous to hearing than non-impulsive noise, and there is a positive relationship between exposure duration and the amount of TTS induced. TTS can accumulate across multiple exposures, but the resulting TTS will be less than the TTS from a single, continuous exposure with the same total sound exposure level. Sounds generated by seismic sources, pile-driving and mid-frequency sonars have directly been tested and proven to cause noise-induced threshold shifts in marine mammals at high received levels. Finneran (2015) reviewed the current state of knowledge on TTS and permanent threshold shift (PTS). TTS typically decreases in marine mammals relative to the logarithm of the increasing recovery time. There is, however, considerable individual difference in all TTS-related parameters between subjects and species tested so far.

PTS is considered injurious in marine mammals, but there are no published data on the sound levels that cause PTS in marine mammals. Regeneration of sensory cells, as known to occur in fishes, has not been documented for any marine or terrestrial mammal. Onset levels of PTS onset are typically extrapolated from TTS onset levels and assumed growth functions (Southall et al. 2007). The NMFS (2018) criteria incorporate the best available science to estimate PTS onset in marine mammals from sound energy (SEL24h), or very loud, instantaneous peak sound pressure levels. Criteria are given separately for each cetacean functional hearing group and discriminate between impulsive and non-impulsive sounds as detailed below.

Hearing group	PTS onset thresholds (received level)		TTS onset thresholds (received level)	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low-frequency cetaceans	L_{pk}, flat: 219 dB $L_{E, LF}$, 24h: 183 dB	$L_{E, LF}$, 24h: 199 dB	L_{pk}, flat: 213 dB $L_{E, LF}$, 24h: 168 dB	$L_{E, LF}$, 24h: 179 dB
Mid-frequency cetaceans	L_{pk}, flat: 230 dB $L_{E, MF}$, 24h: 185 dB	$L_{E, MF}$, 24h: 198 dB	L_{pk}, flat: 224 dB $L_{E, MF}$, 24h: 170 dB	$L_{E, MF}$, 24h: 178 dB
High-frequency cetaceans	L_{pk}, flat: 202 dB $L_{E, HF}$, 24h: 155 dB	$L_{E, HF}$, 24h: 173 dB	L_{pk}, flat: 196 dB $L_{E, HF}$, 24h: 140 dB	$L_{E, HF}$, 24h: 153 dB

The role of the temporal pattern of sound on TTS in marine mammals has been studied in MF and HF cetaceans (Mooney et al. 2009a; Finneran et al. 2010b; Kastelein et al. 2014; Kastelein et al. 2015). The results of these studies show that TTS can accumulate across multiple exposures, but the resulting TTS will be less than the TTS from a single, continuous exposure with the same total SEL.

Only a few studies have investigated TTS in marine mammals in response to exposure to impulsive sounds such as seismic impulses. Lucke et al. (2009) tested the effect of a single seismic source on a male harbour porpoise. They documented onset of TTS at received (unweighted) SEL of 164 dB re 1 μPa^2·s. This equates to a (HF) weighted SEL24h of 140 dB re 1 μPa^2·s (NOAA 2016). The main energy of the fatiguing stimulus (seismic pulse) was centred below 500 Hz, but a substantial amount of energy was also present at higher frequencies. Kastelein et al. (1997) tested the auditory tolerance of a harbour porpoise to playbacks of broadband pile driving sounds. After one hour of exposure an unweighted SEL 146 dB re 1 μPa^2·s and a SEL24h of 180 dB re 1 μPa^2·s, a TTS of 2.3 dB and 3.6 dB occurred at 4 kHz and 8 kHz, respectively. The average weighted SEL24h from these exposures was 144 dB re 1 μPa^2·s.

In a study using playbacks of pile driving sounds, Kastelein et al. (2013) exposed harbour porpoises to a maximum single-strike unweighted broadband SEL of 145 dB re 1 μPa^{2}s and a cumulative SEL24h of up to 187 dB re 1 μPa^2·s. TTS increased from 0 dB after 15 min exposure to 5 dB after 360 min exposure. Based on their results, they calculated an onset of TTS for this type of sound at a SEL24h of approximately 175 dB re 1 μPa^2·s. Kastelein et al. (2017) exposed a harbour porpoise to 10 and 20 consecutive seismic impulses at received SEL24h of 188-191 dB re 1 μPa^2·s with a mean shot intervals of around 17 seconds. TTS of ~4.4 dB was measured at 4 kHz.

Finneran et al. (2015) tested the exposed three bottlenose dolphins to 10 impulses produced by a seismic source. The highest exposures were conducted at peak sound pressure levels (PK) of 210 dB re 1 μPa, peak-peak sound pressure levels (PK-PK) of 212 dB re 1 μPa, and cumulative (unweighted) SEL24h of 195 dB re 1 μPa^2·s. This exposure induced 9 dB TTS in one animal at 8 kHz.

Mortality

The only evident case of an injury to a marine mammal caused by what can clearly be considered an underwater sound source was reported by Ketten et al. (1993). However, as the most likely sound source in this case was an underwater explosion of undefined charge weight and distance to the animals, the physical cause of the injury may have been the shock wave created by the explosion.

Divers

Divers exposed to high levels of underwater sound can suffer from dizziness, hearing damage or other injuries to other sensitive (mainly air-filled) organs, depending on the frequency and intensity of the sound. The human auditory system is significantly less sensitive underwater than in air and is further degraded if diving equipment obstructs the ears or face (e.g., diving with a hood or full facemask).

Under water, the human ear is about 20 dB less sensitive than it is in air at low frequencies (20 Hz), increasing to 40 dB at mid-frequencies (less than 1 kHz), and increasing to 70–80 dB less sensitive at higher frequencies (Parvin 1998). Divers who wear neoprene hoods have even higher hearing thresholds (lower sensitivity) above 500 Hz because the hood material absorbs high-frequency sounds (Sims et al. 1999). Exposure studies related to divers have typically focused on military sonar exposure, with little information on seismic survey operations, and as such care is required when considering thresholds for non-military divers, particularly for impulsive sounds such as seismic source impulses (Ainslie 2008).

Underwater auditory threshold curves indicate that the human auditory system is most sensitive to waterborne sound at frequencies between 400 Hz to 1 kHz (Parvin et al. 1994); cited in Anthony et al. 2009), and these frequencies have the greatest potential for damage. Within the literature (all as cited in Ainslie, 2008), there is some variation in acceptable SPLs for divers as discussed below.

The auditory threshold of hearing under-water was lowest at 1 kHz (70 dB re 1 μPa SPL) and increased for lower and higher frequencies to around 120 dB re 1 μPa at 20 Hz and at 20 kHz (Parvin 1998). Fothergill et al. (2000) and Fothergill et al. (2001) conducted controlled acoustic exposure experiments on military divers under fully controlled conditions at a US Ocean Simulation Facility and an US Open water test facility; in all tests, the divers were covered with soft or hard shell dive suits and their position and distance relative to sound source, signal characteristics and received levels were controlled and documented (Pestorius et al. 2009). A total of 89 male Navy divers were exposed to pure tone signals and sweeps between 160-320 Hz at SPLs up to 160 dB re 1 μPa. The divers were exposed to these sounds over 100 seconds at depths from 10 to 40 m. The divers rated the sounds on a severity scale. For frequencies between 100 and 500 Hz, at a received SPL of 130 dB re 1 μPa, divers and swimmers detected body vibration. None of the divers tested rated levels of 140 dB re 1 μPa as "very severe", however, at 157 dB re 1 μPa, sound was rated as "very severe" 19 per cent of the time. No physiological damage was observed at the highest levels tested: 160 dB re 1 μPa (Fothergill et al. 2001).

In a subsequent study, recreational divers were exposed to tonal signals or 30 Hz-sweeps at frequencies between 100 and 500 Hz at received levels of 130-157 dB re 1 μPa (Pestorius et al. 2009). Each exposure lasted for seven seconds. Nine female and 17 male scuba divers were tested, all wearing full body neoprene wetsuits. Diver aversion and perception of body vibration were used as test parameters. The results showed no sex-specific differences. The results differed as a function of frequency – while test results showed a strong overall variation between subjects, signals at 100 Hz elicited the strongest aversion in all tests and even at 148 dB a few diver ratings indicated extreme aversion. Due to this and the strong variation between test subjects, the following exposure limit for both military and recreational divers was suggested as a conservative measure: For frequencies between 100 and 500 Hz, the maximum SPL should be 145 dB re 1 μPa over a maximum continuous exposure of 100 seconds or with a maximum duty cycle of 20 per cent and a maximum daily cumulative total of three hours. The trading relation between the maximum SPL and duration was 4 dB per doubling of duration (e.g., 141 dB SPL for a 200 second exposure) (Pestorius et al. 2009).

In alignment with these studies, and considering only frequencies between 100 and 500 Hz, Parvin (2005) suggested 145 dB re 1 μPa as a safety criterion for recreational divers and swimmers. This does not imply that this level is associated with the onset of injury.

Guidance issued by the Diving Medical Advisory Committee (DMAC 2020) suggests that adverse effects to divers may be experienced at distances of up to 27 km from the seismic source, which is a considerably greater distance than has previously been recognised. However, the basis for this conclusion is not provided.

Appendix B: Spill Modelling Review

Technical Note

To	NERA CSEP
From	Xodus Group
Date	17 June 2020
Subject	NERA CSEP eBase Library - Spill Model Review

Introduction

Xodus Group have been commissioned by NERA to update the NERA Collaborative Seismic EP (CSEP) eBase Library, specifically data relating to the existing environment. To define the extent of the existing environment to be described for the NERA CSEP eBase Library, the environment that may be affected (EMBA) needs to be determined.

The largest EMBA associated with seismic activities generally relates to the environment predicted to be exposed to hydrocarbons in the event of a vessel collision. A review of all suitable publicly available (NOPSEMA website) and NERA supplied Offshore Project Proposals (OPP) and Environment Plans (EP) was undertaken to determine the maximum modelled distance travelled by spilled hydrocarbons as a result of a hypothetical vessel collision within waters offshore northwest Australia.

This review was undertaken to determine the oil spill EMBA for seismic activities undertaken under the NERA CSEP within three pre-defined operational areas; Bonaparte, Browse and Carnarvon Operational Areas (refer to Attachment A, Figure 13).

Method

The review focused on OPPs/EPs which detail spill modelling (in or within proximity to the defined CSEP Operational Areas) delivered by service providers specialising in complex spill model development and application (e.g. RPS), rather than those based on desktop applications such as ADIOS. The review also focused on spill modelling outputs using the defined NOPSEMA threshold exposure values (NOPSEMA, 2019); however, where relevant, results based on other threshold levels (such as those based on published peer review literature) were also considered.

A summary of the selection criteria used to refine the EPs for inclusion or exclusion in the review are listed as follows:

- Surface releases assessed in seismic EPs and EPs provided to NERA.
- Large surface releases of MDO/MGO (greater than 700 m^3 – volume larger than the maximum noted in NERA 2018:1003 - Consequence analysis of an accidental release of diesel).
- OPPs/EPs with large surface releases were reviewed to see if:
    - complex spill modelling was undertaken.
    - enough detail in the EP or the modelling report were provided to define maximum exposure distances.
    - defined NOPSEMA threshold exposure values or other published peer reviewed threshold levels have been used.

- EPs that referenced spill models already cited in Attachment A, Table 3, were not included to reduce repetition.

The list of projects selected for the review is listed in Attachment A, Table 3, but does not include those that were identified to not meet the review criteria.

Results

Review findings based on the maximum extent of spilled hydrocarbons originating from the three Operational Areas are summarised in Table 1 (surface and in-water) and Table 2 (shoreline).

Detailed findings of the review are provided in Attachment A, Table 3.

Twenty-one spills were modelled ranging from 58 m^3 to 2,975 m^3 over fifty-six locations (Figure 1, Table 3). The largest spill volumes did not always correspond with the furthest distance the spill travelled as detailed in Figure 2 for surface and Figure 3 for entrained hydrocarbons. Figures for each Operational Area showing spill volumes modelled and furthest distance the spill travelled as detailed in Figure 2 for surface and Figure 3 for entrained hydrocarbons are:

- Carnarvon: Figure 4 to Figure 6
- Bonaparte: Figure 7 to Figure 9
- Browse: Figure 10 to Figure 12

Modelling reviewed predicted hydrocarbon contact along shorelines from the tip of Cape Van Diemen (Melville Island), Northern Territory (NT) to the Ningaloo Coast, Western Australia (WA); no shoreline contact was predicted in Indonesia; however, in-water hydrocarbons were predicted to extend within international waters, specifically the Timor Sea.

Recommendations

Based on an analysis of the spill modelling results provided in Attachment A - Table 3, and the varying distances and directions that hydrocarbon may travel under the oceanographic and hydrodynamic conditions in northwest Australia, Xodus Group recommends that a Spill EMBA for each of the Operational Areas be developed using a collective of the available geospatial modelling data in an effort to preserve the actual shape and extent of stochastic spill modelling results. The geospatial analysis is recommended in preference to a simplified single maximum distance applied in all directions around an Operational Area as this does not account for key currents or other oceanographic processes that would strongly influence the spatial extent of any spill event.

Similarly, if additional spill-related areas are required to be developed (e.g. a Spill Impact Assessment Area), the same geospatial approach would be recommended for use, just with the relevant moderate/high exposure thresholds used instead of the low thresholds.

Table 1: Summary of maximum predicted extent of in-water and surface hydrocarbon exposure for each operational area

Operational Area	Maximum distance modelled for surface slick at 1 g/m^2	Maximum distance modelled for in-water hydrocarbons i.e. entrained and dissolved oil at 10 ppb	EP or OPP Reference – Refer to Table 3 for further details.
All areas Spill volume Min: 58 m^3 Max: 2975 m^3 Ave: 781 m^3	Min: 28 km Max: 680 km Ave: 224 km	Min: 33 km Max: 2327 km Ave: 735 km	NA
Bonaparte Spill volume Min: 700 m^3 Max: 2975 m^3 Ave: 1085 m^3	Min: 41 km Max: 680 km Ave: 262 km	Min: 38 km Max: 1108 km Ave: 454 km	**Surface:** ConocoPhillips Barossa Area Development **Entrained:** ConocoPhillips Barossa Area Development
Browse Spill volume Min: 60 m^3 Max: 1527 m^3 Ave: 579 m^3	Min: 42 km Max: 559 km Ave: 253 km	Min: 33 km Max: 2327 km Ave: 864 km	**Surface:** Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign **Entrained:** • Searcher Seismic Quoll 3D Marine Seismic Survey • Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign
Carnarvon Spill volume Min: 58 m^3 Max: 2000 m^3 Ave: 1006 m^3	Min: 28 km Max: 350 km Ave: 152 km	Min: 133 km Max: 1167 km Ave: 675 km	**Surface and Entrained:** Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign

Table 2: Summary of shoreline contact by floating oil – Northern Extent and Southern Extent

Shoreline Extent	Operational Area	Shoreline exposed to concentrations	EP or OPP Reference – Refer to Table 3 for further details.
Most Northern Point	Bonaparte	Cape Van Diemen of Melville Island	Barossa Gas Export Pipeline Installation https://info.nopsema.gov.au/activities/353/show_public
Most Southern Point	Carnarvon	Ningaloo World Heritage Coastline	Corowa Development: Offshore Project Proposal https://www.nopsema.gov.au/environmental-management/offshore-project-proposals/offshore-project-proposals-public-comment/corowa-development-project/

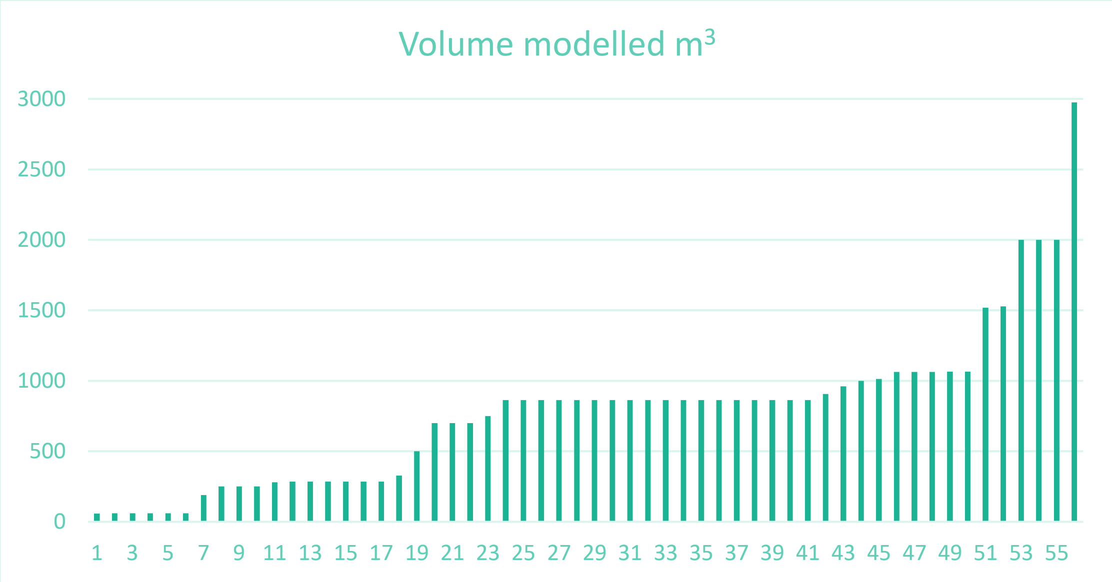

Figure 1: Modelled spill volumes

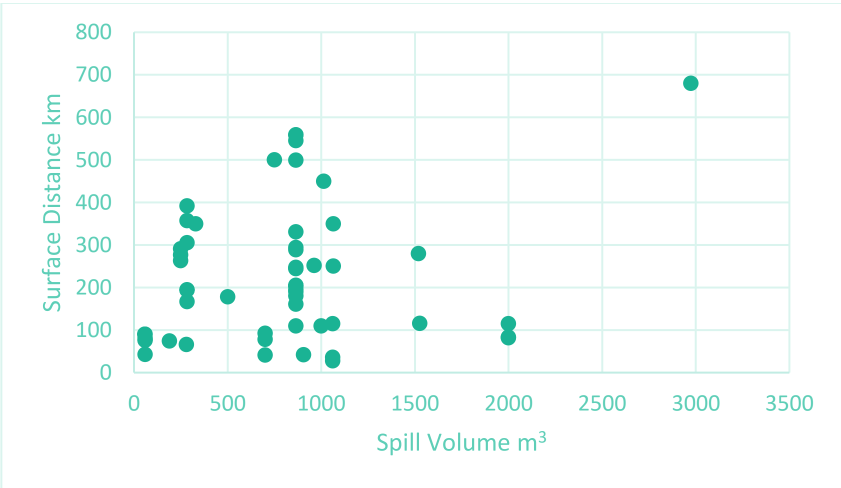

Figure 2: Spill volume vs surface distance travelled

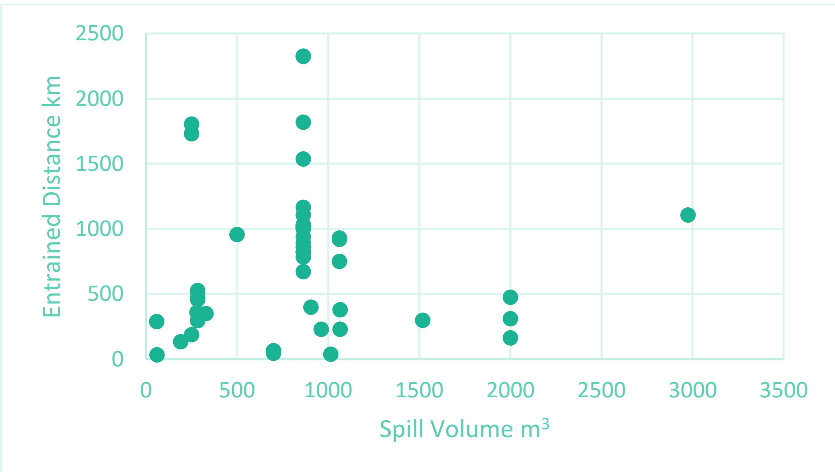

Figure 3: Spill volume vs entrained distance travelled

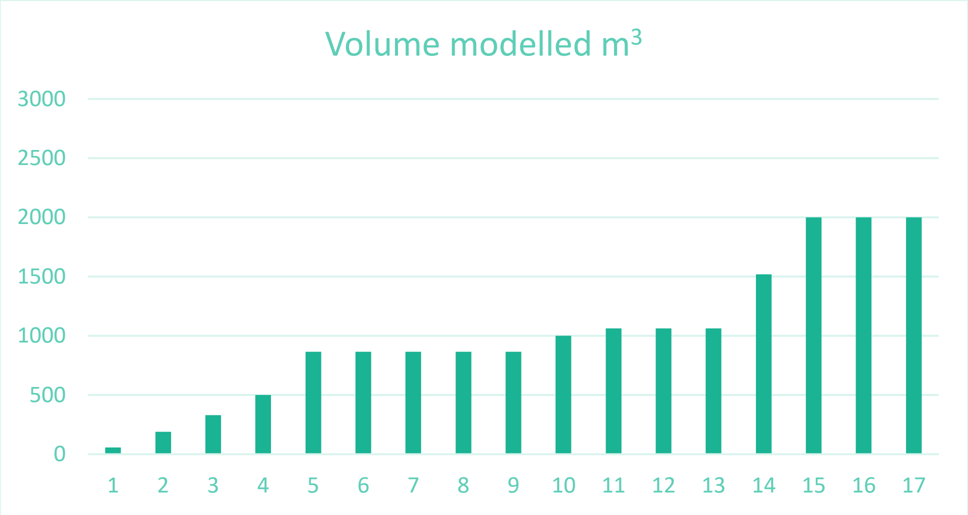

Figure 4: Carnarvon modelled spill volumes

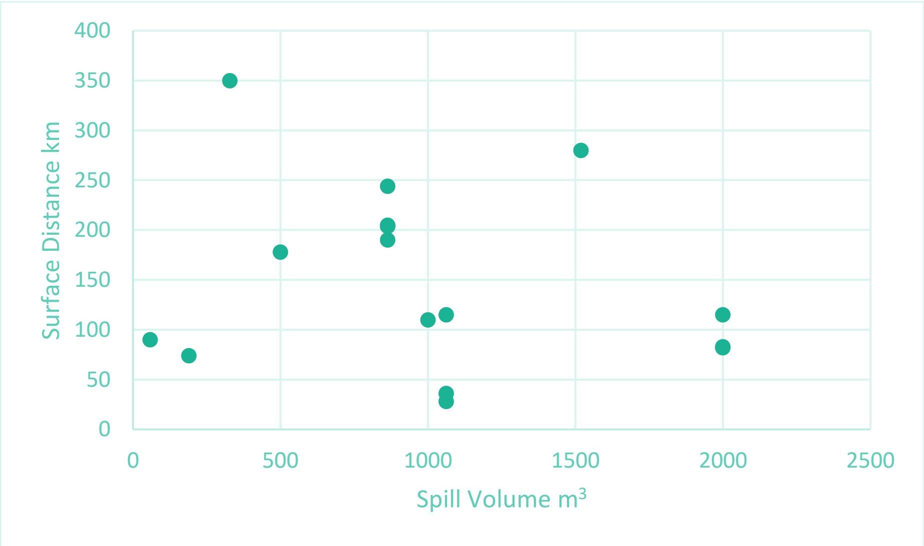

Figure 5: Carnarvon spill volume vs surface distance travelled

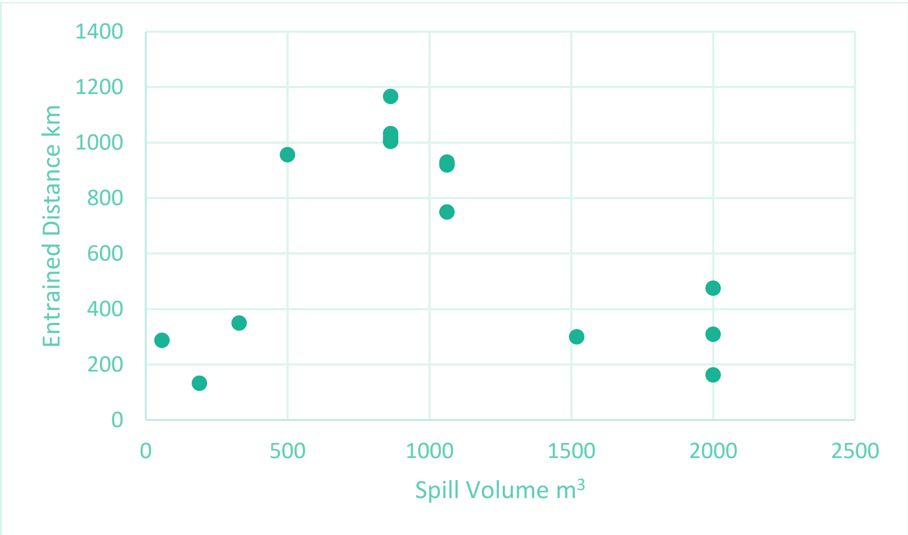

Figure 6: Carnarvon spill volume vs entrained distance travelled

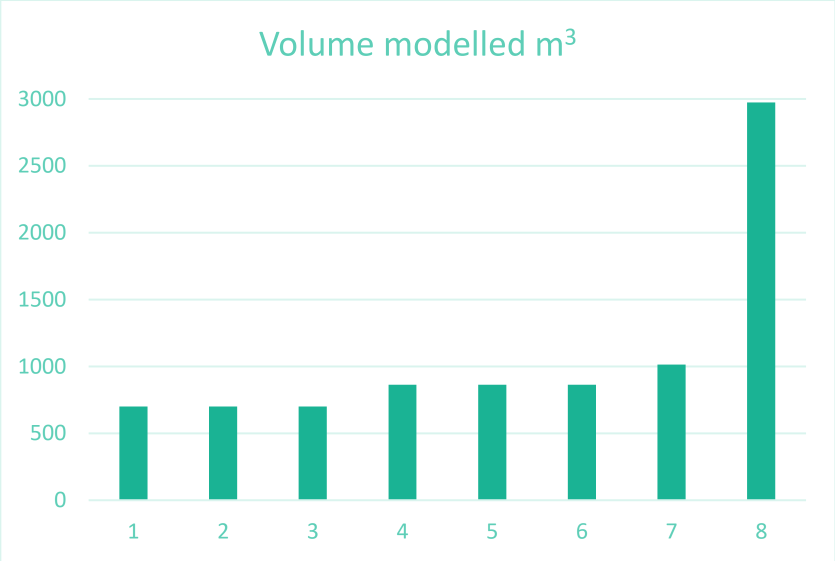

Figure 7: Bonaparte modelled spill volumes

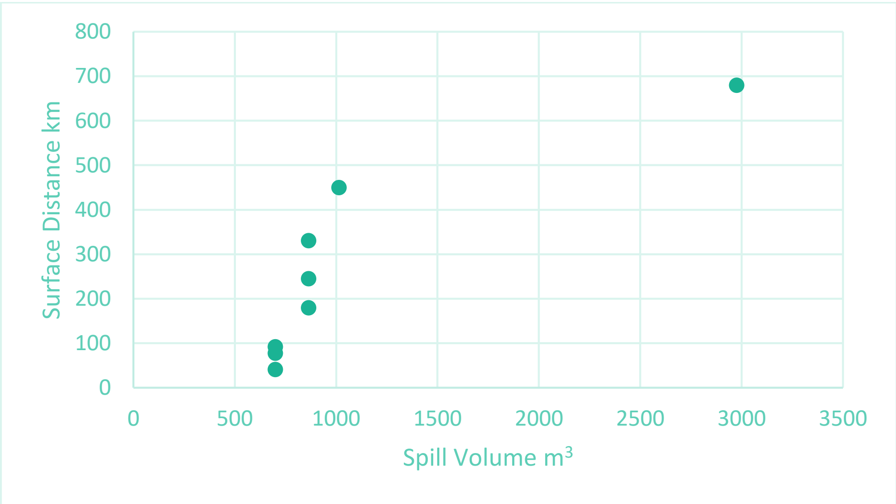

Figure 8: Bonaparte spill volume vs surface distance travelled

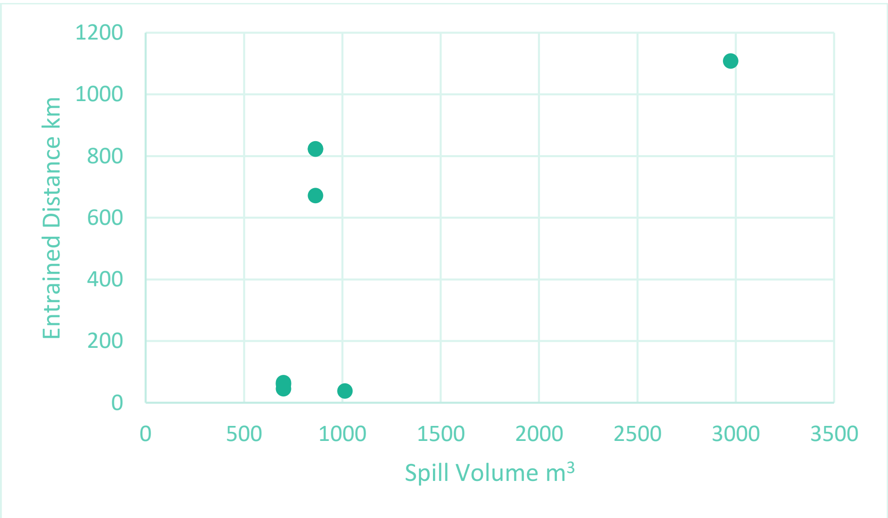

Figure 9: Bonaparte spill volume vs entrained distance travelled

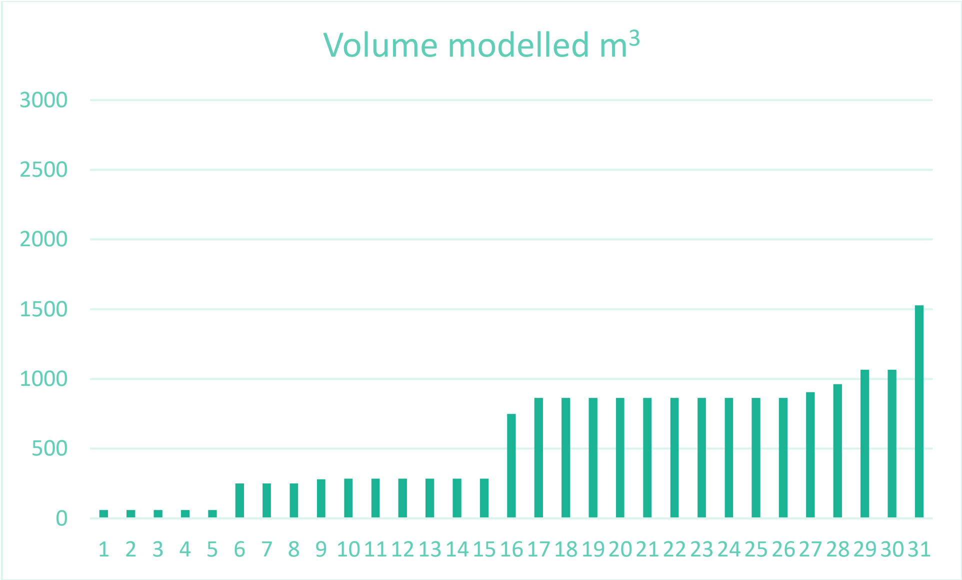

Figure 10: Browse modelled spill volumes

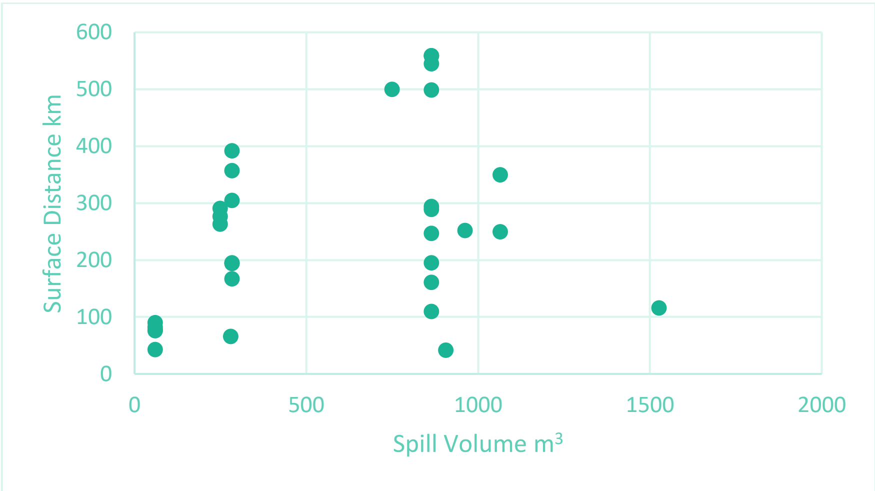

Figure 11: Browse spill volume vs surface distance travelled

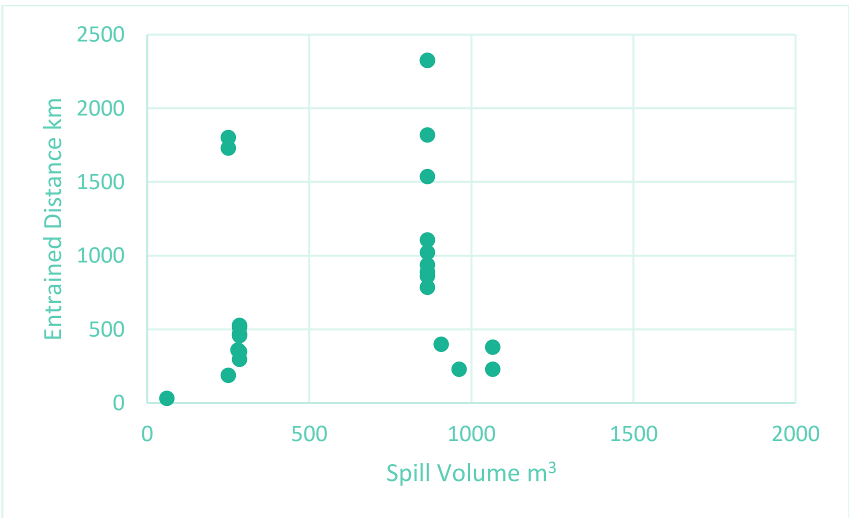

Figure 12: Browse spill volume vs entrained distance travelled

References

National Offshore Petroleum Safety and Environmental Management Authority, 2019. Oil spill modelling, Environmental bulletin- April 2019 – A652993. Accessed at: <https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf>

Attachment A – Detailed Spill Model Review Results

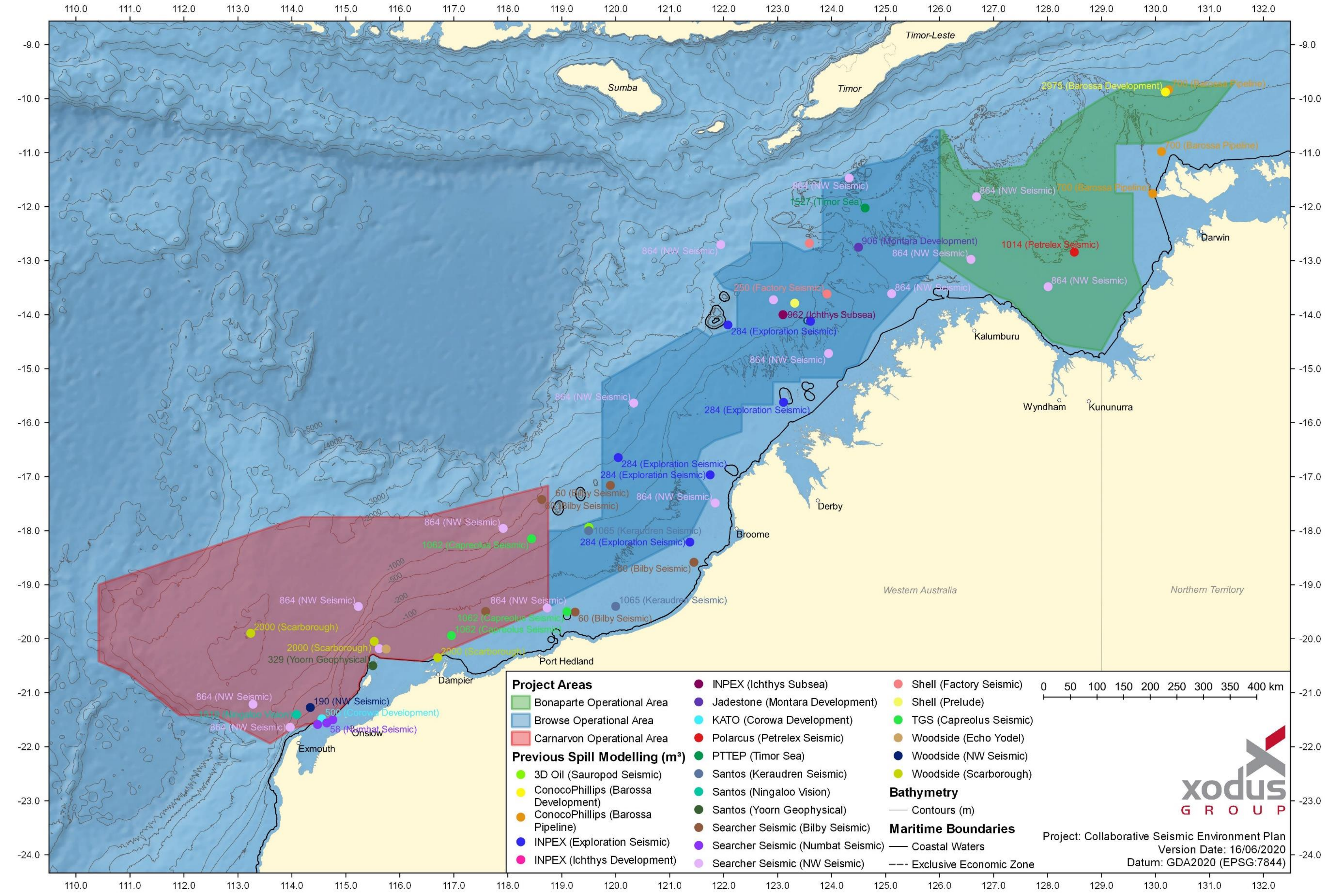

Figure 13: Operational areas with modelled spill locations

Table 3: Detailed EP spill report result summaries for each operational area

Activity / EP	Operation al Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: $1 g/m^2$)	Release Location	Surface Slick Feature (max. distance for all release locations)				Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)				Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: $10g/m^2$)	Shoreline Contact
ConocoPhillips Barossa Gas Export Pipeline Installation https://info.nopsema.gov.au/activities/353/show_public	Bonaparte	700 m^3 surface release of MDO over 6 hours, tracked over 50 days	**Loc.1:** 9°50'8.5"S, 130° 14' 49.92432" **Loc.2:** 10° 58' 48"S, 130° 6' 50.4"E **Loc3:** 11° 45' 31.68"S, 129° 57' 10.08"E	$10 g/m^2$			**Summer**	**Transitional**	**Winter**	100 ppb		**Summer**	**Transitional**	**Winter**	$100 g/m^2$	No shoreline accumulation was predicted for KP0 location. Other locations next to Bathurst Island and Melville Island: • above 100 g/m^2 along the western shoreline of Bathurst Island, with the maximum accumulation predicted to be~7396 g/m^2. The maximum length of shoreline contact, above the thresholds, is ~19 km. • above 100 g/m^2 at the tip Cape Van Diemen of Melville Island, with the maximum accumulation predicted to be 133 g/m^2.
					Loc. 1	*Main Direction*	SSW	-	W		*Main Direction*	-	-	W		
						Max Distance	33	-	41		*Max Distance*	-	-	45 km		
					Loc. 2	*Main Direction*	-	SW	W		*Main Direction*	E	E	N/S		
						Max Distance	-	78 km	36 km		*Max Distance*	65 km	65 km	65 km		
					Loc. 3	*Main Direction*	-	WNW	WNW		*Main Direction*	All directions	All directions	EW		
						Max Distance	-	92 km	62 km		*Max Distance*	60 km	60 km	60 km		
ConocoPhillips Barossa Area Development https://www.nopsema.gov.au/environmental-management/assessment-process/offshore-project-proposals/offshore-project-proposals-public-comment/barossa-area-development-offshore-project-proposal/	Bonaparte	2975 m^3 surface release of MDO over 6 hours	9°52'35.77"S, 130°11'8.36"E	1-10 g/m^2			**Summer**	**Transitional**	**Winter**	10-100 ppb		**Summer**	**Transitional**	**Winter**	Not stated	No shoreline contact.
					-	*Main Direction*	W	WSW	W		*Main Direction*	NE	SW	WSW		
						Max Distance	367 km	680 km	591 km		*Max Distance*	~593 km	~1108 km	~1029 km		
Polarcus Petrelex 3D Marine Seismic Survey https://info.nopsema.gov.au/activities/89/show_public	Bonaparte	1,014 m^3 surface release of Shell Diesoline (MDO) over 6 hours tracked over 20 days	12°50'31.41625"S 128°29'50.85638"E	1 g/m^2			**Summer**	**Transitional**	**Winter**	100 ppb		**Summer**	**Transitional**	**Winter**	10 g/m^2	No shoreline contact.
					-	*Main Direction*	E-SE	SE	NW		*Main Direction*	NE	SW	SW		
						Max Distance	113 km	450 km	215 km		*Max Distance*	18 km	13 km	38 km		
Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign **Not publicly available – NERA provided EP**	Bonaparte	864 m^3 surface release of MDO over 1 hour	Coordinates of modelled spill not available. Spill sites within Bonaparte Operational Area as per modelling report:	1 g/m^2			Apr - Sep	Oct – Mar		10 ppb		Apr - Sep	Oct – Mar		-	No shoreline contact described in EP or modelling report.
					AS	*Main Direction*	W, SE	W and NE			*Main Direction*	W, SE	W and NE			
						Max Distance	112 km, 234 km	97 km and 331 km			*Max Distance*	647 km, 247 km	479 km, 672 km			
					BD	*Main Direction*	W, SW, E	WSW, ESE			*Main Direction*	WNW, SW, ESE	W, SW, NE			
						Max Distance	236 km, 181 km, 146 km	245 km, 222 km			*Max Distance*	1073 km, 873 km, 225 km	574 km, 525 km, 824 km			
					BS	*Main Direction*	W, E	WSW, ESE			*Main Direction*	SW, E	SW, NE			
						Max Distance	226 km, 224 km	113 km, 180 km			*Max Distance*	920 km, 345 km	822 km, 693 km			

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	Release Location	Surface Slick Feature (max. distance for all release locations)				Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)				Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	Shoreline Contact
3D Oil Limited Sauropod 3D Marine Seismic Survey **https://info.nopsema.gov.au/environment_plans/27/show_public**	Browse Roebuck Basin in exploration permit area WA-527-P	280m³ surface release of MDO over 6 hours tracked over 30 days	Latitude: -17°56"17.0' Longitude: 119°30"14.8'	1 g/m²	-	*Main Direction*	N	WSW	NNE	10 ppb	*Main Direction*	All Directions	All Directions (furthest in SW direction)	All Directions (furthest in WSW direction)	10 g/m²	No shoreline contact.
						Max Distance	31 km	66 km	31 km		*Max Distance*	260 km	310 km	360 km		
INPEX Browse E&P Pty Ltd 2D Seismic Survey WA-532-P, WA-533-P and WA-50-L **https://info.nopsema.gov.au/activities/352/show_public**	Browse	284 m³ surface release of MGO over 6 hours tracked over 21 days.	**Site 1:** 18° 12' 40.08" S 121° 22' 27.24" E **Site 2:** 16° 57' 57.95" S 121° 45' 1.14" E **Site 3**: 16° 38' 47.63" S 120° 2' 52.78" E **Site 4:** 15° 37' 23.28" S 123° 6' 34.04" E **Site 5**: 14° 7' 18.89" S 123° 36' 37.15" E **Site 6:** 14° 11' 23.14" S 122° 4' 44.63" E	1 g/m²	**Site 1**	*Main Direction*	-			>500ppb	*Main Direction*	-			1 g/m²	**Site 1:** Locations receiving shoreline contact >1g/m²: • North Broome coast • Eighty-Mile Beach Minimum time for shoreline contact >1 g/m²: • 84 hours (80-mile beach) Worst case shoreline oil accumulation concentration (g/m²): • 51 g/m² (North Broome coast)
						Max Distance	194 km				*Max Distance*	470 km				
					Site 2	*Main Direction*	-				*Main Direction*	-				**Site 2:** Locations receiving shoreline contact >1g/m²: • Lacepede Islands. • North Broome Coast. • Northern Dampier Peninsula Minimum time for shoreline contact >1 g/m²: • 34 hours (Lacepede Islands) Worst case shoreline oil accumulation concentration (g/m²): • 3,311 g/m² (Lacepede Islands)
						Max Distance	167 km				*Max Distance*	297 km				
					Site 3	*Main Direction*	-				*Main Direction*	-				**Site 3:** Locations receiving shoreline contact >1g/m²: • Mermaid Reef AMP • Rowley Shoals Marine Park Minimum time for shoreline contact >1 g/m²: • 56 hours (Clerke Reef - Rowley Shoals Mark Park) Worst case shoreline oil accumulation concentration (g/m²): • 1,929 g/m² (Clerk Reef – Rowley Shoals)
						Max Distance	357 km				*Max Distance*	527 km				
					Site 4	*Main Direction*	-				*Main Direction*	-				**Site 4:** Locations receiving shoreline contact >1g/m²: • Adele Island • Lalanggarram/Camden Sound Marine Park • Buccaneer Archipelago Minimum time for shoreline contact >1 g/m²: • 5 hours (Adele Island) Worst case shoreline oil accumulation concentration (g/m²):
						Max Distance	195 km				*Max Distance*	349 km				

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	Release Location	Surface Slick Feature (max. distance for all release locations)		Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)		Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	Shoreline Contact
												• 3,313 g/m² (Adele Island)
					Site 5	*Main Direction*	-		*Main Direction*	-		**Site 5:** Locations receiving shoreline contact >1g/m²: • Browse Island • Seringapatam Reef • Scott Reef Minimum time for shoreline contact >1 g/m²: • 1 hour (Browse Island) Worst case shoreline oil accumulation concentration (g/m²): • 3,312 g/m² (Browse Island)
						Max Distance	392 km		*Max Distance*	458 km		
					Site 6	*Main Direction*	-		*Main Direction*	-		**Site 6:** Locations receiving shoreline contact >1g/m²: • Sandy Islet- Scott Reef Minimum time for shoreline contact >1 g/m²: • 35 hours (Sandy Islet –Scott Reef) Worst case shoreline oil accumulation concentration (g/m²): 3,312 g/m² (Sandy Islet –Scott Reef)
						Max Distance	305 km		*Max Distance*	514 km		
Santos Keraudren Extension 3D Marine Seismic Survey **https://info.nopsema.gov.au/activities/404/show_public**	Browse	1,065 m³ instantaneous surface release of MDO/MGO tracked over 4 weeks.	**Southern Release Location:** Just outside of Browse Operational Area 119.944ºE, 19.409ºS ~100 km ENE of Bedout Island. **Northern release Location:** 119.531ºE, 17.976ºS ~304 km W of Broome.	1 g/m²	**Southern Release Location**	*Main Direction*	All Directions (furthest in E and W direction)	10 ppb	*Main Direction*	All Directions (furthest in W and NE direction)	10 g/m²	Shoreline accumulation at the low exposure value (10 g/m²) predicted to occur between: • Bedout Island (14% probability), approximately 100 km to the west-southwest of the release location; and • Roebuck-Eighty Mile Beach (21% probability), approximately 250 km to the northeast. Maximum predicted shoreline loading: • 80-mile Beach of ~358 tones.
						Max Distance	250 km		*Max Distance*	380 km		
					Northern Release Location	*Main Direction*	All Directions (furthest in E and W direction)		*Main Direction*	All directions		Shoreline loading at low exposure (10 g/m²): • Rowley Shoals emergent/intertidal features of Mermaid Reef AMP (27% probability), • Clerke Reef (31% probability); and • Imperieuse Reef (29% probability) (Rowley Shoals Marine Park), located in relative proximity to the release location (80-100 km away). Maximum predicted shoreline loading at Imperieuse Reef of • ~335 tones.
						Max Distance	350 km		*Max Distance*	230 km		
Searcher Seismic Quoll 3D Marine Seismic Survey **Not publicly available – NERA provided EP**	Browse Just outside operational area	864 m³ surface release of MDO over 1 hour	Approximately 12ºS, 124ºE	1 g/m²			Apr – Sep | Oct– Mar	10 ppb		Apr – Sep | Oct– Mar	-	Spill report does not refer to any shoreline contact although distance covered by spill is considerable and enters Indonesian waters.
					-	*Main Direction*	W, SE and NE | WNW, SW and NE		*Main Direction*	W and SW | W, SW and NE		

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	Release Location	Surface Slick Feature (max. distance for all release locations)				Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)				Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	Shoreline Contact
						Max Distance	493 km (W), 165 km (SW), and 144 km (NE)	545 km (WNW), 262 km (SW) and 281 km (NE)			*Max Distance*	2327 km (W) and 1019 (SW) km	1242 km (W), 885 km (SW) and 688 km (NE)			
Inpex Ichthys Development Drilling Campaign WA-50-L https://info.nopsema.gov.au/activities/391/show_public	Browse	250 m³ instantaneous surface release of marine diesel tracked over 21 days	Approximately 123ºE, 14ºS	1 g/m²	-	*Main Direction*	-			≥ 500 ppb	*Main Direction*	-			10 g/m²	No shoreline contact at 10 g.m² Worst case oil shoreline concentration (g.m²): • Ashmore Reef - 11 g/m² (summer) • Sandy Islet- 11 g/m² (summer) • Cartier Island – 3.2 g/m² (transitional)
						Max Distance	277 km				*Max Distance*	188 km (transitional season)				
Inpex Ichthys Umbilicals, Risers and Flowlines and Subsea Production Systems Installation WA-50-L https://info.nopsema.gov.au/activities/416/show_public	Browse	962 m³ instantaneous release of diesel tracked over 21 days.	Approximately 29 km north-west of Browse Island.	1 g/m²	-	*Main Direction*	-			≥ 500 ppb		Mar - Aug	Sept - Nov	Nov - Dec	10 g/m²	Worst case concentration (g/m²) of accumulated oil on shoreline (where concentration has exceeded >10 g/m²): • Ashmore Reef – 144 g/m² • Browse Island – 3313 g/m² • Cartier Island – 765 g/m² • Scott Reef – 260 g/m²
						Max Distance	252 km				*Main Direction*	-	-	-		
											Max Distance	154 km	123 km	230 km		
Shell Australia Factory 3D Seismic Survey https://docs.nopsema.gov.au/A695487	Browse	250 m³ instantaneous surface release of MDO	**Location 1:** 12° 40' 36.88", 123° 35' 22.00" **Location 2:** 13° 37' 00.10", 123° 54' 58.00"	1 g/m²	*Location 1*	*Main Direction*	-			10 ppb	*Main Direction*	-			10 g/m²	For release Location 1, floating oil at high threshold concentrations could arrive at: • Carter Island (within 14 hours in summer and within 9 hours in winter and transitional months) For release location 2, floating oil at low threshold concentrations will arrive at: • Browse Island (within 45 hours in transitional months and within 119 hours in winter and will not contact this shoreline in summer)
						Max Distance	291 km				*Max Distance*	1732 km				
					Location 2	*Main Direction*	-				*Main Direction*	-				
						Max Distance	263 km				*Max Distance*	1804 km				
Jadestone Energy (Eagle) Pty Ltd WHP and Subsea Fields ACL7 ACL8 Drilling Program 2020 https://info.nopsema.gov.au/environment_plans/489/show_public	Browse	906m³ surface release of diesel	Approximately 124°30'00"E, 12°45'00"S	10 g/m²	-	*Main Direction*	-			100 ppb	*Main Direction*	-			-	No shoreline contact.
						Max Distance	~42 km				*Max Distance*	~400 km				
PTTEP Timor Sea Well Suspension https://info.nopsema.gov.au/environment_plans/504/show_public	Browse Outside operational area to the North	1527 m³ surface release of MDO over 6 hours tracked over 40 days	12° 1' 29.26" S; 124° 37' 16.04" E	10 g/m²	-		Summer	Winter	Transitional	700 ppb	-	-			100 g/m²	The modelling results for shoreline contact are summarised as follows: • No shoreline contact is predicted under summer or winter conditions. • During the transitional period, there is a 1% probability of shoreline contact at Ashmore Reef above the 100 g/m² threshold. The maximum length of shoreline contacted above the threshold is 4 km, and the peak volume is approximately 16 m³. The minimum time before shoreline accumulation above the 100 g/m² threshold is 6.8 days
						Main Direction	ENE	N	SW							
						Max Distance	44 km	116 km	64 km							
Searcher Seismic Bilby 2D Multi-Client	Browse / Carnarvon	60 m³ surface	**Release site 1:**	0.5 g/m²	**Release site 1**	*Main Direction*	ENE			>960 ppb.hrs	*Main Direction*	-			10-100 g/m²	Maximum shoreline length (km) with stranded oil concentration >10 g/m² of 13 km.

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m^2)	Release Location	Surface Slick Feature (max. distance for all release locations)			Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)			Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m^2)	Shoreline Contact
Marine Seismic Survey, 2015 **Not publicly available – NERA provided EP**		release of MGO over 6 hours during December to May period.	Lat: 17° 25' 20.0303" S Lon: 118° 37' 48.0338" E **Release site 2:** Lat: 19° 29' 41.4314" S Lon: 117° 35' 27.4669" E **Release site 3:** Lat: 19° 30' 21.8055" S Lon: 119° 14' 55.2415" E **Release site 4:** Lat: 18° 35' 1.9591" S Lon: 121° 26' 58.9614" E **Release site 5:** Lat: 17° 09' 39.4428" S Lon: 119° 54' 10.9420" E			*Max Distance*	90 km							
					Release site 2	*Main Direction*	W							
						Max Distance	82.1							
					Release site 3	*Main Direction*	W							
						Max Distance	42.9			*Max Distance*	33 km			
					Release site 4	*Main Direction*	NE							
						Max Distance	75.8							
					Release site 5	*Main Direction*	WNW							
						Max Distance	**76.9**							
Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign **Not publicly available – NERA provided EP**	Browse	864 m^3 surface release of MDO over 1 hour	Coordinates of modelled spill not available. Spill sites within Browse Operation Area as per Spill report: CD, CS. DD, DM, DS, ED, ES, FD, FS **Note the following spill sites just outside or on border of the defined Operational Area:* *ES - coastal side* *DD – Outer border* *CD – Outside outer border*	1 g/m^2			Apr - Sep	Oct – Mar	10 ppb		Apr - Sep	Oct – Mar	-	No shoreline contact described in EP or modelling report.
					CD	*Main Direction*	W, SW, NE	WNW, SW, NE		*Main Direction*	W, SW	W, SW, NE		
						Max Distance	493 km, 165 km, 144 km	545 km, 262 km, 281 km		*Max Distance*	2327 km, 1019 km	1242 km, 885 km, 688 km		
					CS	*Main Direction*	SW, NW	SW, NE		*Main Direction*	SW, WNW, NE	SW, NE		
						Max Distance	285 km, 101 km, 141 km	499 km, 105 km		*Max Distance*	919 km, 1024 km, 223 km	754 km, 622 km		
					DD	*Main Direction*	S, WSW	SW, W, NW		*Main Direction*	SW, WNW	SW, W. NE		
						Max Distance	243 km, 311 km, 261 km	279, 463 km, 559 km		*Max Distance*	1007 km, 1821 km	853 km, 1005 km, 839 km		
					DM	*Main Direction*	SW, NW	SW, N, NE		*Main Direction*	WNW, SW	SW, WNW, NE		
						Max Distance	289 km, 270 km, 167 km	279 km, 212 km, 201 km		*Max Distance*	1537 km, 916 km	889 km, 745 km, 684 km		
					DS	*Main Direction*	W, SW, NE	SW, ENE		*Main Direction*	SW, NW, NE	SW, NE		
						Max Distance	224 km, 146 km, 171 km	247 km, 114 km		*Max Distance*	839 km, 492 km, 277 km	862km, 669 km		
					ED	*Main Direction*	SW, W, N	WSW, SSW, N		*Main Direction*	SW, WNW, NE	NW, NE		
						Max Distance	294 km, 201 km, 246 km	263 km, 197 km, 271 km		*Max Distance*	1108 km, 1018 km, 496 km	662 km, 630 km		
					ES	*Main Direction*	SW, NNE	SSW, NE		*Main Direction*	WSW, NW, NE	WSW, NE		
						Max Distance	161 km, 113 km	110 km, 150 km		*Max Distance*	890 km, 339 km, 349 km	805 km, 376 km		
					FD	*Main Direction*	SW, NW, NE	WNW, NW, ENE		*Main Direction*	WSW, WNW, NE	SW, WNW, NE		
						Max Distance	195 km, 173 km, 125 km	131 km, 148 km, 152 km		*Max Distance*	939 km, 694 km	814 km, 594 km, 658 km		

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: $1 g/m^2$)	Release Location	Surface Slick Feature (max. distance for all release locations)			Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)			Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: $10g/m^2$)	Shoreline Contact
					FS	*Main Direction*	W, E	W, E		*Main Direction*	WSW, N	WSW, NE		
						Max Distance	110 km, 68 km	62 km, 108 km		*Max Distance*	786 km, 446 km	684 km, 437 km		
Shell Australia Pty Ltd Prelude FLNG **https://info.nopsema.gov.au/environment_plans/490/show_public**	Browse	750m³ diesel surface release over 1 hour	13°47.2´S, 123°19.0´ E	$1 g/m^2$	-	*Main Direction*	SSW		10 ppb	-	-		$10 g/m^2$	The annualised maximum accumulated volume averaged over all replicate spills was: • Browse Island: $0.7 m^3$ • Scott Reef: $0.4 m^3$ • Ashmore Reef: $0.07 m^3$ • Cartier Island: $0.09 m^3$ The maximum local accumulation averaged among replicate spills was: • Browse Island: $25 g/m^2$ • Scott Reef: $5.5 g/m^2$ • Cartier Island: $7.2 g/m^2$
						Max Distance	500 km							
TGS-NOPEC Geophysical Company Pty Ltd Capreolus-2 3D Marine Seismic Survey 2020 - 2023 **https://info.nopsema.gov.au/environment_plans/493/show_public**	Carnarvon	1,062 m³ surface release of MDO over 6 hours tracked over 40 days	**Location 1:** Latitude: 19° 56' 29.8998" S Longitude: 116° 57' 26.517" E *(Bottom left orange dot)* **Location 2:** Latitude: 19° 29' 56.241" S Longitude: 119° 5' 46.3194" E *(Bottom right orange dot)* **Location 3:** Latitude: 18° 8' 55.1328" S Longitude: 118° 26' 31.095" E *(Top orange dot)*	$1 g/m^2$	**Location 1**	*Main Direction (annual)*	SE		10 ppb	*Main Direction*	All directions (furthest in SSW direction)		$10 g/m^2$	No shoreline contact
						Max Distance (annual)	35.7 km			*Max Distance*	~930 km			
					Location 2	*Main Direction (annual)*	NW			*Main Direction (annual)*	All directions (furthest in W direction)			Location 2: Probability of contact to any shoreline at, or above, the low threshold (10–100 g/m^2) • 7% Minimum time before oil contact: • ~8 hours Maximum volume of oil ashore: • 72.3 m^3. Maximum length of shoreline at 10 g/m^2 and 100 g/m^2: • 3 km and 2 km. Only Bedout Island was predicted to be contacted by oil at and above the low threshold, occurring from Location 2, with a maximum length above the moderate and high threshold • 3 km and 2 km, respectively. Maximum volume on shoreline: • 1.8 m^3.
						Max Distance (annual)	28.5 km			*Max Distance (annual)*	~750 km			
					Location 3	*Main Direction (annual)*	WNW			*Main Direction (annual)*	All directions (furthest in N and WSW direction)			No shoreline contact
						Max Distance (annual)	115 km			*Max Distance (annual)*	~920 km			
Searcher Seismic Dunnart 2D Marine Seismic Survey Not publicly available – NERA provided EP	Carnarvon	864 m³ surface release of MDO over 1 hour during	Approximately 20ºS, 115ºE	$1 g/m^2$			Apr - Sep	Oct – Mar	10 ppb		Apr - Sep	Oct – Mar	-	No shoreline contact
					-	*Main Direction*	WSE and NE	SW and N		*Main Direction*	SW, W and NNE	SW, NW and NE		

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	Release Location	Surface Slick Feature (max. distance for all release locations)			Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)			Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	Shoreline Contact
		April - September				*Max Distance*	204 km and 178 km	109 km and 156 km		*Max Distance*	1005 km, 992 km and 715 km	895 km, 887 km and 759 km		
Searcher Seismic Numbat 3D Marine Seismic Survey **Not publicly available – NERA provided EP**	Carnarvon	58 m³ instantaneous surface release of MGO tracked over 14 days during March to April	**Loc-1:** 21.58881°S 114.47779°E **Loc-2:** 21.55991°S 114.64727°E **Loc-3:** 21.50145°S 114.75884°E	1 g/m²	**All locations**	*Main Direction*	-		10 ppb	*Main Direction*	SW and NNE		1 g/m²	Floating slicks with concentrations ≥1g/m² is forecast to contact: • Peak Island • Flat Island • Serrurier Island • Besieres Island (Southern Islands Group) • Muiron Islands • Thevenard Island.
						Max Distance	~90 km			*Max Distance*	~288 km and 134 km			
Searcher Seismic Northern Western Australian Marine Seismic Survey Campaign **Not publicly available – NERA provided EP**	Carnarvon	864 m³ surface release of MDO over 1 hour	Coordinates of modelled spill not available. Spill sites within Carnarvon Operation Area as per Spill report: GD, GS, HD, HS	1 g/m²			Apr - Sep	Oct – Mar	10 ppb		Apr - Sep	Oct – Mar	-	No shoreline contact described in EP or modelling report.
					GD	*Main Direction*	WSW, NE	SW, N		*Main Direction*	SW, W, NNE	SW, NW, NE		
						Max Distance	204 km, 178 km	109 km, 156 km		*Max Distance*	1005 km, 992 km, 715 km	895 km, 887 km, 795 km		
					GS	*Main Direction*	SW, NE	SW, ENE		*Main Direction*	SW, NW, NNE	SW, W, NNE		
						Max Distance	205 km, 122 km	192 km, 97 km		*Max Distance*	1033 km, 565 km, 890 km	1002 km, 710 km, 785 km		
					HD	*Main Direction*	SW, W, NE	S, N, NE		*Main Direction*	SSW, NW, N	W, NW, NE		
						Max Distance	168 km, 171 km, 106 km	146 km, 190 km, 159 km		*Max Distance*	1167 km, 1135 km, 999 km	885 km, 540 km, 417 km		
					HS	*Main Direction*	WSW, NE	SW, N		*Main Direction*	SW, W, NNE	SW, W, NE		
						Max Distance	244 km, 106 km	140 km, 80 km		*Max Distance*	993 km, 1018 km, 939 km	829 km, 890 km, 742 km		
Kato Corowa Development: Offshore Project Proposal https://www.nopsema.gov.au/environmental-management/offshore-project-proposals/offshore-project-proposals-public-comment/corowa-development-project/	Carnarvon	500 m³ surface release of MGO over 6 hours tracked over 30 days	114° 33' 26.20" E 21° 28' 59.40" S	1 g/m²	**All locations**	*Season*	Winter		10 ppb	*Season*	Winter		>10 g/m²	Worst-case oil accumulation on a shoreline is predicted at: • Muiron Islands Marine Management Area Accumulated concentration and volume of: • 3.3 kg/m² and 185 m³, respectively. Worst-case maximum length of shoreline with concentrations exceeding the low threshold (10 g/m²) was calculated during transitional months as: • 23 km Within: • Ningaloo WH • Shark Bay WH
						Main Direction	SW			*Main Direction*	SW			
						Max Distance	178 km			*Max Distance*	957 km			
Santos Yoorn-1 Geophysical Survey https://info.nopsema.gov.au/activities/415/show_public	Carnarvon	329 m³ surface release of diesel released over 0.5 hours	Approximately 115°30'00"E, 20°30'00"S	1 g/m²	-	*Main Direction*	-		10 ppb	*Main Direction*	SW		>10 g/m²	Oil accumulation on shorelines above the 10 g/m² exposure value was predicted to occur at: • Montebello Islands (24% probability) Lower contact probabilities of 1-6 % were predicted for: • Dampier Archipelago • Murion Islands • Ningaloo Coast North
						Max Distance	350 km			*Max Distance*	350 km			
Woodside Energy Ltd North-west Australia 4D MSS	Carnarvon	190 m³ surface release of marine diesel	**Area C:** 27 km west of Murion Islands	10 g/m²	*Area C*	*Main Direction*	-		500 ppb	*Main Direction*	-		10 g/m²	The Ningaloo Coast North shoreline is predicted to be contacted by floating oil concentrations at: • 10 g/m² (22%) • 50 g/m² (16.5%)

Activity / EP	**Operational Area**	**Spill Model Parameters**	**Release Location**	**Surface Threshold** Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	**Release Location**	**Surface Slick Feature (max. distance for all release locations)**		**Entrained Threshold** Compliance with NOPSEMA (Low Exposure Value: 10ppb)	**In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)**		**Shoreline Threshold** Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	**Shoreline Contact**
https://info.nopsema.gov.au/activities/9/show_public			*Note, not enough information available for Areas A and B in EP thus not included*			*Max Distance*	74 km		*Max Distance*	133 km		• 100 g/m² (11.5%)
Woodside Energy Ltd Echo Yodel and Capella Plugging and Echo Yodel Decommissioning **https://info.nopsema.gov.au/environment_plans/503/show_public**	Carnarvon	1000 m³ surface release of diesel	Approximately 50 km South of: 19° 44' 17.062" S, 115° 44' 53.85" E	10 g/m²	-	*Main Direction*	-	500 ppb	-	-	100 g/m²	Shoreline accumulation may occur at the following sites: • Southern Pilbara Islands – maximum accumulated volume of <1 m³ and a maximum local accumulated concentration on shorelines of 11 g/m² • Muiron Islands – maximum accumulated volume of <1 m³ and a maximum local accumulated concentration on shorelines of 6.3 g/m² • Ningaloo Coast North – maximum accumulated volume of <1 m³ and a maximum local accumulated concentration on shorelines of 4.1 g/m² • Ningaloo Coast Middle – maximum accumulated volume of <1 m³ and a maximum local accumulated concentration on shorelines of 24 g/m²
						Max Distance	110 km					
Santos WA PVG Pty Ltd Ningaloo Vision Operations WA-35 – L (Van Gogh/Coniston/Novara fields) **https://info.nopsema.gov.au/environment_plans/500/show_public**	Carnarvon	1,519 m3 surface release of MDO released over 1 hour	21°24'12.39"S, 114°05'17.22"E	1 g/m²	-	*Main Direction*	-	10 ppb	*Main Direction*	-	10 g/m²	Furthest shoreline accumulation above the low exposure value of 10 g/m² may occur at: • Outer Shark Bay Coast, approximately 600 km from the release location
						Max Distance	280 km		*Max Distance*	300 km		
Woodside Energy Ltd Scarborough Offshore Project Proposal	Carnarvon	2000 m³ instantaneous surface release of MDO	**Scenario 1:** 20° 21' 3.28' S 116° 42' 5.58''E **Scenario 2:** 20° 03' 1.44'' S 115° 31' 35.04''E **Scenario 3:** 19° 53'54.72'' S 113° 14' 19.56''E	1 g/m²	*Scenario 1*	*Main Direction*	-	500 ppb	*Main Direction*	-	100 g/m²	**Scenario 1:** The maximum local accumulated concentration ashore for the worst-case simulation was predicted to be: • 156 g/m² (at WA Coastline) Exposures above the threshold are predicted to have a probability of intersecting the following key sensitive receptors, at the associated maximum accumulated volume in the worst-case simulation: • 1% probability to Dampier Archipelago; 3 m³ • 1% to WA Coastline; 3 m³ • Other shoreline receptors were <1%
						Max Distance	~83 km		*Max Distance*	~163 km		
					Scenario 2	*Main Direction*	-		*Main Direction*	SW		**Scenario 2:** • There is <1% probability of any shoreline contact above the threshold. • The maximum local accumulated concentration ashore for the worst-case simulation was only 11 g/m² at Barrow Island and WA Coastline – which is not above the threshold of 100 g/m². • Barrow Island and WA Coastline were only predicted to accumulate a maximum of 1 m³ for the worst-case simulation.
						Max Distance	~82 km		*Max Distance*	~310 km		

Activity / EP	Operational Area	Spill Model Parameters	Release Location	Surface Threshold Compliance with NOPSEMA (Low Exposure Value: 1g/m²)	Release Location	Surface Slick Feature (max. distance for all release locations)		Entrained Threshold Compliance with NOPSEMA (Low Exposure Value: 10ppb)	In-water Hydrocarbons (max. distance for all release locations for both entrained and dissolved hydrocarbons)		Shoreline Threshold Compliance with NOPSEMA (Low Exposure Value: 10g/m²)	Shoreline Contact
												• No other shoreline contact was predicted above the threshold.
					Scenario 3	*Main Direction*	S		*Main Direction*	SW		**Scenario 3:** No shoreline contact.
						Max Distance	~115 km		*Max Distance*	~476 km		

Appendix C: Commercial Fishing Operational Protocol

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Creating connections for growth

NATIONAL ENERGY RESOURCES AUSTRALIA

COLLABORATIVE SEISMIC ENVIRONMENT PLAN PROJECT

COMMERCIAL FISHING INDUSTRY OPERATIONAL PROTOCOL

Communication requirements and seismic survey spatial and temporal controls between commercial fishers and petroleum titleholders

Revisions	Date	Purpose
A	18 Jan 2021	Draft for circulation to consortium members
B	4 Feb 2021	Inclusion of feedback from project team & consortium members
C	12 Feb 2021	Document revisions based on WAFIC feedback
D	20 Feb 2021	Further revisions based on additional WAFIC feedback to Rev C
E	19 Mar 2021	Revisions based on March 9, 2021 Zoom Meeting feedback
F	27 Mar 2021	Revisions after 3rd consortium review.
G	8 Apr 2021	Revisions based on April 7th Zoom Meeting feedback.
1	30/06/2021	Final document for initial release

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1. Commercial Fishing Industry Operational Protocol Overview

1.1. Purpose

This Operational Protocol outlines a set of commitments relating to communication with the commercial fishing industry before, during and after a seismic survey planned and conducted under the Collaborative Seismic Environment Plan (CSEP).

Secondly, the protocol establishes spatial and temporal controls to limit the size, location and frequency of seismic surveys conducted under the CSEP. This covers the critical “where, when and how often” seismic surveys can be conducted under the CSEP over commercial fishing areas.

1.2. Outcomes

The intended outcomes of this protocol are:

- easy commercial fisher access to information relating to planned seismic surveys under the CSEP,
- an open-door communication policy, with seismic survey operator commitment for face-to-face or online video conference meetings with commercial fishers on a commercial fisher needs basis,
- templates for information distribution in a standard format, including survey maps and chart plotter files, for all advance notifications of intent to conduct a seismic survey under the CSEP from petroleum titleholders to commercial fishers,
- methods for advance survey notifications including minimum timeframes and communications,
- consistent on-water communication protocols between fishing vessels and seismic survey and support vessels,
- spatial and temporal controls that manage seismic surveys to keep them within the bounds of average historic levels and at levels that provide for manageable coexistence with commercial fishers; and
- a requirement that CSEP consortium members will abide by the commitments within this Operational Protocol for any survey activity conducted under the environment plan resulting from the CSEP project, unless otherwise agreed through further consultation and/or negotiation with potentially affected commercial fishers.

1.3. Background

In 2018, National Energy Resources Australia (NERA) established an industry consortium to seek approval from the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for seismic survey activities in an area in Commonwealth waters off Western Australia (WA) and the Northern Territory (NT) from 2021 and beyond.

NERA is the facilitator of the CSEP Project and does not conduct petroleum activity. This protocol has been developed by the CSEP Project Steering Committee in consultation with commercial fishing licence holders in fisheries that are active within the CSEP Project proposed operational area, and with the Western Australian Fishing Industry Council (WAFIC), the Northern Territory Seafood Council (NTSC) and the Commonwealth Fishing Association (CFA). Seafood Industry Australia were invited to participate in the CSEP project but deferred involvement to WAFIC.

1.4. Scope

This Operational Protocol covers NERA CSEP consortium members, as petroleum titleholders and commercial fishers operating within the CSEP operational area. As of May 2021, there were 11 CSEP consortium member companies. Membership of the CSEP consortium entitles member companies to conduct seismic surveys under the CSEP. Surveys may be conducted within the defined CSEP Operations Area (in Commonwealth offshore waters from west of Northwest Cape to North of the Tiwi Islands), subject to meeting all other regulatory requirements, for the five-year lifespan of the CSEP.

As a control measure under the CSEP to manage potential impacts to commercial fishing, this Operational Protocol will be subject to inspection under the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) environmental inspection program. Information detailing performance against the controls within this protocol will be prepared for distribution to commercial fishers at the annual forum that will convene under Commitment 1, Detail b.

1.5. Definitions

I. **Acquisition Area** - The primary target area for a seismic survey and the area in which seismic data will be recorded. (See Seismic Survey “Areas” Definitions Sample Diagram)

II. **Active Source Area** - An area including and around the Acquisition Area in which the seismic energy source (airgun array) can be active. This includes survey line run-ins and run-outs. (See Seismic Survey “Areas” Definitions Sample Diagram)

III. **Adjustment Area** – An area extending 10 kilometres around the perimeter of a 3D or 4D seismic survey Active Source Area. (See Seismic Survey “Areas” Definitions Sample Diagram) This is the area defined within the CSEP Commercial Fishing Industry Adjustment Protocol for monetary adjustment of lost catch, fishing gear damage or displacement.
NOTE: The definition of an Adjustment Area for a 2D survey will require case-by-case specification due to the differing survey layout.

IV. **Commercial fisher** – For the purpose of this protocol, an entity, person, fishing licence holder, company or group who lawfully operates a commercial fishing vessel or aquaculture operation within a government regulated fishery or under any other statutory commercial fishing entitlement.

V. **Control** – A measure or action designed to limit or minimise specific potential adverse effects.

VI. **Future appointed CSEP governance body** – On regulator acceptance of the CSEP Project environment plan, the consortium will appoint an individual, company, organisation or committee to administer the environment plan throughout its validity period, including compliance and relevant information monitoring and document updating.

VII. **Operations Area** – A larger defined area encompassing the Active Source Area in which survey vessel activities other than actively operating the seismic energy source can be conducted, such as line turns, equipment maintenance and deployment/recovery, crew change, resupply etc. (See Seismic Survey “Areas” Definitions Sample Diagram)

VIII. **Petroleum Titleholder** – The Petroleum Titleholder is the registered holder of the Access Authority, Special Prospecting Authority, Exploration Permit, Retention Lease or Petroleum Production Licence over which the seismic survey will be acquired, as detailed in the environment plan for the seismic survey subject to this protocol.

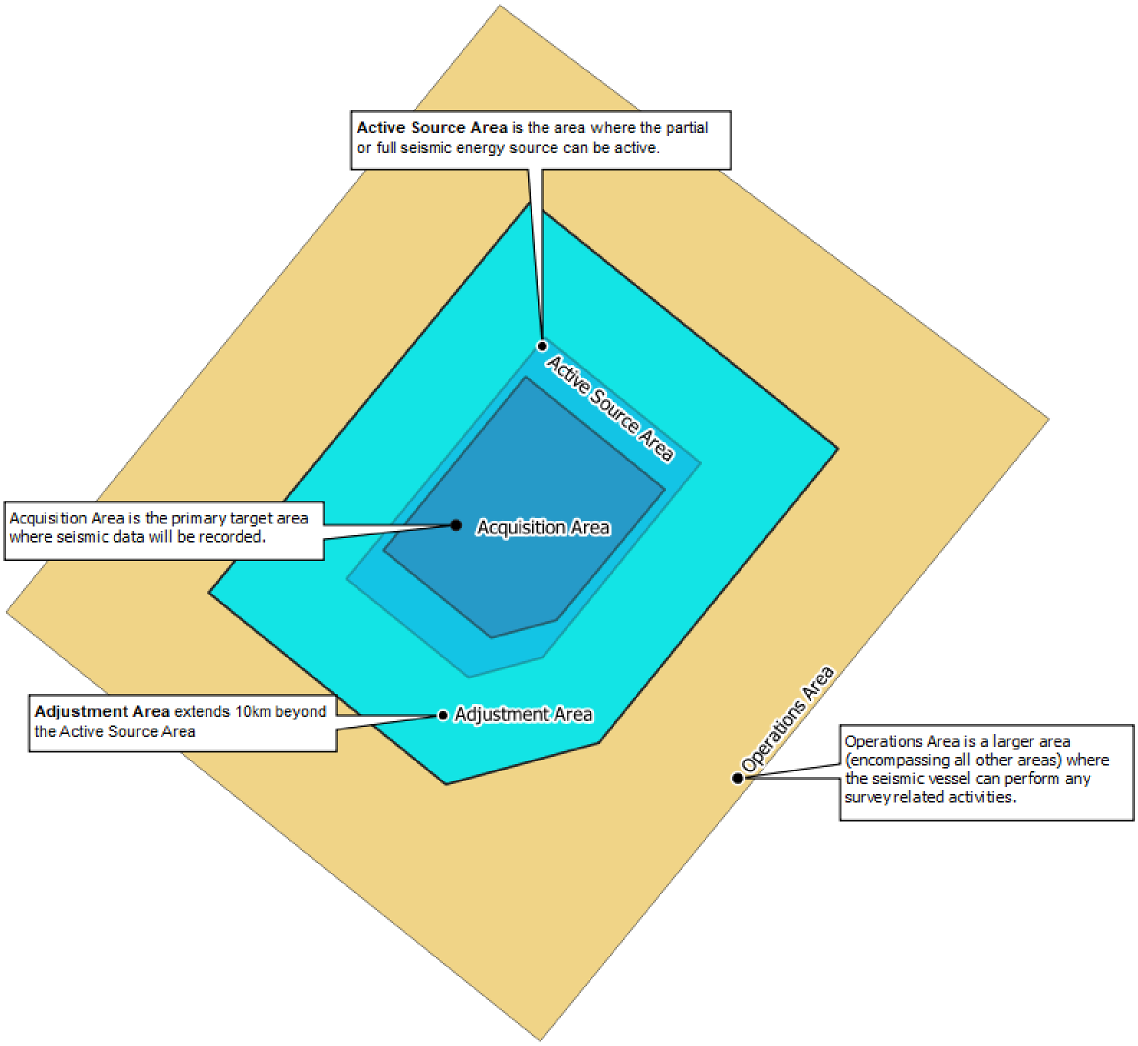
IX. Potentially affected commercial fisher – a fisher who has Regularly Fished Fishing Grounds within the proposed survey Operations Area.

X. **Regularly Fished Fishing Grounds** – An area where fishing catch effort has been recorded in one or more Statistical Fishing Blocks on Government statutory fishing returns for at least two out of the previous five years.

XI. **Regulated Fishing Season** – The period, or periods, within a calendar year where a commercial fisher is permitted to undertake fishing activities, as dictated by the relevant state or commonwealth government regulator.

XII. **Statistical fishing block** - Government statistical grid/block numbering system used to record commercial fishing activity data.

Figure 1 Seismic Survey "Areas" Definitions Sample Diagram



2. Commitments

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2.1. Commitment 1

A. To maintain regular contact with potentially affected commercial fishers, including updates on survey scheduling prior to commencement.

B. To provide information in an agreed standard format to potentially affected commercial fishers prior to commencement of a planned seismic survey.

C. To establish and maintain regular and detailed on-water communications with any commercial fishing vessels that may be operating within or near a seismic survey Operations Area.

D. To ensure the WAFIC website CSEP information hub is up-to-date and accurate.

</td><td>

a. Establishment of an easy to access portal, for example on the WAFIC or other nominated, suitably managed website, covering CSEP updates and seismic survey schedules to ensure at any one time, the most recent and correct information is readily available as soon as is practical.

b. An annual industry roundtable forum, either in-person or virtual, will be established with CSEP consortium members, commercial fishers and peak bodies, where all publicly releasable plans for seismic surveys proposed to be undertaken under the CSEP will be presented and discussed by CSEP consortium members. Information detailing performance against the controls within this protocol will also be circulated. The forum will encourage commercial fisher input regarding any relevant updated fisheries information for petroleum titleholders and on how each industry can better work together going forward.

c. No less than 3 months prior to commencement of a planned seismic survey, a “Notification of Intent” to conduct a seismic survey under the CSEP, in a standardised format, as detailed in Appendix A will be provided to potentially affected commercial fishers.

The notification will include:

I. The estimated commencement date of survey activities.
II. A standardised map in both PDF and Georeferenced image file formats (e.g. GeoTIFF) attached to the electronic notification, including information as detailed in Appendix B ,
III. Standardised chart plotter/GIS data file(s), as defined in Appendix C .

Potentially affected commercial fishers will also be advised:-

I. As soon as any changes to planned survey details or commencement timing become apparent, and
II. Of the latest survey commencement date estimate not less than 10 days prior to survey vessel mobilisation to the survey location.

All notifications will be sent via email, or other nominated electronic means. Commercial fishers who do not provide email contact details will be advised in paper form via Australia Post, or other mail or courier service, which will include a print version of the activity advice. Electronic data file information will also be provided on request, should the mail recipient have access to online facilities.

d. Survey vessels will establish and maintain regular on-water communications with any commercial fishing vessels that may be operating within a survey Operations Area[1], including daily. updates regarding survey vessel activities, including proposed movements within the Operations and Adjustment Areas1. Vessel to vessel communications will primarily be conducted via VHF marine radio, though alternate viable options, such as mobile phone or emails, are permitted where available.

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</table>

• [1] *Refer to Definitions section on page 2 of this document.*

2.2. Commitment 2 A. To limit seismic surveys (extent and frequency) to a level where titleholders and commercial fishers can co-exist. B. To prevent overlapping 3D seismic surveys within the same regulated fishing season for each potentially affected managed fishery.	a. As a primary control, wherever possible and operationally feasible, and taking into consideration other critical timing factors, *Petroleum Titleholders*[2] will work with commercial fishers to avoid seismic survey activities during the most active fishing and spawning periods of any directly affected managed fishery. b. The total combined size of the *Acquisition Areas*[2] of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP within the CSEP *Operations Area*[1] will not exceed 40,000 km^2 in any calendar year. c. The *Acquisition Area*[2] of any single 3D or 4D seismic survey, or survey phase, conducted under the CSEP within the CSEP *Operations Area,* will not exceed 10,000 km^2. This control is to limit the duration of presence of seismic survey vessels within the same marine multi-use area to manageable levels. "It is estimated to take between approximately 95-195 days to acquire 10,000 km^2, including contingency time for potential vessel or equipment downtime and adverse weather conditions."[2]. d. Seismic survey vessel activities for seismic surveys conducted under the CSEP will not overlap the *Regularly Fished Fishing Grounds*[2] of any individual managed fishery by more than 33% of the *Regulated Fishing Season*[2] for each calendar year, throughout the 5 year duration of the CSEP validity. Duration calculation relates to seismic survey vessel time spent within the *Regularly Fished Fishing Grounds*[2] of each directly affected managed fishery, not the overall survey duration or full managed fishery boundaries. e. Exceptions to fisheries covered by the controls in item 'd.' are the Pilbara Trap and Pilbara Fish Trawl Managed Fisheries, whereby seismic survey vessel activities for seismic surveys conducted under the CSEP will not overlap these smaller area fisheries by more than 25% of the *Regulated Fishing Season*[2] *per* calendar year throughout the 5 year duration of the CSEP validity. Duration calculation relates to seismic survey vessel time spent within the permitted regularly fished fishing grounds of each of these two fisheries. f. The *Active Source Area*[2] of any 3D or 4D seismic surveys conducted under the CSEP will not overlap other previously acquired 3D seismic survey *Active Source Areas*[2] within the same *Regulated Fishing Season*[2] of any surveys conducted under the CSEP. This control includes 4D reservoir monitoring surveys, alternate azimuth surveys over previously acquired 3D surveys and partially overlapping, multi-phase 3D surveys, whether by the same or an alternate petroleum title holder. A 3D multi-azimuth (MAZ) survey acquired in a single acquisition phase is not subject to this control but will have other Environment Plan controls to avoid potential short term cumulative impacts. g. Total combined 2D seismic surveys conducted under the CSEP within the CSEP *Operations Area*[2] will not exceed 50,000 survey line km per calendar year. This control is for all 2D seismic surveys conducted under the CSEP and could be utilised, for example, for a single, large scale regional 2D survey, or several smaller surveys conducted in a single year. h. Any 2D survey lines that overlap, or partially overlap, a 3D *Active Source Area*[2] that has been surveyed within the previous 12 months will be acquired at a grid line spacing of not less than 10 km. This control measure will reduce potential cumulative impacts and minimise 2D survey vessel presence in a previously 3D surveyed area.

- [1] *Refer to Definitions section on page 2 of this document.*
- [2] *Reference "TGS Capreolus-2 3D MSS Environment Plan" March 2020, NOPSEMA public comment portal.*

	NOTES: I. None of the seismic survey size, location or time limiting controls listed within this commitment are to be considered in isolation. (i.e. No single control can be used to override any or all other controls detailed within the commitment). II. Any planned seismic survey that may result in a deviation from these spatial or temporal commitments will require further consultation with potentially affected commercial fishers. The results of this further consultation will determine whether there is a mutually agreeable compromise position to allow for a commitment deviation to occur. III. CSEP consortium members and the future appointed CSEP governance body will regularly monitor seismic survey planning and execution under the CSEP, including proposed locations, timing and completed survey totals, to avoid breaching any control detailed within this protocol.

Appendix A ***Standard Format Notification of Intent to Conduct A Seismic Survey***

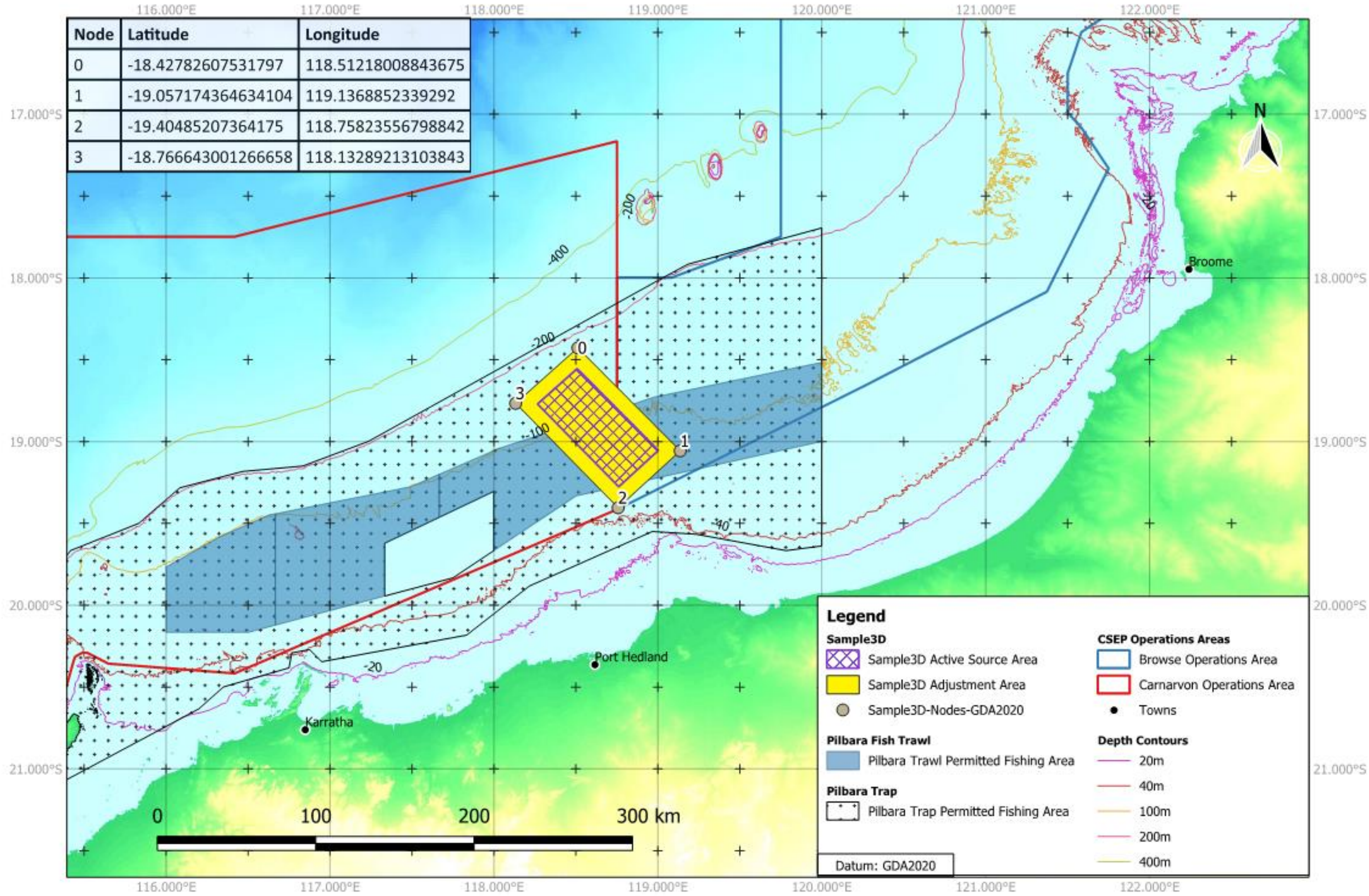
Survey Name			
Survey Title Holder			
Title Holder Contact Details			
Survey Vessel Name			
Survey Vessel Operator			
Survey Vessel Operator Contact Details			
Survey Type			
Size - km^2 (3D/4D) or line km (2D)			
Estimated Start Date			
Estimated Completion Date			
Total Duration			
Survey Adjustment Area Coordinates Datum: GDA2020 UTM Zone 51	Node #	Latitude (S) / Y	Longitude (E) / X
Water Depth (min/max) - m			
Notes/Comments			

Appendix B ***Standard Notification of Intent Mapping Requirements***

- Location of the survey Adjustment Area
- Grid lines in a 1-degree grid annotated in lat/long
- Bathymetric contours in 20-40 m intervals for depths <100m
- Bathymetric contours in 100 m intervals for depths >100m
- Managed fishery boundaries for the specific stakeholder's interests
- Referenced data sources
- 10x 10 nmi Reporting Grid References (Either WA or NT, as applicable)

Example:

Figure 2 *Sample 3D Seismic Survey Notification Map*



Appendix C ***Navigation Chart Plotter and GIS Data Required Format***

- KML and GPX vector files, or other suitable format data file used by modern Electronic Charting System (ECS) plotters or Electronic Chart Display and Information Systems (ECDIS), in either WGS84 or GDA2020, including the proposed Adjustment Area for 3D surveys or all pre-planned survey lines for 2D surveys.
- Data will be provided either via email attachment, a download link in the notification email(s) via a suitable Internet file transfer method (e.g. Dropbox or company FTP) or, on written request from a commercial fisher, via USB memory card sent through Australia Post.

Appendix D: Commercial Fishing Adjustment Protocol

NATIONAL ENERGY RESOURCES AUSTRALIA

COLLABORATIVE SEISMIC ENVIRONMENT PLAN PROJECT

COMMERCIAL FISHING INDUSTRY ADJUSTMENT PROTOCOL

Loss of catch – Displacement – Fishing gear loss or damage

Revision	Date	Purpose
A	May 2020	Engagement with WAFIC/NTSC/CFA
B	August 2020	Broader commercial fishing industry consultation
C5	February 2021	Round 2 commercial fishing industry consultation
1	May 2021	Final published document

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1. Commercial Fishing Industry Adjustment Protocol Overview

1.1. Purpose

This protocol establishes a baseline standard to underpin seismic survey adjustment for loss of catch, displacement and fishing gear loss or damage, between the oil and gas and commercial fishing industries.

The purpose of this protocol is to provide a practical, evidence-based process and reasonable monetary adjustment to a commercial fisher for loss of catch, displacement, and fishing gear loss or damage. Adjustment is available during a seismic survey and as appropriate, for a period after a seismic survey conducted under an Environment Plan (EP) that references and is therefore subject to this protocol.

1.2. Background

In 2018, National Energy Resources Australia (NERA), established the Collaborative Seismic Environment Plan (CSEP) Project, including an industry consortium, to seek approval from the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for seismic survey activities in an area in Commonwealth waters off Western Australia (WA) and the Northern Territory (NT) from 2021 and beyond. The CSEP Project is aimed at achieving fundamental and long-term improvements to the way that seismic activities are planned with consideration for commercial fishing activities.

NERA is an Industry Growth Centre funded by the Australian Government, tasked with the transformation of Australia's energy sector through innovation, collaboration, and efficiency. NERA is the facilitator of the CSEP Project and does not conduct petroleum activity.

1.3. Commitment

CSEP Project consortium members (refer **Appendix 1**) commit to minimising potential impacts on commercial fishing and the fish stocks that support the industry primarily through avoidance of fishing activities. However, consortium members recognise that their activities may, from time-to-time, take place in the same area and at the same time as commercial fishing. Minimising interference with each other's rights and interests is also reflected in primary petroleum and fishing legislation[1].

Best endeavours will be made to avoid, minimise and mitigate potential impacts on the commercial fishing industry before the adjustment processes contained in this protocol are applied.

1.4. Scope

This protocol covers a commercial fisher (refer definition) who fishes as a normal part of their commercial fishing activity within an Adjustment Area (refer definition) during and/or for a specified period after, a seismic survey conducted under an EP that references and is

[1] For relevant statutory information refer to section 280 *Offshore Petroleum and Greenhouse Gas Storage Act 2006*, section 124 *Petroleum (Submerged Lands) Act 1982* (WA), section 124 *Petroleum (Submerged Lands) Act 1981* (NT), and section 171 *Fish Resources Management Act 1994*.

therefore subject to this protocol. Adjustment is also available for fishing outside of an Adjustment Area in circumstances where a commercial fisher is unable to, or chooses not to, continue fishing within an Adjustment Area.

1.5. Consultation

This protocol has been developed by the CSEP Project Steering Committee in consultation with State, Territory and Commonwealth commercial fishing licence holders in fisheries that are active within the CSEP Project proposed operational area. Consultation has also included:

- Western Australian Fishing Industry Council (WAFIC)
- Northern Territory Seafood Council (NTSC),
- Commonwealth Fisheries Association (CFA),
- Seafood Industry Australia deferred involvement in the CSEP project to WAFIC,
- Department of Primary Industry and Regional Development (DPIRD) (WA),
- Fisheries Division in the Department of Industry, Tourism and Trade (NT),
- Australian Fisheries Management Authority,
- Department of Industry, Science, Energy and Resources,
- Australian Petroleum Production & Exploration Association (APPEA) and
- International Association of Geophysical Contractors (IAGC).

1.6. Definitions

- **Adjustment Area** – An area extending 10 kilometres[2] around the perimeter of a 3D or 4D seismic survey active source area (refer **Appendix 6** for explanatory diagram). ***NOTE****: Spatial parameters of an Adjustment Area for a 2D survey will require case-by-case specification due to the differing survey layout.*
- **Acquisition Area** - The primary target area for a seismic survey in which seismic data will be recorded.
- **Active Source Area** - An area including and around the Acquisition Area in which the seismic energy source (airgun array) can be active. This includes survey line run-ins and run-outs.
- **Catch Per Unit of Effort (CPUE)** - For the purposes of this protocol the catch will be defined in kilograms of landed catch and the unit of effort will be defined in hours (decimal hours where available) fished for trawl, hours fished or kilometres of line set or number of hooks per kilometre for line fishing, or number of trap lifts, resulting in the landed catch e.g. CPUE=kilograms per (trawl/line) hour or trap lift.
- **Commercial fisher** – for the purpose of this protocol, a commercial fisher is the entity, person, licence holder, company or affected business who would have received the revenue from the landed catch that is the subject of a claim under this protocol, or who can show they have incurred the cost of lost or damaged fishing gear or displacement.
- **Fishing gear** - Fishing equipment deployed in the water by a vessel engaged in commercial fishing activity.

[2] 10 kilometres is proposed as a reasonable distance around the Active Source Area and consistent with existing industry standards.

- **Landed catch** - The whole landed weight as detailed in Government catch and effort information provided for the purpose of this protocol, or as recorded in statutory Catch and Disposal Records. Fish that is processed in any way before landing, for example gutted and gilled or headed, should be converted back to whole weight for the purpose of this protocol.
- **Market price**[3] – The price received by a commercial fisher at the point of first landing, excluding any price margins for marketing, transport, sales commissions, value adding or packaging. In respect to a claim under this protocol. The market price should reflect the price at the time the loss of catch was incurred by the claimant.
- **Statistical fishing block** - Government statistical grid/block numbering system used to record commercial fishing activity data and referred to in this protocol as a block.
- **Titleholder** – The Titleholder is the registered holder of the Access Authority, Special Prospecting Authority, Exploration Permit, Retention Lease or Petroleum Production Licence over which the seismic survey will be acquired, as detailed in the environment plan for the seismic survey subject to this protocol.
- **Historical fishing activity, block** - A statistical fishing block, or fishing event location (latitude/longitude) plotted within the 10x10nm grid system, with fishing activity detailed in Government catch and effort information or as recorded in a statutory Catch and Disposal Record for at least two out of the previous five years prior to a relevant seismic survey conducted under this protocol.

1.7. Operation of the protocol

Notification of the establishment of an Adjustment Area will be provided to relevant commercial fishing licence holders in writing no less than 28 days before a seismic survey starts. Notification is to be provided in the form of a map plus digital files in formats such as KML, GPX or shapefiles (also refer to CSEP Commercial Fishing Operational Protocol).

Fishers (the fishing vessel/licence) must have established previous fishing history, at a minimum of two out of the previous five years, for all block(s) or fishing event(s) for which they wish to make a claim for loss of catch or displacement adjustment under this protocol.

To receive adjustment under this protocol, a commercial fisher must be able to show that they would have received the revenue from the landed catch that is the subject of a claim or show that they have incurred the cost of lost or damaged fishing gear.

Adjustment under this protocol is dependent on a commercial fisher continuing to carry out their fishing activities to the best of their ability and to mitigate and limit financial loss despite the occurrence of a seismic survey. Adjustment is not available where a fisher chooses to move away from a survey and makes no attempt to fish within the survey Adjustment Area.

Note that this protocol will be documented in the EP developed by the CSEP project as a control measure to manage potential impacts to commercial fishing licence holders and will therefore be subject to inspection under NOPSEMA's environmental inspection program.

[3] Note Western Australian Fishing Industry Council Report *Final Report of GVP – Beach Price Reference Group. Finfish and Crabs. 8 May 2015.*

2. Commercial Fishing Adjustment Available Under This Protocol

2.1. Loss of catch adjustment

Evidence-based loss of catch adjustment under this protocol relates to fish lawfully caught and retained by a fishing vessel under a Western Australian, Northern Territory or Commonwealth fishing licence. The adjustment process applies to historical fishing activity over established fishing grounds, and not to speculative fishing activity.

The loss of catch adjustment process applies to commercial fishing activity conducted by a licensed fishing vessel within an Adjustment Area, and other fished areas during a month. For each month where adjustment is claimed, the licensed fishing vessel must conduct fishing within an Adjustment Area, unless a fishing trip spans two months where each month will be considered to have satisfied this requirement.

Loss of catch adjustment is available for the period of a survey and for six months after a survey is completed[4]. This adjustment process assumes that any loss of catch experienced will be evident in a reduced CPUE for that fishing vessel (or license if subject to boat replacement) compared to previous years for the same eligible claim block/fishing event location by species by month.

Loss of catch assessments will be conducted using the seismic survey period catch and effort data per month plus the previous 10 years (by same block/fishing event location & month) where available.

2.1.1. Method of assessing loss of catch adjustment

Treatment of catch and effort data to determine eligible fishing events to be included in the adjustment assessment process

As detailed in this protocol, adjustment is available for fishing activity where it can be shown there is a minimum of 2 out of the prior 5 years where fishing activity has taken place in the same block or fishing event location that is the subject of a claim. This requirement applies to the Adjustment Area and for any other block/fishing event location/area for which adjustment is being claimed.

The first step in conducting a loss of catch adjustment assessment will be to determine which fishing activity is eligible for adjustment under this protocol.

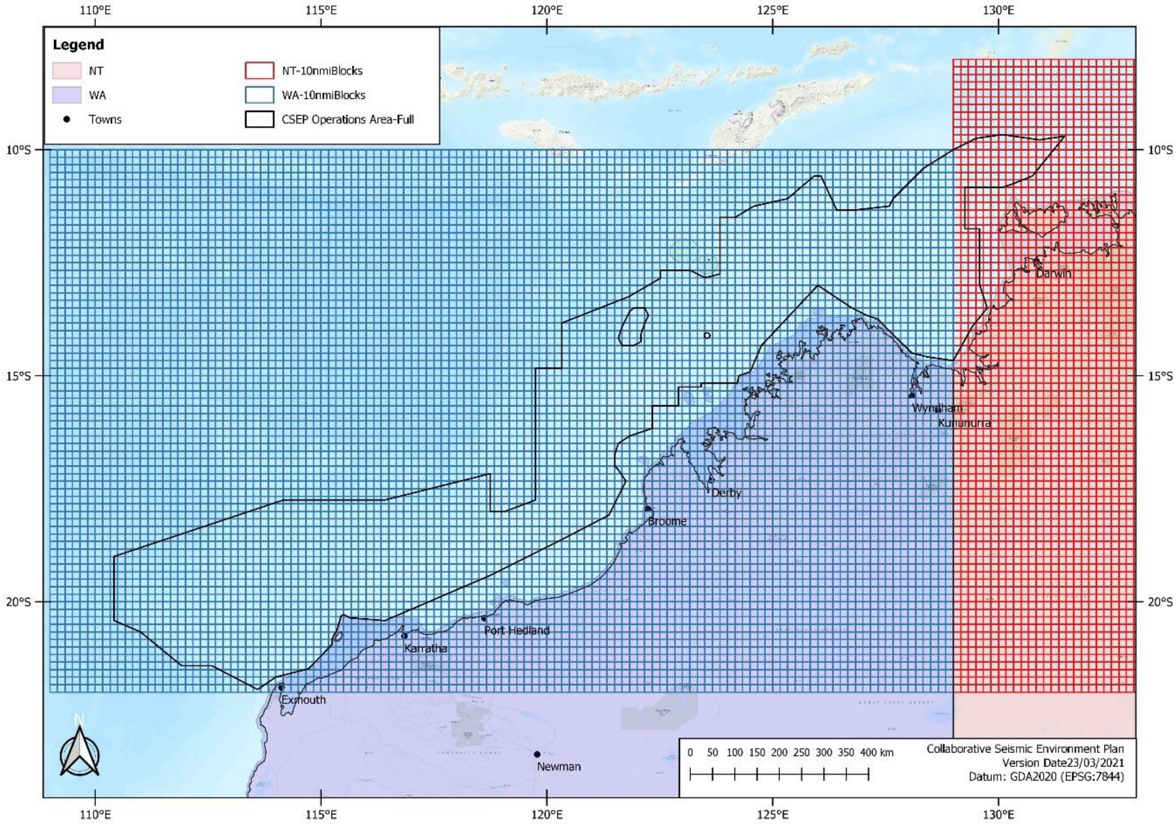
Where catch and effort data is provided in 10x10nm statistical grid format, the same block by month will be checked for the 5 years preceding the survey year to ascertain the minimum requirement of a minimum of 2 years fishing activity within the previous 5 years. Where catch and effort data is provided in larger than 10x10nm statistical grid format, applicants may be asked for additional positional information for blocks that partially overlap the Adjustment Area, or are outside of the Adjustment Area, to assess the minimum fishing history requirement.

Where catch and effort data is provided by the location of each fishing event by latitude and longitude coordinates the existing WA and NT 10x10nm statistical grid system will be used to assess the minimum fishing history requirement. The start point of each fishing event will

[4] Temporal parameters for a 2D survey will be considered on a case-by-case basis.

plotted within the 10nm grid system to aid the assessment of previous fishing history by allocating each event to a 10nm block to determine fishing events eligible to be included in the adjustment assessment process. Note that assessors have the flexibility to make judgements that will enhance the statistical accuracy of an assessment and/or provide balanced practical assessment outcomes.

The WA and NT 10x10nm grid system is illustrated below. The two grid systems align and cover the CSEP Operational Area. Claims in blocks west of 129° East longitude will use the WA grid and East of 129° will use the NT grid. Claims overlapping 129° East can use either grid.



Map showing WA and NT fishing activity reporting grid systems

2.1.2. Calculating an average CPUE

Catch and effort history covering the prior 10 years is required to provide an average CPUE value that is subject to minimal influence from fish stock recruitment and environmental fluctuations.

CPUE will be defined in kilograms of landed catch and the unit of effort will be defined in hours (decimal hours where available) fished for trawl, hours fished, or kilometres of line set or number of hooks per kilometre for line fishing or number of trap lifts, resulting in the landed catch, for example CPUE=kilograms per trawl/line hour or trap lift. Average CPUE will be based on the mean catch and effort values of all eligible fishing events per claim month.

It is recognised that in some cases 10 years of catch history data may not be available and where this occurs an assessor should determine an appropriate historical average CPUE based on the information available in the application and any other information that an assessor deems appropriate.

The use of 10 years prior catch history and the intention of this protocol is that assessments are conducted based on the available catch and effort information. However, an assessor may also consider significant catch trends within a fishery and/or management changes if they are thought to materially affect resulting catch rates or landed catch volumes.

2.1.3. Loss of catch adjustment assessment method

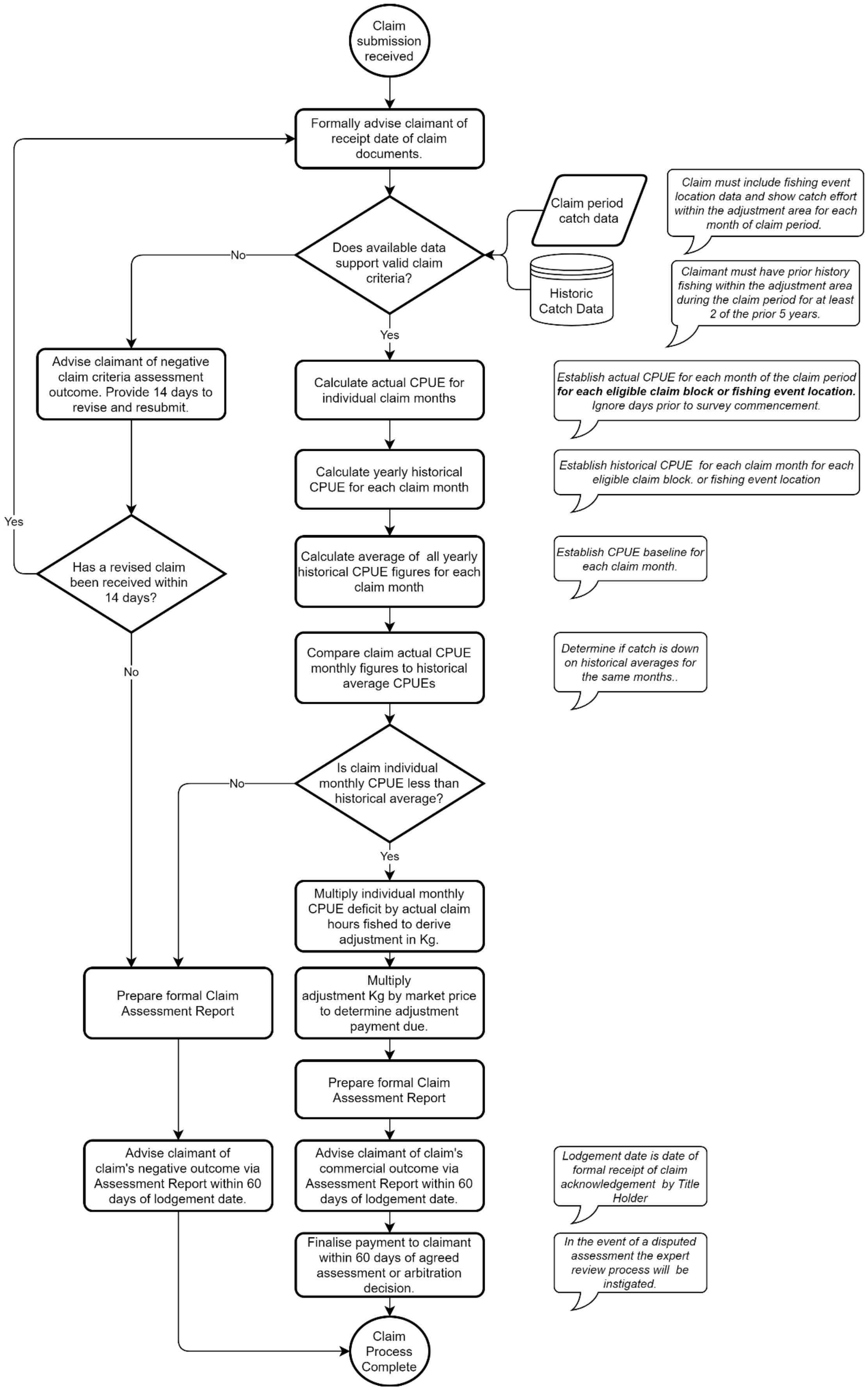
1. Claim month must contain fishing activity within the Adjustment Area, unless a fishing trip spans two consecutive months, where it will be considered that this requirement has been met for both months.
2. Claimant must have historical fishing activity (refer definition) for each block or fishing event location subject to a claim.
3. Yearly historical average CPUEs (up to 10 years) will be calculated for all eligible fishing events fished in the claim month, by species, and then averaged to provide a baseline historical average CPUE for the claim month.
4. The claim month actual average CPUE will be calculated for eligible fishing events by species by month.
5. The actual average CPUE will be compared to the historical average CPUE for the same block/fishing events and month and adjustment will be established where there is a shortfall.
6. The shortfall in CPUE will be multiplied by the unit of effort (hours, kilometers of line set/number of hooks per kilometer, number of trap lifts) fished for that claim month, and then the species market price, to provide the amount of monetary adjustment due for that month.
7. Adjustment may be calculated per individual species or combined as appropriate.

2.1.4. Adjustment method loss of catch adjustment calculation example

Claim month April 2020	Species narrow barred mackerel. Troll hours fished 100. Market price $17 per kg. Total catch 8,200kgs.
Claimant has historical fishing activity within Adjustment Area prior to April 2020	Condition met
Claimant fished in Adjustment Area during April 2020	Condition met
April historical baseline CPUE	100 kgs per hour
April 2020 CPUE	82 kgs per hour
Shortfall in CPUE	18 kgs per hour
Shortfall multiplied by 100 hours fished in April 2020	1,800 kgs
1,800 kgs multiplied by market price of $17 per kg	$30,600
Monetary adjustment due for April 2020	$30,600

The full loss of catch assessment process is detailed in the flow chart on the following page.

2.1.5. Loss of catch assessment flow chart



2.1.6. Exceptions to loss of catch assessment method information requirements.

1. Where a fisher is unable to provide 10 years prior catch and effort data due to Government confidentiality requirements or other reason, an assessment may still be conducted subject to the claim assessor being satisfied that an accurate assessment can still be conducted using the volume of data available.
2. If requested by the claimant, an assessment may be conducted using a fisher's own catch and effort data where a claim assessor forms the view that the data is consistent with Government data accuracy and formatting and that the data is suitable to conduct an accurate assessment.

The loss of catch adjustment process under this protocol does not cover circumstances where there may be discussions and/or agreement reached between a seismic survey title holder and a commercial fisher prior to a survey taking place, that it is not appropriate for fishing to occur within the area of a seismic survey. Likewise, if a commercial fisher feels that they will be disadvantaged by a seismic survey due to alternative suitable fishing grounds not being available to them during the seismic survey, then they should engage with the titleholder ahead of a survey commencing.

A commercial fisher wishing to lodge a claim for adjustment should notify the survey titleholder of their intention to lodge a claim as soon as possible after the conclusion of a seismic survey and a claim may be lodged up to 12 months after the conclusion of the seismic survey.

2.2. Displacement

In addition to the loss of catch adjustment provisions outlined above, if a commercial fisher is unable to fish in their historical fishing area (refer definition) within an Adjustment Area during a seismic survey and incurs costs over and above the normal running costs for a fishing trip while relocating to another historical fishing area, then costs associated with increased distance/transit time, fuel and crewing will be considered under this protocol for monetary adjustment. For displacement, an alternative fishing ground must be within 50 kilometres of the Adjustment Area.

Displacement will be assessed based on a comparison of the above-mentioned running costs per day at sea against the previous yearly average.

NOTE: The CSEP project team is investigating the development of an alternative displacement method using a default nautical mile rate adjustment payment for additional miles covered in a month compared to same month in previous years. The default rate could be set for individual fisheries and/or classes of vessels. This alternate method may be introduced as the default displacement process when available and then included in future revisions to this protocol.

A commercial fisher who decides it is necessary to relocate to another fishing ground because of a seismic survey subject to this protocol and wants to be considered for displacement adjustment must notify the titleholder of the seismic survey, where possible, prior to undertaking the relocation. Evidence must also be provided to substantiate fishing gear in use at the claim time.

A claim for displacement must be made within 6 months of the conclusion of a seismic survey.

2.3. Fishing gear loss or damage

A commercial fisher may lodge a claim in accordance with this protocol if they experience accidental loss or damage of deployed fishing gear from physical contact with a seismic survey vessel and/or its in-water equipment or supporting vessels during a seismic survey subject to this protocol.

Through pre-survey notifications and communications, titleholders and commercial fishers should have an awareness of survey and fishing activities and make all reasonable efforts to avoid direct interaction and fishing gear loss or damage. It should be noted that seismic survey vessels carrying out seismic acquisition are limited in their manoeuvrability.

If fishing gear loss or damage occurs, the commercial fisher should immediately notify the titleholder.

When lodging a claim, the claimant should clearly document when, where and how the gear damage or loss occurred and where possible, the name and details of vessel(s) involved in the incident. A claim should include a quote (two where possible) with costs associated with repairing or replacing the lost or damaged fishing gear.

As a result of assessing the claim, by mutual agreement with the claimant, the titleholder may offer to cover the cost of repairing or replacing the damaged fishing gear or providing like-for-like replacement equipment.

In association with a claim for fishing gear loss or damage, the value of any foregone catch from the lost or damaged fishing gear for the duration of that fishing trip may also be included. Adjustment for foregone catch shall be based on the average CPUE for the month that the lost or damaged fishing gear incident took place. If insufficient information is available for that month, then the same month in the previous year can be used. Claims for forgone catch may only be based on the proportionate loss of catch resulting from the lost or damaged fishing gear for the period of the fishing trip where the loss was suffered.

In the event a claim for forgone catch has been submitted, the titleholder may (at their sole expense) enlist the services of an independent person or organisation to assess the claim. If agreement cannot be reached between the claimant and titleholder then refer to the independent expert review provisions in the *How long will it take to deal with my claim and independent expert review process* section of this protocol.

A claim for fishing gear loss or damage must be lodged within 6 months of the conclusion of the survey.

3. Claim Information and Assessment Process

A titleholder conducting a seismic survey in accordance with an EP subject to this protocol will provide a contact point to relevant commercial fishers relating to lodging a claim or notification regarding loss of catch, displacement, or fishing gear loss or damage. Contact information will also be provided to WAFIC, NTSC and CFA as the respective peak commercial fishing industry bodies.

All information provided in an application under this protocol must be kept confidential by the titleholder, an assessor or expert reviewer of a claim and any other person who has access to the information.

Provided a claimant can demonstrate the required previous fishing history within an Adjustment Area, if all the remaining information requirements set out in this protocol are not available to a claimant, then such claims will be considered on a case-by-case basis.

An option for applicants lodging a claim is to authorise an assessor to access the relevant fishing catch and effort information directly with the appropriate Government Department. Alternatively, applicants may provide the required Government catch and effort information with their claim application.

Applicants will receive confirmation of a claim being lodged with the titleholder. If an assessor forms the view that the information lodged with a claim is not sufficient to conduct a meaningful assessment or support the application, then the claimant will be advised in writing and given 14 days to respond to the assessor. If no response is received within 14 days, then the assessment will be completed, and the claimant advised of the outcome.

Claims will be assessed by separate monthly fishing activity, with each month assessment outcome not influencing or impacting on another month assessment outcome. This protocol outlines the adjustment processes in a manner to provide consistent assessments over time. However, assessors have the flexibility to make judgements that will enhance the statistical accuracy of an assessment and/or provide balanced practical assessment outcomes.

For fully documented applications that meet the Adjustment Area historical fishing activity requirement, whether successful or not, clerical costs relating to preparing, submitting, and engaging in the adjustment process under this protocol, up to a value of $2,000 per claim, will be reimbursed by the survey titleholder as part of the claim process. A statement outlining time and resource costs to support an amount up to $2000 should be included with an application. Clerical costs that exceed $2,000 may also be included with a claim and reimbursed under this protocol if evidenced by documentation.

3.1. Who can lodge a claim and when?

A commercial fisher (refer definition) who suffers a loss of catch, displacement or gear loss or damage whilst operating in and around a seismic survey Adjustment Area, subject to this protocol can lodge an adjustment claim.

A person so authorised may lodge a claim on behalf of a commercial fisher. Claims may be lodged by a person, company, or association on behalf of more than one commercial fisher, provided that the required individual catch history is provided and there is evidence of the authority to lodge the claim on behalf of others.

A loss of catch claim can be submitted up to 12 months after the conclusion of a seismic survey.

3.2. What information do I need to lodge a claim?

Claimants will need to be able to identify the relevant vessel and licence(s) that are involved in the claim, and to provide evidence of the entity that would have received the revenue that is the subject of a loss of catch claim. A key information requirement when lodging a loss of catch claim will be to either authorise access to the relevant Government catch and effort data or provide the catch and effort data with the application.

Full details on the information required to be lodged with a claim are contained in the application forms at **Appendix 2- Loss of catch, Appendix 3- Displacement and Appendix 4 – Fishing gear loss or damage.**

Each claim should relate to only one seismic survey and associated titleholder.

3.3. Who will assess my claim and what information will be in the report?

Subject to a claim being lodged, the titleholder of a seismic survey (at their expense) in consultation with the claimant, will engage a suitably experienced/qualified independent person or organisation as the assessor of the claim.

The titleholder is to provide the assessor with a letter of instruction/project brief, which is to be provided to the claimant as part of the assessment report.

An assessment report prepared by an assessor should include the following information:

- a copy of the letter of instruction/project brief received by an assessor when engaged to carry out the independent assessment,
- confirmation (or otherwise) that the information provided in the claim is sufficient to conduct a meaningful assessment,
- a summary of the claim details (survey, applicant, vessel, month(s)),
- for a loss of catch claim, monthly CPUE assessments as outlined in this protocol including an estimation of any loss of catch (in kilograms) and its market price, and
- any other information, comments, or views relevant to the assessment that the assessor may wish to include.

Upon receiving and considering the assessment report, the titleholder will provide a copy of the report to the claimant and offer to meet with the claimant to discuss/address the claim.

3.4. How long will it take to deal with my claim?

An appropriately documented claim (including relevant catch and effort information) should be assessed, and a report provided to the claimant, within 60 days of the lodgement date of the claim. If an assessor is authorised to access catch and effort data, then the 60 day time period begins upon receipt of the necessary catch and effort data. If an appropriately documented claim report cannot be made available to the claimant within 60 days of a claim being lodged or receipt of catch and effort information as appropriate, and no mutual agreement to extend the time-period has been entered into, then the titleholder (at their expense) in consultation with the claimant, shall appoint a suitably experienced/qualified independent person or organisation to provide an expert review of the claim.

Included as part of the settlement of each claim, will be a binding agreement that summarises the claim outcomes and an agreement by the claimant that acceptance of the settlement negates any further claims for the same species and month(s) of that seismic survey.

3.5. Independent expert review of a claim

If a claimant disagrees with a claim assessment outcome and cannot reach agreement with the titleholder, they may opt to go to an independent expert review (funded by the titleholder of the survey).

If a claim is subject to independent expert review, then as part of that process, both the claimant and the titleholder shall be given the opportunity to address the assessor to state their position, prior to an independent expert review decision being reached.

An independent expert reviewer must provide a view as to whether the claim assessment process has been conducted in line with the requirements of the protocol. The independent expert reviewer may also consider any additional information deemed appropriate by him or herself, including information provided by either the claimant or the titleholder. An independent expert review decision is binding on the claimant and the titleholder and may differ from the initial assessment report.

A timeline diagram setting out the relevant time frames under this protocol can be found at **Appendix 5**.

3.6. How long will it take for me to be paid adjustment?

Once a claimant and titleholder agree with a claim outcome, or an expert reviewer has issued a report, the titleholder will provide monetary adjustment to the claimant within 60 days.

4. Protocol Review and Maintenance

This protocol will remain in force for the validity period of an accepted EP resulting from the NERA CSEP project, anticipated to be a five-year term from date of acceptance by NOPSEMA. The protocol will be subject to review and update by the CSEP Project Steering Committee at least once in each 12-month period during the validity period of the EP. Changes will be considered in consultation with WAFIC, NTSC and CFA (and their stakeholders as appropriate) and subject to agreement by the CSEP Project Steering Committee.

Appendix 1: CSEP Project Consortium Members (as at March 2021)

National Energy Resources Australia (NERA)

BGP (Exploiter Pte Ltd)

CGG Services (Australia) Pty Ltd

ConocoPhillips Australia Pty Ltd

Ion Energy (GX Technology Australia Pty Ltd)

IPB Petroleum Limited

Inpex Operations Australia Pty Ltd

Petroleum Geo-Services (PGS) Australia Pty Ltd

Santos Limited

Searcher Seismic Pty Ltd

Shell Australia Pty Ltd

TGS-NOPEC Geophysical Company Pty Ltd

Appendix 2: Loss of Catch Application Form

National Energy Resources Australia - Collaborative Environment Plan Project

Commercial Fishing Industry Adjustment Protocol - Application Form for Loss of Catch claim

Application Form - Commercial Fishing Adjustment Protocol - Loss of Catch	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statement	Yes or No
I wish to authorise direct access to my catch and effort history relevant to this application.	Yes/No (If yes then authorisation holder to sign here)
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	
Claim details	
Months for which loss of catch adjustment is being claimed	

Application Form - Commercial Fishing Adjustment Protocol - Loss of Catch	
Market price information – please include documentary evidence of price received from normal buyer/processor for catch relevant to loss of catch claim.	
Catch and effort information for blocks/area by month by species for which loss of catch is being claimed plus previous 10 years. If 10 years Government catch history is not available and/or or you wish to provide your own validated catch history, please indicate here.	Indicate whether Government or own catch and effort data is being provided and number of previous years of data available.
NOTE: If any information is not available from Government and fishers own catch data is being submitted, then copies of the relevant statutory catch and effort fishing returns should be submitted with the claim.	
Catch and effort information should be provided in the form of: • Vessel • Year • Month • Fishery • Blocks fished provided at the highest (e.g., 10x10nm) available block resolution, or fishing event locations (by latitude and longitude). • Block days including fishing events in identified area/blocks per month. • Fishing hours (in decimal hours) showing the duration of each fishing event at highest available block/fishing event resolution. • Whole weight calculated based on the reported landed weight and listing the relevant conversion factor(s) if applicable.	
Other relevant information may be submitted with a claim and will be assessed on a case by case basis. Questions regarding the claim process may be directed to a person nominated by the titleholder.	
Please list the documents provided with your application	
1.	
2.	
3.	
4.	

Appendix 3: Displacement Application Form

National Energy Resources Australia - Collaborative Seismic Environment Plan Project

Commercial Fishing Industry Adjustment Protocol - Application Form for Displacement claim

Application Form - Commercial Fishing Adjustment Protocol - Displacement	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statement	Yes or No
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	
Claim details	
Evidence of the additional distance, fuel and crew costs incurred by the relocation of the fishing operation.	Attach receipts/evidence of costs for claim month. Include vessel track data.
Evidence of previous year daily (at sea) average distance, fuel and crew costs	Attach receipts/evidence of costs for previous year.

Application Form - Commercial Fishing Adjustment Protocol - Displacement
Include five years catch data preceding the year of the claim in the following form: • Vessel • Year • Month • Fishery • Fishing event location/blocks fished provided at the highest available block resolution. • Whole weight calculated based on the reported landed weight and listing any relevant conversion factor(s). Note that 5 years of catch data is required for displacement purposes to show recent fishing history has occurred within an Adjustment Area. If less than 5 years catch data available, then claim assessor should evaluate appropriate method of assessment.
Please list the documents provided with your application
1.
2.
3.
4.

Appendix 4: Fishing Gear Loss Or Damage Application Form

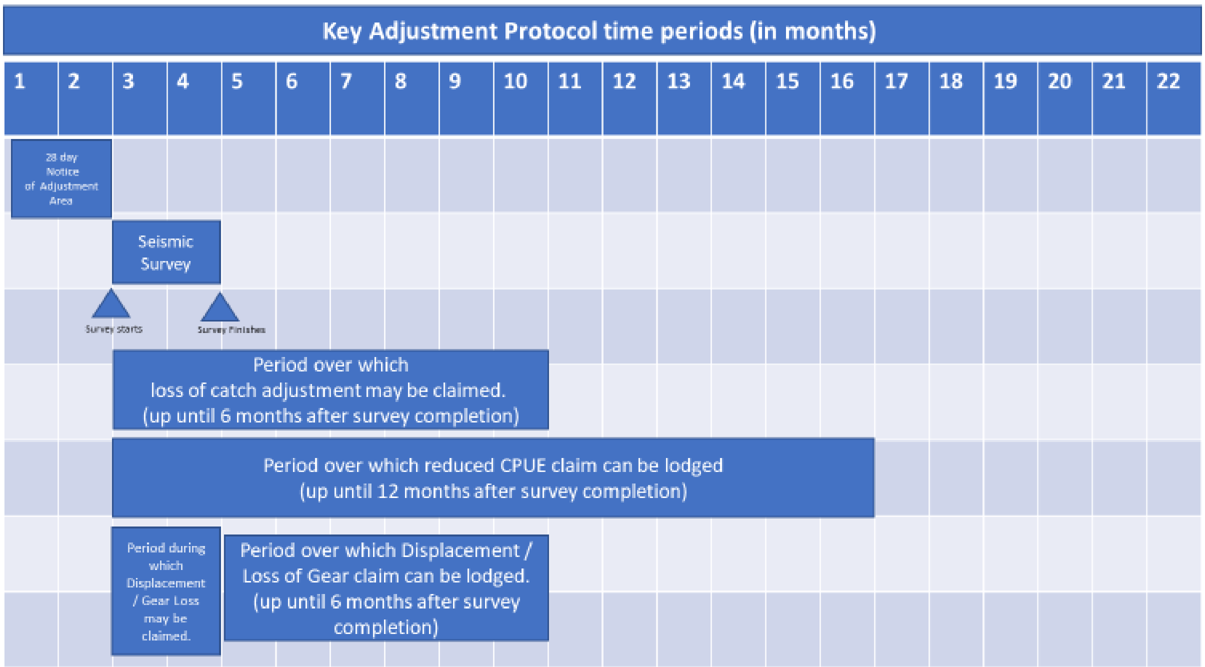
National Energy Resources Australia - Collaborative Seismic Environment Plan Project

Commercial Fishing Industry Adjustment Protocol – Application Form for fishing gear loss or damage claim

Application Form - Commercial Fishing Adjustment Protocol – Fishing gear loss or damage	
Survey Details	
Seismic survey name	
Survey titleholder	
Claimant Details	
Name of person/company making claim	
Address	
Email	
Contact number	
I am the entity that has incurred the costs of the lost or damaged fishing gear that is the subject of this claim. If claiming for loss of catch, I am the entity that would have received the revenue from the catch that is the subject of this claim. Please include evidence of above statements.	Yes or No and supporting information.
I wish to authorise direct access to my catch and effort history relevant to this application.	Yes/No (If yes then authorisation holder to sign here)
Relevant authorisation holder details (if different from claimant)	
Name	
Address	
Email	
Contact number	
Authorisation/licence(s) name and number	

Application Form - Commercial Fishing Adjustment Protocol – Fishing gear loss or damage	
Claim details	
Evidence of notification to the titleholder of the gear loss and/or damage incident.	
Information describing when, where and how the gear damage and/or loss occurred.	
Where possible, the name and details of vessel(s) involved in the incident.	
A claim should include a quote (two where possible) with costs associated with repairing or replacing the lost or damaged fishing gear.	
Estimate of any proportionate loss of catch including market price, plus catch and effort information sufficient to calculate CPUE for claim month or same month in previous year.	
Please list the documents provided with your application	
1.	
2.	
3.	
4.	

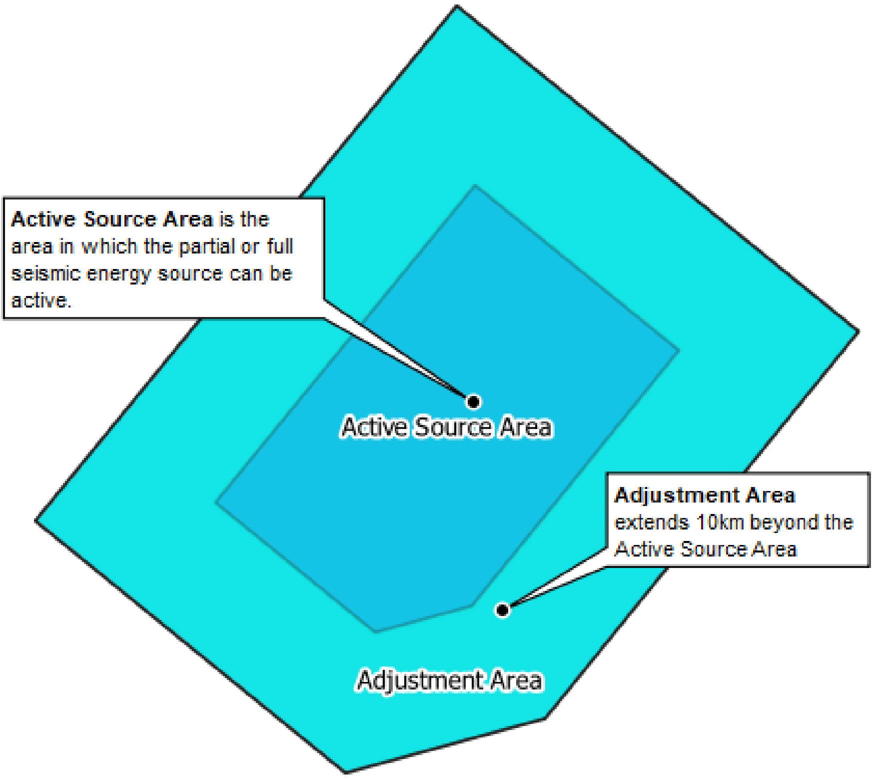
Appendix 5: Adjustment Protocol Timeframes



Timeframes for processing a claim

1. Claims to be finalised within 60 days of being lodged, or receipt of catch and effort information, unless mutual agreement reached between claimant and titleholder to extend time frame.
2. If agreement cannot be reached between the titleholder and claimant within the prescribed times above then the titleholder, in consultation with the claimant, must appoint an independent expert reviewer to decide the claim.
3. Subject to an independent expert review decision, the titleholder shall settle the claim in accordance with the decision within 60 days.

Appendix 6: Diagram Showing Example of An Adjustment Area



Appendix E: CSEP Titleholder's Environment Policy

CGG

Care+Protect

CGG

Environmental & Climate Policy

The health of the environment and climate is critical to the well-being of people and communities globally. In order to best protect the environment, climate and the communities where we globally operate:

- We always act responsibly and abide by all applicable environmental laws;
- We continue to advance our data collection capabilities to best measure, monitor and continuously reduce our impact;
- We commit to improving our power usage efficiency, increasing the low-carbon content of our energy supply, and reducing our Green House Gas (GHG) emissions;
- We continue to advance our technology and services to enable our Clients to best reduce the impact of their activity;
- We encourage and support our businesses, all employees and locations globally to find and take specific actions that support the health of the environment, climate and the communities where we operate.

Paris, January 2020

Sophie ZURQUIYAH
Chief Executive Officer

ConocoPhillips

Health, Safety & Environment Policy

Our Commitment

ConocoPhillips is committed to protecting the health and safety of everybody who plays a part in our operations, lives in the communities in which we operate or uses our products. Wherever we operate, we will conduct our business with respect and care for both the local and global environment and systematically manage risks to drive sustainable business growth. We will not be satisfied until we succeed in eliminating all injuries, occupational illnesses, unsafe practices and incidents of environmental harm from our activities.

Our Plan

To meet our commitment, ConocoPhillips will:

- Demonstrate visible and active leadership that engages employees and services providers, and manage health, safety and environmental (HSE) performance as a line responsibility with clear authorities and accountabilities.
- Ensure that all employees and contractors understand that working safely is a condition of employment, and that they are each responsible for their own safety and the safety of those around them.
- Maintain "stop work" policies that establish the responsibility and authority for all employees and contractors to stop work they believe to be unsafe.
- Manage all projects, products and processes through their life cycles in a way that protects safety and health and minimizes impacts on the environment.
- Provide employees with the capabilities, knowledge and resources necessary to instill personal ownership and motivation to achieve HSE excellence.
- Maintain process, procedures and training to prepare for and respond to emergencies.
- Provide relevant safety and health information to contractors and require them to provide proper training for the safe, environmentally sound performance of their work.
- Measure, audit and publicly report HSE performance and maintain open dialogue with stakeholder groups and with communities where we operate.
- Comply with applicable regulations and laws.
- Work with both governments and stakeholders where we operate to develop regulations and standards that improve the safety and health of people and the environment.
- Maintain a secure work environment to protect ourselves, our contractors and the Company's assets from risks of injury, property loss or damage resulting from hostile acts.
- Communicate our commitment to this policy to our subsidiaries, affiliates, contractors and governments worldwide and seek their support.

Our Expectations

Through implementation of this policy, ConocoPhillips seeks to earn the public's trust and to be recognized as the leader in HSE performance.

IPB

IПB

IPB Petroleum Limited

Health, Safety, Environment and Community Policy

IPB Petroleum Ltd (IPB) is a publicly owned, Australian-based petroleum exploration company focused on exploration in Australian offshore sedimentary basins. The Company is fully aware of its responsibility to conduct all activities with the goal of achieving best practice Health, Safety and Environment (HSE) performance, to ensure that there is no harm to its people (staff, consultants, contractors and other stakeholders) and that any potential environmental impacts are managed to be as low as reasonably practicable.

To achieve this aim, IPB will:

- Comply with all applicable legislation as a minimum standard.
- Apply industry best practice where legislation does not exist.
- Ensure that we have the resources to achieve our HSE commitments.
- Acknowledge that no job is so important or urgent that HSE matters are not given top priority – our people are empowered to stop the job and address the risk if it is not safe to proceed with a task.
- Work with the most qualified and experienced people for a given role.
- Develop an HSE Management System and maintain and continually improve it as we grow to ensure the systematic management of HSE hazards.
- Incorporate HSE issues and training as part of our core business functions.
- Encourage our people to contribute to improvements in HSE performance whenever the opportunity arises.
- Establish HSE targets for our activities, and measure against these, in order to drive continuous improvement.
- Maximise our energy and resource use efficiency in our day-to-day business and project activities.
- Require our contractors to manage HSE issues using systems, standards and procedures accordance with this Policy.
- Communicate openly with all our stakeholders regarding our HSE performance.

As IPB's Managing Director, I am committed to working with our people to ensure that this policy is communicated, understood, accepted and implemented and reviewed and updated in response to the company's growth.

Brendan Brown
Managing Director

Issue Date: 6 February 2014

PGS

HSEQ POLICY

HEALTH AND SAFETY

Our ambition is zero injury to people. We commit to preventing injuries and ill health and to provide safe and healthy working conditions for all.

We shall:

- Act responsibly and be accountable for our actions
- Promote safe behavior and empower our colleagues to lead by example
- Stop any unsafe work and welcome intervention
- Prohibit the possession and consumption of illegal substances and alcohol at worksites
- Promote good health and well-being for all employees

CLIMATE AND ENVIRONMENT

Our goal is zero spill and minimum harm to the environment. We commit to protecting the environment and preventing pollution.

We shall:

- Plan and conduct our work to minimize the impact on marine life, habitats and local communities
- Ensure the responsible use of energy and minimize emission of CO2 and other pollutants
- Minimize waste and ensure safe handling and responsible disposal
- Encourage the development and diffusion of technologies that minimize our environmental impact

SECURITY

Our ambition is zero harm to our personnel and assets as a consequence of criminal or terrorist activity. We commit to proactively monitoring and mitigating security risks.

We shall:

- Continually monitor global security risks
- Assess and mitigate security risks for all operations
- Never operate unless the security risk has been mitigated to an acceptable level
- Promote security awareness among all employees
- Be prepared to professionally and responsibly manage emergency response and crisis situations

QUALITY

Our ambition is to meet or exceed customer expectations with high quality services and zero quality defects. We commit to providing the highest standards to enhance customer satisfaction.

We shall:

- Foster a quality mind-set to ensure a 'right first time approach'
- Promote PGS project methodologies to consistently deliver high quality services.
- Provide relevant training and development in relation to roles and responsibilities
- Seek and act upon customer feedback

Please refer to the **Health & Safety Standard**, **Drug and Alcohol Standard**, **Security Standard** and **Environment Standard** for specific rules and requirements to be applied in PGS.

We shall work in accordance with the principles of the OHSAS 18001, ISO 14001 and ISO 9001 standards and commit to eliminating hazards and reducing HSEQ risks, complying with applicable legal and other requirements, and to continuously improve our management system and performance. We are committed to stopping any unsafe or non-compliant work and welcome intervention to minimize risks to all stakeholders.

Rune Olav Pedersen	Gottfred Langseth	Nathan Oliver	Berit Osnes	Rob Adams
President & CEO	*EVP & CFO*	*EVP Sales & Services*	*EVP New Energy*	*EVP Operations*

HSEQ-GOV 1063

Approved 22 October 2021

Santos

Environment, Health & Safety

Policy

Our Commitment

Santos is committed to being the safest gas company wherever we have a presence and preventing harm to people and the environment

Our Actions

We will:

1. Integrate environment, health and safety management requirements into the way we work
2. Comply with all relevant environmental, health and safety laws and continuously improve our management systems
3. Include environmental, health and safety considerations in business planning, decision making and asset management processes
4. Identify, control and monitor risks that have the potential for harm to people and the environment, so far as is reasonably practicable
5. Report, investigate and learn from our incidents
6. Consult and communicate with, and promote the participation of all workers to maintain a strong environment, health and safety culture
7. Empower our people, regardless of position, to "Stop the Job" when they feel it necessary to prevent harm to themselves, others or the environment
8. Work proactively and collaboratively with our stakeholders and the communities in which we operate
9. Set, measure, review and monitor objectives and targets to demonstrate proactive processes are in place to reduce the risk of harm to people and the environment
10. Report publicly on our environmental, health and safety performance

Governance

The Environment Health Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

Managing Director & CEO

Status: APPROVED

Document Owner:	Jodie Hatherly, General Counsel and VP Legal, Risk and Governance		
Approved by:	The Board	Version:	3

20 August 2019 Page 1 of 1

Searcher

Searcher

ENVIRONMENTAL
Policy Statement

OBJECTIVE

Searcher Seismic Pty Ltd (Searcher) is a company that maintains the protection of the natural environment as an integral and significant component of all its business strategies.

At Searcher we are committed to identifying and managing the risks and impacts of our activities to minimise adverse environmental impacts, applying leading industry standard practices in our approach to environmental stewardship.

APPLICATION

This policy applies to Searcher and all its affiliates and subsidiaries and all personnel working on Searcher controlled workplaces, services and field-based operations.

The meaning of environment includes ecosystems and their constituent parts including: people and communities, natural and physical resources, the qualities and characteristics of locations, places and areas, the heritage value of places, and their social, economic and cultural features.

PRINCIPLES

The Directors and Senior Management are committed to:

- undertaking all operations in an environmentally conscious manner that minimises harm or damage to the natural environment.
- establishing measurable Environmental objectives and targets that promote continual improvement, aimed at prevention of pollution and conservation of energy.
- implementing, communicating and maintaining an integrated Quality, Health, Safety & Environmental management system that is clear, concise and easily understood.
- providing training and awareness to all stakeholders regarding the sensitive environment we operate within and must maintain and protect.
- reviewing our Environment policy and systems at least on an annual basis to ensure they comply and align with any legislative or company structure changes and industry best practice.
- conduct operations in compliance with relevant local environmental regulations, licenses and legislation and to industry best practice
- All Searcher employees, contractors and project partners are responsible for ensuring that the protection of the natural environment is always a major consideration.

O.A.L

Signed: Odd Arne Larsen - Director 23 September 2021

Version: 10.0

Shell

SHELL COMMITMENT AND POLICY ON HEALTH, SECURITY, SAFETY, THE ENVIRONMENT AND SOCIAL PERFORMANCE

COMMITMENT

In Shell we are all committed to:

- Pursue the goal of no harm to people;
- Protect the environment;
- Use material and energy efficiently to provide our products and services;
- Respect our neighbours and contribute to the societies in which we operate;
- Develop energy resources, products and services consistent with these aims;
- Publicly report on our performance;
- Play a leading role in promoting best practice in our industries;
- Manage HSSE & SP matters as any other critical business activity; and
- Promote a culture in which all Shell employees share this commitment.

In this way we aim to have an HSSE & SP performance we can be proud of, to earn the confidence of customers, shareholders and society at large, to be a good neighbour and to contribute to sustainable development.

POLICY

Every Shell Company:

- Has a systematic approach to HSSE & SP management designed to ensure compliance with the law and to achieve continuous performance improvement;
- Sets targets for improvement and measures, appraises and reports performance;
- Requires contractors to manage HSSE & SP in line with this policy;
- Requires joint ventures under its operational control to apply this policy, and uses its influence to promote it in its other ventures;
- Engages effectively with neighbours and impacted communities; and
- Includes HSSE & SP performance in the appraisal of staff and rewards accordingly.

Ben van Beurden
Chief Executive Officer

Tony Nunan
EVP / Country Chair Shell Australia

Originally published in March 1997 and updated by the Executive Committee December 2009.

General Disclaimer: The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate entities. In this Policy the expression "Shell" is sometimes used for convenience where references are made to companies within the Shell group or to the group in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell companies in general or those who work for them. These expressions are also used where no useful purpose is served by identifying specific companies.

TGS

ENVIRONMENTAL POLICY

TGS is committed to protecting the environment in which we live and work, while also conducting our operations in an environmentally sustainable and responsible manner. TGS strives to lead the industry in minimizing the impact of our operations on the environment. TGS is dedicated to the continuous improvement of our environmental programs and standards across all our operations.

We will strive to achieve these commitments by:

- Planning operations to minimize and/or reduce environmental impacts to acceptable levels;
- Incorporating climate risk into TGS' business and operational strategy;
- Monitoring our performance against approved environmental management plans;
- Measuring and reporting direct and indirect Greenhouse Gas Emissions (GHG) generated through seismic operations and across TGS' supply chain;
- Carrying out environmental audits, inspections and site visits of TGS operations;
- Maintaining compliance with applicable laws, regulations and guidance from trade associations;
- Monitoring the environmental performance of our contractors throughout the life cycle of each project;
- Ensuring that our contractors restore all project sites to their original condition;
- Promoting the International Association of Geophysical Contractor's (IAGC) Ghost Net and Marine Debris Removal Initiative (GNI), and contractually requiring that all vessel contractors participate;
- Educating our employees and contractors in TGS' environmental stewardship and sustainability strategies;
- Identifying, developing and implementing alternative energy solutions;
- Publishing our environmental performance in the annual Corporate Social Responsibility report;
- Periodically reviewing this policy and related plans to ensure ongoing suitability and effectiveness.

Our environmental efforts will be based on the implementation of the following key global strategies:

- Conducting environmental risk assessments of our operations and assessing our impact on the environment;
- Minimization and reduction of waste generated by design and purchase;
- Adoption of reduce, re-use and recycle programs where efficiencies can be found;
- Where hazardous chemicals, materials or products are used, adopt substitution techniques aimed at reducing or eliminating the handling, use and storage of such items;
- Minimization of carbon emissions by survey design and minimization of technical and non-technical downtime;
- Guarding against accidental and operational pollution;
- Development of emergency response plans for environmental incidents;
- Implementing applicable UN Global Compact Sustainable Development Goals (SDG's), including SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption & Production), SDG 13 (Climate Action), SDG 14 (Life Below Water) and SDG 15 (Life on Land).

This policy is applicable across all of TGS' operations. We shall take steps to encourage our non-operated business partners to apply this policy or an equivalent policy. We expect our contractors, vendors, suppliers and consultants to adhere to this policy when providing services to, or acting on behalf of, TGS.

Kristian Johansen
Chief Executive Officer – TGS
November 2nd, 2021

Appendix F: Pre-survey CSEP Review Form

This form is required to be complete by the CSEP titleholder who is proposing to conduct a seismic survey under the Collaborative Seismic Environment Plan (CSEP) to ensure that the survey meets the requirement of the CSEP.

Part 1 is to be completed by the titleholder and submitted to the CSEP Consortium Steering Committee who will review the information to determine if the proposed survey is within the CSEP requires and can proceed under the CSEP.

This form is required to be submitted and approved prior to the titleholder providing a "notice of intent" to stakeholders. The CSEP Consortium Steering Committee will provide a result of their review within 10 business days of receiving all accurate information on this form.

Part 1: Titleholder to complete

As part of the submission the following is required:

- Map showing operational area and acquisition area. Definitions of these areas are provided in Section 4.3.
- Shapefiles of the operational area and acquisition area.

Survey Details:

Details	**Titleholder Survey Information**	**CSEP Consortium Steering Committee Check (Yes/No)**
CSEP Titleholder:		
CSEP Titleholder contact and contact details:		
Survey Name:		
Title/s:		
Survey type (2D, 3D, 4D):		
Survey area 3D or 4D (km^2)		
Survey 2D survey line km		
Survey 2D grid lone spacing (km)		

Survey Parameters:

Parameter	CSEP Parameters	Titleholder Survey Parameter	Within CSEP Parameters (Yes/No)	CSEP Consortium Steering Committee Check (Yes/No)
Activity within CSEP Operational Area	CSEP Operational Area			
3D or 4D Acquisition Area	Not exceed 10,000 km^2			
Volume of seismic source	Max 4,130 cubic inches (in^3)			
Operating pressure	Max 2000 psi			
Seismic vessel sail line speed	Up to 8–9 km/h (4–4.5 knots)			
No. streamers	Up to 16 streamers			
Streamer length	Up to 10 km			
Vessel fuel	Marine diesel oil or Marine diesel gas			
Shallowest water depth	25 m			
Vessel largest fuel tank	2,000 m^3			

CSEP Requirements:

Details	Titleholder Survey Information
Have the controls from the CSEP applicable to the survey been identified and can they be implemented? Identification and assessment of controls to be provided.	
If the controls applicable to the survey cannot be implemented has an MoC been completed and provided with this form? MoC forms to be provided.	

Part 2: CSEP Consortium Steering Committee

This section is to be completed by the CSEP Consortium Steering Committee.

Review Details:

Review	Yes/No	Actions (if required)
Are the parameters specified in Part 1 within the CSEP parameters?		
Have the controls applicable to the survey been identified and can they be implemented?		
If the controls applicable to the survey cannot be implemented has an MoC been completed and provided?		
Does the MoC trigger the revision of the CSEP?		
Operational Protocol Requirements		
The total combined size of the Acquisition Areas of any 3D or 4D seismic surveys, or survey phases, conducted under the CSEP within the CSEP Operations Area will not exceed 40,000 km^2 in any calendar year.		
Seismic survey vessel activities for seismic surveys conducted under the CSEP will not overlap the Regularly Fished Fishing Grounds of any individual managed fishery (excluding the Pilbara Trap and Pilbara Fish Trawl Managed Fisheries see below) by more than 33% of the Regulated Fishing Season for each calendar year.		
Exceptions to fisheries covered by the controls in the item above are the Pilbara Trap and Pilbara Fish Trawl Managed Fisheries, whereby seismic survey vessel activities for seismic surveys conducted under the CSEP will not overlap these smaller area fisheries by more than 25% of the Regulated Fishing Season per calendar year.		
The Active Source Area of any 3D or 4D seismic survey will not overlap other previously acquired 3D seismic survey Active Source Areas within the same Regulated Fishing Season of any surveys conducted under the CSEP? See the Adjustment protocol which details the survey types this control applies to.		
Total combined 2D seismic surveys conducted under the CSEP within the CSEP Operations Area will not exceed 50,000 survey line km per calendar year.		

Review	Yes/No	Actions (if required)
Any 2D survey lines that overlap, or partially overlap, a 3D Active Source Area that has been surveyed within the previous 12 months will be acquired at a grid line spacing of not less than 10 km.		

Approval Process:

Date:		
Completed by:		
Signature:		
Decision:	☐	Approved – survey can be conducted under the CSEP
	☐	Not approved - – survey cannot be conducted under the CSEP
	☐	Approved – with conditions
Conditions if required		

Appendix G: Summary of Stakeholder Consultation and Assessment of Objections and Claims

Adjustment and Operational Protocol Development

Note: Consultation records in this section are by date detailing the consultation undertaken to develop the Commercial Fishery Adjustment and Operational Protocols.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Western Australian Fishing Industry Council (WAFIC) Northern Territory Seafood Council (NTSC) NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division WA Department of Primary Industries and Regional Development (DPIRD)	Fisheries-01	11/02/2019	Meeting	COMFISH-ADJ-DOC1	CSEP Project Manager meets with WAFIC, DPIRD, NTSC and NT Fisheries to introduce and discuss project. NTSC and WAFIC identified four issues and potential solutions. The issues were: • Lack of trust in the environmental impact assessment process. • Inadequate consultation because concerns are not heard or acted upon. • Presence of scientific uncertainty and a failure to acknowledge the impact of seismic on fishers. • Unclear, uncertain, and unenforced management measures. Agreed to provide further documented on the project and meet again to work through issues.	Engagement has been ongoing throughout the development of the Operational and Adjustment protocols and CSEP with WAFIC, DPIRD, NTSC and NT Fisheries. Issues raised have been addressed via the development of the Operational and Adjustment protocols and engagement of the commercial fishers including WAFIC, DPIRD and NTSC in the development of the commercial fishing sections of the CSEP.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-01	04/10/2019	Email	WAFIC-ADJ-DOC1 WAFIC-ADJ-EM1	First draft (Rev 0.3) of adjustment protocol “Protocol for adjustment for evidence-based direct losses to fishers as a result of seismic activities”. WAFIC raised concern regarding the protocol and suggests that the next Adjustment draft has incorporated/addressed initial comments that WAFIC then update and include our colleagues in other state and commonwealth commercial fishing peak bodies. CSEP Project Team responded to suggest meeting with WAFIC to realign expectations and set a better foundation before we proceed.	Meeting held as per #WAFIC-02.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-02	07/11/2019	Meeting	WAFIC-ADJ-EM2	Meeting between NERA and WAFIC CEOs, agreement reached to reset project engagement.	See WAFIC-03 record for CSEP Project agreed focus areas.
Western Australian Fishing Industry Council (WAFIC) Northern Territory Seafood Council (NTSC)	WAFIC-03	13/02/2020 14/02/2020	Meeting Email	WAFIC-ADJ-EM3 WAFIC-OP-EM1	Meeting between CSEP Project Team and WAFIC CEO and Executive Officer Resource Access – Oil and Gas, Meeting follow up email cc CEO NTSC. It was agreed that CSEP Project Team would focus on: • identifying relevant fisheries and associated key indicator species, spawning periods and key fishing grounds/times for incorporation into seismic survey planning. • develop alternative draft Adjustment Protocol that incorporates an evidenced based process to identify commercial fishing loss of catch, displacement and gear entanglement; and • develop draft protocol relating to the number/timing/areas of seismic surveys relative to	Engagement has been ongoing with WAFIC to develop the Operational and Adjustment protocols and the commercial fishing sections of the CSEP which covers identification of relevant fisheries and associated key indicator species, spawning periods, and key fishing grounds/times for incorporation into seismic survey planning (Section 5.8).

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					fisheries and key fishing grounds/key indicator species spawning times. CSEP also details that they will contact WA and NT Fisheries Departments (See Fisheries-02 Record 17.2.2020).	
NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division WA Department of Primary Industries and Regional Development (DPIRD): Fisheries	Fisheries-02	17/02/2020	Email	DEPT FISH Email 17.2.2020	CSEP contacted to provide status of the CSEP Project and that working with WAFIC and the NTSC to re-engage with the project, with a focus on key issues of concern to the commercial fishing sector including identifying relevant fisheries/stocks/ key indicator species/peak spawning periods/key fishing grounds, a revised draft of a commercial fishing industry Adjustment Protocol and parameters around the spatial and temporal occurrence of seismic surveys. Request to NT for any input regarding relevant NT fisheries/stocks/key indicator species/spawning times/key fishing grounds, and/or where information can be sourced.	Engagement has been ongoing with NT and WA fishery departments in the development of the Operational and Adjustment protocols and the commercial fishing sections of the CSEP which covers identification of relevant fisheries and associated key indicator species, spawning periods and key fishing grounds/times for incorporation into seismic survey planning (Section 5.8).
Western Australian Fishing Industry Council (WAFIC)	WAFIC-04	13/05/2020	Meeting	WAFIC-ADJ-EM4 WAFIC-ADJ-Draft A	First engagement with WAFIC on Draft A Commercial Fishing Industry Adjustment Protocol. Enclosed a pdf copy of Draft A for distribution to key people. Follow-up email provided Adjustment Protocol. Email included CEO NTSC.	Comments on Draft A were provided by WAFIC and NTSC. Comments, where appropriate were incorporated in Draft B which was sent to WAFIC, NTSC, CFA, Austral Fisheries and MG Kailis Group for information and feedback (See COMFISH-02 Record).
Western Australian Fishing Industry Council (WAFIC)	WAFIC-05	12/06/2020	Meeting	WAFIC-ADJ-EM5 WAFIC-ADJ-DOC2 WAFIC-ADJ-Draft A Comments	Second engagement with WAFIC on Draft A Commercial Fishing Industry Adjustment Protocol. Spreadsheet provided to track outcomes and how addressed within Adjustment Protocol.	
Northern Territory Seafood Council (NTSC)	NTSC-01	16/06/2020	Email	NTSC 01 ADJ-Draft A Comments	NTSC provided comments on Draft A Commercial Fishing Industry Adjustment Protocol.	
Western Australian Fishing Industry Council (WAFIC) Northern Territory Seafood Council (NTSC) Commonwealth Fisheries Association (CFA) Austral Fisheries MG Kailis Group	COMFISH-02	16/07/2020	Email	COMFISH-ADJ-EM1 COMFISH-ADJ-DOC2 COMFISH-ADJ-DOC3 COMFISH-ADJ-DOC4 COMFISH-ADJ-DOC5	Draft B of Commercial Fishing Industry Adjustment Protocol (COMFISH-ADJ-DOC2) updated and formally provided to WAFIC, NTSC, CFA, Austral Fisheries and MG Kailis Group for information and feedback. Draft B reflected the groups feedback. A summary of the amendments made (COMFISH-ADJ-DOC5) was provided. Proposal is to release the draft protocol for 30 days consultation/feedback and then finalise the protocol through the peak commercial fishing industry body group and the consortium. Proposed covering letter (COMFISH-ADJ-DOC4) to go with draft protocol attached for feedback. The relevant fisheries listed in attached adjustment protocol consultation plan (COMFISH-ADJ-DOC3). Requested if WAFIC, NTSC and CFA would consider providing licensee lists for each of their fisheries. If the licensee lists are not available from the peak bodies, we will make application to the relevant Government Departments (which may delay the release of the draft). Once the adjustment protocol consultation is underway, the CSEP Project Team would like to begin the seismic survey spatiotemporal protocol development process. It is envisaged	Request for feedback on Draft B of Commercial Fishing Industry Adjustment Protocol and draft letter to go to stakeholders.

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					that the adjustment protocol, together with a spatiotemporal protocol setting out parameters for the conducting of surveys under the CSEP, will address two of the key concerns of the commercial fishing industry and underpin the development and assessment/acceptance of the CSEP. Feedback requested by Friday 24 July if possible.	
Northern Territory Seafood Council (NTSC)	NTSC-02	23/07/2020	Email	NTSC 02 CSEP Project-Draft Commercial Fishing Industry Adjustment Protocol	NERA emailed NTSC 23.07.2020 to let NTSC know that that meeting with WAFIC to discuss process and cover letter for Adjustment Protocol and asking if NTSC can provide NERA with the fishery licensee contact details. NTSC emailed NERA 28.07.2020 advising that they do not provide members contact details to other providers. Need to obtain from NT Fisheries. NTSC offered to make reference (and links) to a generic letter and draft protocol in an email to relevant NTSC members, however this does not reach 100% of the membership due to some members opting not to provide email addresses. NERA emailed NTSC 28.7.2020 detailing that they initiated contact with NT Fisheries to obtain the licensee details but would appreciate it if you would also forward to those members, you have email contact with. In respect to the consultation period, I acknowledge the covid impact, but would like to stick to something closer to 30 days if we can. Would you be comfortable with going with 5 weeks and then we can review the feedback at 4 weeks and if necessary, consider extending? NERA emailed NTSC 11.8.2020 to let NTSC know almost ready to send out the draft protocol for consultation. We have decided to run with 30 days consultation and will review how we are going at 3 weeks. We have obtained licensee lists for the NT fisheries and will organise for them to be sent direct from Darwin to minimise mail time. I'd also appreciate it if you could circulate the letter and draft protocol by email if you are able. NTSC emailed NERA on 27.08.2020. NTSC will have a link to the consultation in our weekly email to members tomorrow. NTSC members have received the document and made a comment 'there is not latitudes and longitudes to identify where the areas are'. NERA replied to NTSC on 27.08.2020. In respect to the comments NTSC have received regarding no latitude and longitude identification of areas under the protocol. The adjustment protocol is aimed at establishing a standardised process to be used under the Environment Plan for the CSEP. The EP is yet to be finalised and go through the statutory NOPSEMA process. In practice what would occur under the CSEP is that no less than 28 days prior to a seismic survey taking place, the titleholder would provide notification of the survey and the associated Adjustment Area, including lats and longs. The information to go to fishery licensees would also include a map of the Adjustment Area, and also in digital	Feedback on Draft B of Commercial Fishing Industry Adjustment Protocol and draft letter to go to stakeholders. Feedback was addressed and finalised version of Draft B Commercial Fishing Industry Adjustment Protocol (WAFIC-ADJ-DOC4) and cover letter (WAFIC-ADJ-DOC3) provided for final comment before sending out for broader consultation. See COMFISH-03 Record 11/08/2020.

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					shapefile and KML format so that it can be loaded straight into their plotters. NERA can also add the words "latitude and longitude" into the definition of Adjustment Area in the protocol to ensure clarity.	
Western Australian Fishing Industry Council (WAFIC) Northern Territory Seafood Council (NTSC) Commonwealth Fisheries Association (CFA) Austral Fisheries MG Kailis Group	COMFISH-03	11/08/2020	Email	WAFIC-ADJ-EM6 WAFIC-ADJ-DOC3 WAFIC-ADJ-DOC4	Finalised version of Draft B Commercial Fishing Industry Adjustment Protocol (WAFIC-ADJ-DOC4) and cover letter (WAFIC-ADJ-DOC3) provided for final comment before sending out for broader consultation.	For information and final comment on Draft B of Commercial Fishing Industry Adjustment Protocol and draft letter to go to stakeholders.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-06	20/08/2020	Email	WAFIC 02 Adjustment protocol email WAFIC 02 Adjustment Protocol Consultation Draft B Aug 2020 Letter WAFIC 02 Consultation Licence Lists	WAFIC provided email of the commercial fishers and associations they would send Draft B Commercial Fishing Industry Adjustment Protocol and cover letter. WAFIC provided NERA with an excel spreadsheet of the fishery license's that received the email or mailout.	Draft B Commercial Fishing Industry Adjustment Protocol sent to fishing licence holders as per COMFISH-04 Record 20/8/2020.
Commercial Fishers – Adjustment Protocol	COMFISH-04	21/08/2020	Email/Mail	WAFIC-ADJ-EM7 WAFIC 02 NERA Adjustment Protocol Consultation Draft B Aug 2020 Letter WAFIC 02 Consultation Licence Lists NTMAIL-ADJ-DOC1 NSLH 01 Adjustment Protocol Consultation Draft B Aug 2020 email NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter NERA Adjustment Protocol Consultation Draft B Aug 2020	Draft B Commercial Fishing Industry Adjustment Protocol full commercial fishing consultation 19 August to 25 September. Draft B emailed/mailed to all commercial fishing licence holders in fisheries active in CSEP operational area. <u>Western Australia</u> • Pilbara Trawl Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Line Fishery • Pilbara Crab Managed Fishery • Mackerel Managed Fishery • Northern Demersal Scalefish Managed Fishery • Kimberley Prawn Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery WA Northern Shark License Holders were included though the fishery is currently closed. <u>Commonwealth</u> • Northern Prawn Fishery – via NPF Industry Pty Ltd • North West Slope Trawl Fishery • Western Deepwater Trawl Fishery • Western Tuna and Billfish Fishery <u>Northern Territory</u> • Aquarium Fish/Display • Coastal Line • Demersal • Offshore Net and Line • Spanish Mackerel	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol was received from: AFMA – see AFMA-01 CFA – see CFA01 Commercial Fisher – see CF-01 DISER – see DISER-01 Mackerel Managed Fishers – see MMLH1-01 and MMLH02-01 NOPSEMA – see NOPSEMA-01 NPFI – see NPFI 02 NT Fisher – see NT 01 NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division (NT DITT) – see NTDITT-01 Oceanic Trading – see OT 01 Pilbara Crab Managed License Holder – see PCMLH1-01 Pilbara and NDSF – see BDF 01 WRLC – see WRLC 01

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					• Timor Reef Also sent to: AFMA (#AFMA-01) APPEA (#APPEA-01) CFA (#COMFISH-05) DAWE-Fisheries (DAWE-FISHERIES 01) DISER (#DISER-01) IAGC (#IAGC-01) NTSC (#COMFISH-05) NOPSEMA (#NOPSEMA-01) NT DITT (#NTDITT-01) Pearl Producers Association (#COMFISH-05) WA DPIRD (#WADPIRD-01) Western Rock Lobster Council (#WRLC-01) Documentation: • WAFIC-ADJ-EM7: WAFIC email to fishers • WAFIC 02 NERA Adjustment Protocol Consultation Draft B Aug 2020 Letter • WAFIC 02 Consultation Licence Lists • NTMAIL-ADJ-DOC1: NT fishery consultation licensee list • NSLH 01 Adjustment Protocol Consultation Draft B Aug 2020 email - WA Northern Shark License Holders • NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter • NERA Adjustment Protocol Consultation Draft B Aug 2020	
Commonwealth Fisheries Association (CFA) Northern Territory Seafood Council (NTSC) Pearl Producers Association	COMFISH-05	21/08/2020	Email	COMFISH 05 Adjustment Protocol Consultation Draft B email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	Draft B Commercial Fishing Industry Adjustment Protocol provided for comment.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol was received from: CFA – see CFA01
Australian Petroleum Production & Exploration Association (APPEA)	APPEA-01	21/08/2020	Email	APPEA 01 NERA Adjustment Protocol Consultation Draft B email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	Draft B Commercial Fishing Industry Adjustment Protocol provided for comment.	Provided for information. No feedback received.
International Association of Geophysical Contractors	IAGC-01	21/08/2020	Email	IAGC 01 Adjustment Protocol Consultation Draft B Aug 2020 email	Draft B Commercial Fishing Industry Adjustment Protocol provided for comment.	Provided for information. No feedback received.

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(IAGC) note know called Energeo Alliance				NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter		
Pilbara Crab Managed License Holder- Stakeholder 1	PCMLH1-01	21/08/2020	Phone	PCMLH-01	General enquiry regarding how the loss of catch process would take place.	No follow-up required.
NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division	NTDITT-01	21/08/2020	Email	DITT 01 Adjustment Protocol Consultation Draft B Aug 2020 email DITT 01 Adjustment Protocol Consultation Draft B Comments NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter DIIS 01 Adjustment Protocol Consultation Draft B Aug 2020 Feedback	Draft B Commercial Fishing Industry Adjustment Protocol and cover letter provided to DITT for comment. Comment period 19 August to 25 September. DITT provided minor comments/queries.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.
WA Department of Primary Industries and Regional Development (DPIRD): Fisheries	WADPIRD-01	21/08/2020	Email	DPIRD 01 Adjustment Protocol Consultation Draft B Aug 2020 email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	Draft B Commercial Fishing Industry Adjustment Protocol and cover letter provided to DPIRD for comment. Comment period 19 August to 25 September. DPIRD acknowledged receipt. DPIRD Fisheries replied and noted that the CSEP Team is working with WAFIC on the Adjustment Protocol.	No follow-up required.
Australian Fishing Management Authority (AFMA)	AFMA-01	24/08/2020	Email	AFMA 01 NERA Adjustment Protocol Consultation Draft B email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	NERA contacted AFMA regarding the CSEP project status and the Draft B Commercial Fishing Industry Adjustment Protocol and cover letter for information and feedback. AFMA replied 24.08.2020 requesting the Commonwealth fisheries that NERA have been consulting with. NERA replied 21.08.2020 that they have been in contact with: • Northern Prawn Fishery • North West Slope • Western Deepwater Trawl Fishery • Western Tuna and Billfish Fishery AFMA has no further Commonwealth fisheries to add.	No follow-up required.

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					AFMA confirmed that the CSEP project had identified the appropriate Commonwealth fisheries to engage with.	
Commonwealth Department of Industry, Science, Energy and Resources (DISER)	DISER-01	24/08/2020	Email	DIIS 01 Adjustment Protocol Consultation Draft B Aug 2020 Feedback NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	The CSEP Project Team provided a copy of Draft B Commercial Fishing Industry Adjustment Protocol and cover letter provided to Commercial Fishers with a request for any feedback. DISER replied on the 30.9.20 with a consolidated DISER-NOPSEMA response detailing that both agencies are supportive of the collaborative development of this protocol and acknowledge its potential to improve engagement between commercial fishers and offshore oil and gas operators. NOPSEMA and DISER would appreciate further updates when appropriate. Specific comments on the Draft Protocol are: <u>Planning to minimise interruptions/negative interactions</u> The adjustment protocol refers to the need for commercial fishers continuing to carry out their fishing activities to the best of their ability despite the occurrence of a seismic survey. If not already, consideration should be given to strategic measures to ensure commercial fishers and seismic survey proponents under the collaborative EP are well informed of each other's activities to inform planning to minimise negative interactions. For example, 6 monthly strategic meetings on planned operations and mitigation options (that reduce need for compensation) where simultaneous operations are identified. 2. The protocol could make reference to a general requirement for fishers to seek to mitigate or limit financial losses, currently this reference is only made with regards to loss of catch, however this requirement could apply more broadly to all forms of potential financial loss (gear loss/damage, displacement, loss of catch). <u>Consultation and peer review</u> 3. It is positive to see that the process has been developed in consultation with fishing licence holders and relevant fisheries peak bodies. 4. Consideration should be given to independent expert review (e.g. fisheries economist) of the draft protocol and/or benchmarking with international good practice to provide assurance that the protocol is robust and aligned with good practice. This may assist with gaining the trust and confidence of commercial fishers. 5. If not already occurred, consideration should be given to sharing the protocol with relevant fisheries management/policy agencies to ensure they are aware of the protocol and have an opportunity to provide comment. For example, this would provide an opportunity for them to comment on the suitability of the fisheries data proposed to support claim assessment as well as the practicability and timeliness of providing 10 years of catch history data.	Feedback was incorporated into the next version of the Adjustment Protocol Consultation. Planning to minimise interruptions/negative interactions Point 1. Noted, already statement in the protocol that titleholders will make all attempts to minimise impacts on commercial fishing and protocol will be a last resort. Point 2. Already in there for displacement at lines 140-142. Will consider if appropriate to replace with a more general comment. Consultation and peer review. Point 4. Up to NERA/Consortium. NERA have a good range of skills on the project team, with international experience. Not sure what a fisheries economist would provide? Point 5: Protocol has been shared with relevant fisheries management/policy agencies see Records. Point 6. Agree and project tea in touch with CGG and have been in contact with CFA. Process for lodging, assessing and adjudicating claims Point7. Think this could be a good idea, will consider further. Point 8. Yes, could provide some basic report requirements, will consider further. Point 9. Noting feedback from commercial fishers, we need to provide for either Government or their own catch data and for assessments to be done on less than 10 years catch data. Point 11. Noted but think the way we have now is better where arbitration comes aft agreement can't be reached. Defining suitable experience/qualifications/independence of assessors/arbitrators Point 13. The protocol says that the assessor and arbitrator are to be appointed with the agreement of both the titleholder and the claimant. Can consider adding some comments about what "suitable experience" is but think the panel approach would significantly increase the resourcing necessary to run the process. For consideration by NERA/consortium. Point 14. NERA already have fishery expertise in the project team and buy in from peak commercial fishing bodies and licensees. Adding info about contracting etc will add to the complexity of the process. Could consider at review. Justification and clarity on spatial and temporal limits Point 15. Footnote 6 covers 10km and don't think we need further comment on 6 months, noting no feedback on that point up to now Point 16. Disagree this creates significant uncertainty or inconsistency, as 2D is very different form 3D.

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					6. It may also be worthwhile for the CSEP Project Team to engage with relevant stakeholders to learn from the recently completed CGG seismic survey, specifically with respect to the design and implementation of the fisheries adjustment scheme. The Department sees value in a Protocol that can be used nationally. <u>Process for lodging, assessing and adjudicating claims.</u> 7. The protocol would benefit from a stand-alone section on the process and roles and responsibilities for lodging, assessing and adjudicating claims, including how claims will be assessed where the required information is not complete, e.g. less than 10 years catch history data. This information appears to be spread across multiple sections, e.g. 'scope' and 'loss of catch', and it is not clear if the same process applies for displacement claims. 8. The current process for assessment and resolution of loss of catch claims includes a step for an independent person to provide a report to the titleholder and no detail is provided on what this report should contain. Suggest minimum contents are specified with a focus on sufficient information for a claimant to understand why a particular conclusion was reached and evidence supporting this. 9. For loss of catch claims, the requirement to firstly seek relevant Government catch data, prior to utilising catch data provided by claimants (footnote 5) could be made a bit clearer, or other options provided. For their 2019 Fisheries Business Assistance program, which assisted fishers to transition to new Australian Marine Park management plans, Parks Australia engaged the Australian Bureau of Agricultural and Resource Economics and Sciences to undertake analysis of data provided by fisheries management agencies, and this analysis was used to calculate the assistance granted to fishers. 10. Consideration could be given to establishing a timeframe for the consideration of claims by the independent person or organisation assessing a loss of catch claim. A timeframe for consideration could also apply to the arbitration process. 11. The current process also includes a step for the titleholder to provide the report to the claimant and meet with the claimant to discuss/address the claim. Consideration should be given to measures to reduce the potential for this step to result in unnecessary conflict and detract from the independent, evidence based assessment. For example, ensure an appropriately independent arbiter is also present. 12. The section on gear loss/damage states that the claim should include any associated lost catch. It is unclear what evidence is required to substantiate this. This section would benefit from a separate appendix, similar to displacement and loss of catch, clearly outlining the information required to be provided in submitting a claim. <u>Defining suitable experience/qualifications/independence of assessors/arbitrators</u>	

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					13. For loss of catch claims, it is stated that the titleholder will engage a suitably experienced/qualified independent person or organisation to assess the claim. This is an important measure to ensure that claim assessment is evidence-based and independent. In order for this measure to be effective it will be important to clearly define the criteria that apply to ensure the assessor is suitably experienced, qualified and independent and consideration should be given to establishing a panel of people that are familiar with the protocol and able to be called upon in the event of claims being lodged. This also applies to the proposed "independent person to arbitrate the claim" should the claim not be settled between titleholder and claimant. A panel with representation from both the fishing and petroleum industries would help ensure the interests of both sectors are represented and independence is maintained. Consideration could also be given to protocols for decision making by a panel, i.e. a majority vote. 14. It is likely that one of the key challenges for the successful implementation of this protocol will be managing a perception of bias (i.e. protocol developed and implemented by petroleum industry and in their best interest to pay minimum compensation) and gaining the trust of the commercial fishers. A common concern raised by fishers on protocols such as these are questions about the true independence/impartiality of assessors and arbiters. Consideration should be given to clearly setting out how this will be ensured, e.g. through contracting process, conflict of interest declarations, letters of instruction and transparency of assessment reports. <u>Justification and clarity on spatial and temporal limits</u> 15. The protocol sets some spatial (10 km around active source area) and temporal (6 months after conclusion of the survey) limits within which claims for loss of catch can be made and it would be beneficial to better explain and justify these. 16. The definition of adjustment area includes a note that the definition of an adjustment area for a 2D survey will require case-by-case specification due to the differing survey layout. This creates significant uncertainty and potential inconsistency, and it is unclear why the same 10 km perimeter can't be applied for a 2D survey.	
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	NOPSEMA-01	24/8/2020	Email	NOPSEMA 01 Adjustment Protocol Consultation Draft B Aug 2020 email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter DIIS 01 Adjustment Protocol Consultation	The CSEP Project Team provided a copy of the NERA Adjustment Protocol Consultation Draft Aug 2020 and Adjustment Protocol Cover Letter that would be provided to Commercial Fishers with a request for any feedback. NOPSEMA replied on 25.08.2020. It is pleasing to see good progress on this issue and it's also good timing as NOPSEMA are progressing discussions with DAWE and Offshore resources branch colleagues on the issues arising for seismic and fisheries and potential solutions to address them. We will discuss with DISER and have a combined set of feedback. NERA replied on 27.08.2020. The CSEP project team has discussed how we might ensure the Adjustment Protocol	Combined feedback from DISER and NOPSEMA was incorporated into the next version of the Adjustment Protocol Consultation (See #DISER-01).

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				Draft B Aug 2020 Feedback	reflects a national view. NERA have had preliminary discussions regarding engaging South East stakeholders once we have closed out engagement with North West stakeholders. We have had an initial discussion with some operators in the South East as well. NERA might potentially do this further engagement in October if feasible. NOPSEMA replied on 31.08.2020. Good to hear NERA making headway on this issue for the sector and that there has been some recent good progress on the government with NOPSEMA, DISER and DAWE drafting a seismic and fisheries co-existence policy framework document. Once draft is ready for socialising would appreciate your feedback. DISER replied on the 30.9.20 with a consolidated DISER-NOPSEMA in relation to the NERA Adjustment Protocol Consultation Draft (DIIS_01_NERA CSEP Adjustment Protocol Consultation) – See DISER Record DISER-01 24/8/2020	
Western Rock Lobster Council (WRLC)	WRLC-01	24/08/2020	Email	WRLC 01 Seismic Survey Sources and Adjustment Protocol NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	CSEP Project Team emailed WRLC the Draft B Commercial Fishing Industry Adjustment Protocol. The CSEP does not overlap or impact the WRL Fishery, so this was provided for information and feedback. WRLC replied 23.08.2020. The protocol appears reasonable for dealing with short term impacts on the commercial fishing sector on the assumption fishery agencies are able and willing to release data on catch histories and ideally average fleet data relative to a particular set of blocks. This presumption will not be easily met as I expect issues of confidentiality will arise particularly if the data available is limited to few operators with normal time lags in collection and processing. One issue that could arise is the high likelihood of accumulated impacts from successive seismic operations and the ability to deal with changes to fish stocks over time especially where zooplankton fish larvae are impacted by seismic activity taking some years to ultimately result in differential losses within a multi species fishery. The protocol it appears does not address this consequence and nor is it intended to and yet fundamentally needs addressing both from a science investigative sense and under an acceptable process noting multiple companies and areas are likely to be involved in seismic survey activity as well as across a number of different fisheries. To fully assess this impact may require a longer term stock assessment study across the whole realm over a long period of time. Whether environmental and fishery related changes can be sufficiently separated from the effects of seismic activity could well be problematic unless field research identifies more precisely seismic effects on different life stages of key indicator fishery species. An enormously complex issue but not unassailable. NERA replied 24.08.2020. In respect to claims under the adjustment protocol, data confidentiality shouldn't be a problem as the process is that individual fishers will obtain and provide their own catch and effort data for independent assessment. Each assessment will compare the individual	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					fisher's activity with their own historical average. NERA agree that the broader questions around potential long term impacts are yet to be addressed and will be scientifically challenging.	
Commercial Fisher - Stakeholder 1	CF-01	01/09/2020	Phone	CF 01 Adjustment Protocol Consultation Draft B Aug 2020 Feedback	Phone conversation and discussion in relation to the following points. **Fisher - vessel - licence - entitlement relationship.** Need to clarify how the process deals with who can apply? How the catch history is obtained. Where does the catch history sit? What happens when entitlement level is changed and what effect does that have on calculating the "average CPUE" **Catch history** - what if the previous catch history is for different months than the survey and after period? How is that addressed? **Consent for data** - what how prior licensees? **10 years is too much of a requirement.** 7 years is a community standard and should be applied. This will also lessen problems with obtaining catch data. Need to clarify with DPIRD their policy for the release of catch history. Need to define what the problem is - compensation for "disruption of business". This view supports a wider application of loss of catch to include alternative fishing areas when fishing. Now a fisher is adjusted while they remain within the adjustment area, but not for loss of catch for fishing in what may be a less productive area. What if you are completely displaced and go back to port? No adjustment for that? For clarity explain the "default path" and then address the outliers in the non-default path Business disruption is in the form of Physical dislocation of a boat and loss of catch, both in the adjustment area and potentially somewhere else as well.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.
Commonwealth Fisheries Association (CFA)	CFA-01	02/09/2020	Phone	CFA 01 Phone Call Record	CFA requested an online meeting for CFA members, and possibly NTSC/WAFIC to discuss: • Application within CSEP op area and other national fisheries. • Short term vs long term impacts and how protocol fits in • Bass Straight scallop fishery and interactions with seismic surveys.	Invitations to meeting sent out by WAFIC (see WAFIC-06 Record 3/9/2020). Meeting held Meeting held on the 9/9/2020 See ZOOM-01 Record.
Western Australian Fishing Industry Council (WAFIC) Northern Prawn Fishery Industry Pty Ltd Pearl Producers Association	WAFIC-06	03/09/2020	Email	WAFIC 03 Adjustment Protocol Meeting Invite PPA 01 Adjustment Protocol Meeting Invite NPFI 01 Adjustment Protocol Meeting Invite	WAFIC emailed an invitation to set up a video conference meeting to further discuss, answer questions etc regarding the draft adjustment protocol direct with commercial fishing licence holders. NERA are especially seeking to engage with licence holders who are actively fishing / an active licence in the north.	Invitation to fishing licence holders to attend an online meeting to discuss adjustment protocol and obtain feedback. Meeting held on the 9/9/2020 See ZOOM-01 Record.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					The meeting will consist of NERA, peak bodies and commercial fishing licence holders.	
Oceanic Trading	OT-01	25/09/2020	Email	OT 01 Adjustment Protocol Feedback	Oceanic Trading provided feedback on the Draft B Commercial Fishing Industry Adjustment Protocol. Loss of catch for up to 6 months after the testing isn't enough for old and slow growing species such as deep sea crab. DPIRD has plenty of the crabs at over 20 years old so obviously if there was a noticeable negative effect on the biomass by seismic testing then 8 months of claimable catch loss isn't sufficient. Why should there be a limit at all if it can be shown to be caused by the seismic testing?	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation. Further consultation was undertaken with the commercial fishers in relation to long term sustainability of the fisheries and claims outside of the Adjustment Protocol (see consultation under Commercial Fishers CSEP Development). Via this engagement an additional control was included in the CSEP (CM#1: Annual Fisheries Review) to review the sustainability of the fishery and action to be taken if changes identified in sustainability of a fish species or a fishers catch.
Mackerel Managed License Holder- Stakeholder 1	MMLH1-01	07/09/2020	Email	MMLH S03 Adjustment Protocol Feedback	Feedback on the Adjustment Protocol after the Zoom Meeting. While being a very technical issue, I am not sure that either side of the fence has a "right (line 24). It is probably more accurately an "access entitlement" Issues raised: Use of a 10 year window assumes the vessel/skipper combination, the current market opportunities and the fishing gear and method have all remained constant. Using the average catch may also be problematic. It may be worth considering having more than one option for calculating compensation. A possible option may include having the ability to also look at CPUE in the months leading up to seismic work, and a corresponding period after. Alternatively, the approach used in fisheries allocation of formally including an "exceptional circumstances" clause in settlement under which the parties can go directly to an independent arbiter if that is the most logical course of action. CSEP replied to MMLH Stakeholder 1 on 14.09.2020. Thanking them for their input and attendance to the Zoom meeting. Good points were made and are worth a further consideration and noted that all views received during the consultation period will be put to the project consortium for consideration.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.
Mackerel Managed License Holder- Stakeholder 2	MMLH2-01	08/09/2020	Email	MMLH S01 Adjustment Protocol Feedback	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol Concerns raised in around sustainability of the fishery and drop in fishers catch from seismic survey in 2019 in which fish have not returned to catch area. 2019 mackerel fishing season began like so many experienced before. Fish began to populate known concentration points and the catches began to increase through the months of April and May. The planned seismic survey commenced around the 17th of May and immediately witnessed a complete and absolute emptying of shoals of fish life. Areas that had been producing strong numbers of fish (mackerel) for weeks became devoid overnight. From that point on no mackerel returned to these reefs during 2019. It is believed a fishing dead zone up to 50 nautical miles east of the survey and 30 miles to the west where no fish were caught after surveying commenced. An	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation. Further consultation was undertaken with the commercial fishers in relation to long term sustainability of the fisheries and claims outside of the Adjustment Protocol (see consultation under Commercial Fishers CSEP Development). Via this engagement an additional control was included in the CSEP (CM#1: Annual Fisheries Review) to review the sustainability of the fishery and action to be taken if changes identified in sustainability of a fish species or a fishers catch.

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					approach was made to the company and an eventual satisfactory outcome was negotiated. Having now experienced a seismic survey in close proximity to traditional fishing grounds there is no doubt that mackerel are severely disturbed by the noise and will rapidly depart the area tens of miles away from the source and are very unlikely to return. As these fish are a primary focus it cannot be said what the impact is to other species, such as many of the demersal fish found in these waters. It is believed the exploration companies need to acknowledge their surveys are going to impact on fish. The spatial area of 10 km is unsatisfactory beyond the survey area as a buffer zone. Certainly, this is the case with mackerel. Seismic surveying is planned to be undertaken in a manner so as to cause as little or no impact to the annual whale migration (fair enough) but no consideration is given to fishing, an important food source, other than it might have an impact. Exploration companies need to acknowledge they are extremely likely to reduce our catch rates and a satisfactory, and promptly attended compensation resolution is forthcoming. NERA replied on 14.09.2020Your comments are very much appreciated, especially as someone with significant commercial fishing experience and who has been through the adjustment process already. Your views will be put to the CSEP Project consortium for consideration.	
Adjustment and Operational Protocol Zoom Group	ZOOM-01	09/09/2020	Meeting	ZOOM-ADJ-DOC1	Meeting 1: Zoom video meeting. Draft B Commercial Fishing Industry Adjustment Protocol discussion between CSEP project team and 11 commercial fishing industry licensee participants from fisheries active within the CSEP operational area. Attendees: Southern Blue Fin Tuna Operator, EO Northern Prawn Fishing Industry Pty Ltd, Sea Harvest Fishing Company (mackerel fishery), SETFIA (CFA member), Pilbara and Norther Demersal Scalefish Fishery Licensee, CEO CFA, MG Kailis Group (Pilbara Fish Trawl)/Chair CFA, Pearl Producers Association, CEO NTSC, WAFIC Representative, CEO WAFIC, CSEP Project Team Members.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.
Northern Territory Seafood Council (NTSC)	NTSC-03	09/09/2020	Email	NTSC 03 Feedback Email Draft B Commercial Fishing Industry Adjustment Protocol NTSC 03 2019-072-Phase1-Summary-31-07-2020	Please find attached some feedback on behalf of a fisher. It is interesting that "localised effort" is still being pursued as a realistic loss adjuster. Aware of compensation around $1.5-2.5m for fisherman in Bass Strait. Sounds good but when you look at potential impact that Fishwell Consulting is assessing (refer NTSC 02 2019-072-Phase1-Summary-31-07-2020) the longer term effects may be significant. Struggling on the purpose of this - An adjustment package that could increase cash flow to the fishing industry in the short term whilst not allowing for the risk of longer term consequences. How do we quantify impact?	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.

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					Who pays to quantify impact? If there is an impact how is adjustment calculated? Receive monetary adjustment for evidenced based loss of catch using an independent assessment process: - Reliant upon fishing in survey area both before (5 years), during and after. - Assumes fish do not move otherwise why have area. - Removes ability for new operators to receive compensation. - It is a process that relies on fishing operators to take risk as a result of another's action. - Fishing industry needs to finance a loss in order to receive an adjustment. Receive monetary adjustment for displacement of commercial fishing activity: - Have not seen evidence of this providing material assistance. Receive monetary adjustment for fishing gear damage from seismic survey vessels; - agree. To set out acceptable spatial and temporal parameters for seismic surveys (when/where/how many) to be conducted under the CSEP that take account of commercial fishing interests: - The catch data provided for this purpose tends to be definitive, yet other science is open for interpretation. NTSC also responded: From the Zoom session held by NERA, the main points were: Fish move and catches vary. Need to focus on the compensation process which results from loss due to interaction. Case studies are often on sedentary animals and pelagic animals are distinctively different - will be important to keep in back of the mind. Timeframes need to be flexible (if needed). The protocol has deliberately steered away from science for the adjustment protocol. Science has been outside the scope of the protocol, however it is in scope for future work/partnerships between NERA and industry. Workload and onus is too high on fishers. Can you consider average revenue/day. Business size in the industry vary (from single person to multi-million process) and some oil and gas leaders offer to pay for accounting/bookkeeping etc to be in place, is this something to consider. Data for licences can be difficult to obtain (skipper/person in charge/ownership change). Lots of clause about “reasonable cost” the onus falls back on claimant and there is a 'colossal amount' of work to submit a claim based on the current protocol.	

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					Calculations don't reflect: Couldn't go fishing, Went fishing, and got less than usual. Variation occurs regardless of seismic, being so specific in the protocol is an issue (every species, every value, over 10 years works against the intent of giving compensation). A fisher isn't the same as vessel, licence holder, endorsement holder etc - who receives compensation and for what. Definitions important (i.e. licence holder/single title holder). There is one title holder for survey. How legally, does it link with the person who suffers loss. Technical element to calculation losses. Gap - cost of movement to vessel may be trivial to commercial loss by fishing in a less profitable area (and some instances where run out of hours to go fishing anyway i.e. trawl gear with time/day limits). Gear loss/damage and opportunity cost. Both operators have opportunity costs if gear disabled, no mention of opportunity loss i.e. 20 traps wrecked, would put an operation out of action for at least a week i.e. lost time waiting for fishing vessel to move gear out of the way- incentive to avoid each other. Is there a time of year to reduce impacts? Not in this protocol, spatial and temporal parameters within the EP. Onus is often on seafood industry to do the “avoidance” which isn't received well in seafood industry. Other influences other than fishing and seismic, environmental, TEPS etc, seismic vessel availability. Longer term impacts. 7 years might be better than 10 years average data. NERA replied on 14.09.2020Thanks for passing on the feedback. All views received during the consultation period will be put to the CSEP Project consortium for consideration.	
Pilbara and Norther Demersal Scalefish Fishery Licensee 1	BDF-01	11/09/2020	Email	BDF 01 Comments on NERA adjustment protocol	Feedback on proposed adjustment protocol: Nearly unworkable due to the heavy onus on the claimant to prepare a claim. Hard to get data from DPIRD catch history to justify a claim. Have over 10 years of continuous catch and revenue history in both the NDSF and Pilbara trap fisheries which allows us to very quickly quantify any loss from an on water interaction measured against what we would normally catch and earn. A recent approach to one operator early this year on this basis and the first time we have ever in 25 years of operation sought compensation was summarily dismissed by the operator. BDF position is in the absence of something far better than what has been proposed here. Is that we are financially better off to maintain our normal fishing operations than to co-operate with survey activities and instructions to my vessels are to decline any requests to relocate in the absence of an explicit compensation agreement.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.

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					Adjustment protocol is also silent on the consequential loss to an operator of gear loss to which can be far greater than the cost of the loss itself. CSEP replied on 14.09.2020. Thanks for your comments and also for attending the recent zoom meeting. In particular your points on fishing history and loss of catch associated with gear damage will receive further investigation/consideration. Stakeholder replied with further comments on 29.09.2020. Some further thoughts on this were that the process needs to identify who is the responsible party on the seismic operators front to avoid handballing of responsibility for interactions. CSEP replied on 02.10.2020 Under the draft protocol as it stands, the titleholder of a seismic survey conducted under the CSEP is responsible for providing adjustment in accordance with the protocol. Under the protocol the titleholder must provide relevant fishery licensees with a notification of the establishment of an Adjustment Area no less than 28 days prior to a survey starting. The notification will also go the relevant commercial fishing peak bodies (WAFIC, CFA & NTSC). The notification will have contact details for the titleholder and a contact point for lodging claims or notification regarding loss of catch displacement and gear loss/damage.	
Department of Agriculture, Water and the Environment (DAWE): Fisheries	DAWE FISH-01	17/09/2020	Email	DAWE-FISH 01 Adjustment Protocol email NERA Adjustment Protocol Consultation Draft B Aug 2020 NERA Adjustment Protocol Consultation Draft B Aug 2020 Cover Letter	Information provided on the CSEP project and the Adjustment Protocol and a Spatio-Temporal Protocol. NERA asked DAWE for any feedback on the adjustment protocol. DAWE replied 30.09.2020. Thank you for providing the NERA consultation draft. Some useful progress is being made, DAWE also note the Protocol was briefly discussed by fishing industry representatives in the Senate Inquiry on seismic testing last week. We look forward to considering these issues in a national context with engagement of industries through the NOPSEMA process.	No follow-up required.
Northern Prawn Fishery Industry Pty Ltd	NPFI-02	25/09/2020	Email	NPFI 02 Submission Adjustment Protocol Draft B	NPFI provided feedback on the Adjustment Protocol Consultation Draft B Aug 2020. NPFI acknowledges and appreciates the work of all involved in developing the draft protocols. NPFI provides the following comments/recommendations on behalf of Northern Prawn Fishery operators: 1. NPFI notes that the draft Protocol currently refer to individuals being eligible to submit claims. NPFI recommends that where there is mutual agreement between an industry organisation and affected fishers, industry organisations should be eligible to submit claims on behalf of those fishers. Subject to agreement between the industry organisation and affected fishers, monetary adjustment could be paid either back through the industry organisation or directly to the fishers on behalf of whom the claim/s is made. 2. NPFI notes that the draft Protocol currently provides for 'reasonable and documented clerical costs relating to preparing, submitting and engaging in the adjustment	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.

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					process will be reimbursed as part of the claim process'. NPFI recommends that this provision should also apply to all claims submitted by industry organisations on behalf of affected fishers. 3. NPFI recommends that where fishery-level data is provided by an industry organisation to inform seismic impacts, cost recovery should be negotiated and apply. 4. NPFI notes that 'Subject to a loss of catch being established, the titleholder will provide monetary adjustment to the claimant to the equivalent of the loss of catch in kilograms at the current market value of the relevant fish species, within 60 days of finalising a claim'. NPFI also that 'if a claim cannot be settled between the titleholder and claimant within 90 days of a claim being lodged', and no mutual agreement to extend the time period has been entered into, then the titleholder (at their expense) in mutual agreement with the claimant, shall appoint an independent person to arbitrate the claim.' NPFI recommends that the time period for settling such claims between the titleholder and claimant should be reduced from 90 to 60 days. 5. NPFI also notes that 'Subject to an arbitration decision, the titleholder shall settle the claim in accordance with the decision within 60 days.' NPFI expresses concern regarding this proposal, noting that the proposed process could result in a very lengthy period (up to 120 days) before fishers receive monetary adjustment. This could cause severe financial and mental health impacts on affected fishers. NPFI recommends that the time period for payment of successfully arbitrated claims be reduced to within 30 days of completion of arbitration. In closing, NPFI notes that the draft protocols as proposed do not address specific commercial fishery concerns about the direct and/or indirect impacts of seismic activities on productivity of fisheries stocks and/or marine environment production systems. NPFI reiterates that identifying the impacts of seismic activity on these systems is a priority need for both commercial fishers and the oil and gas industry. NPFI recommends that both industries work together to develop and instigate research programs to address those needs as a matter of priority. Additional protocols to ensure fishers are properly compensated for any negative impacts of oil and gas exploration/activity on fisheries stocks and/or the marine environment on which those stocks rely should be developed accordingly.	
WA Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS-01	25/09/2020	Email	DMIRS 01_NERA CSEP Adjustment Protocol email.pdf	Information provided on the CSEP project and the Adjustment Protocol and a Spatio-Temporal Protocol. Have provided to NOPSEMA, DISER and DAWE. Requested if have any feedback. DMIRS replied 05/10/2020. Thanks very much for sending this through and keeping DMIRS informed on the Collaborative Seismic EP (CSEP) Project. As you would be aware, DMIRS don't get too many marine seismic surveys occurring in State	GAMEX is run by the Exmouth Game Fishing Club who was sent information regarding the CSEP. See Exmouth Game Fishing Club record under CSEP Consultation. Consultation with DMIRS for the CSEP is detailed under CSEP Consultation.

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					jurisdiction - In the past there have been four MSS occurring in State waters in the last 10 years and there was low commercial fishing effort in all survey areas (although one of the surveys east of the Muiron Islands had to be planned around the rec fishing event GAMEX). With this in mind, DMIRS don't have any specific feedback to provide on the draft Adjustment Protocol. DMIRS would be interested in looking at the Spatio-Temporal Protocol once it's ready for distribution and if NERA could keep us informed on any further progress on the CSEP Project that would be great.	
Adjustment and Operational Protocol Zoom Group	ZOOM-02	02/11/2020	Meeting	ZOOM-ADJ-DOC2 ZOOM-ADJ-Meet 2 email ZOOM-ADJ-Meeting 2 Discussion Points	Meeting 2: Zoom video meeting. Draft B Commercial Fishing Industry Adjustment Protocol discussion between CSEP project team and 9 commercial fishing industry licensee participants from fisheries active within the CSEP operational area. A background document detailing potential amendments to the Draft Commercial Fishing Industry Adjustment Protocol was sent out prior to the meeting. The amendments are a result of commercial fishing industry feedback on the draft protocol and supported by the consortium. Attendees: Southern Blue Fin Tuna Operator, EO Northern Prawn Fishing Industry Pty Ltd, Sea Harvest Fishing Company (mackerel fishery), Pilbara and Northern Demersal Scalefish Fishery Licensee, EO CFA, MG Kailis Group (Pilbara Fish Trawl)/Chair CFA, CEO CFA, WAFIC Representative, CSEP Project Team Members.	Feedback on Draft B Commercial Fishing Industry Adjustment Protocol, where appropriate was incorporated into the next version of the Adjustment Protocol Consultation.
Adjustment and Operational Protocol Zoom Group	OP-ZOOM-01	06/11/2020	Email	ZOOM-OP-EM1a CSEP Spatial Temporal seismic survey controls engagement background paper ZOOM-OP-EM1b	CSEP Spatial Temporal seismic survey controls engagement background paper was sent to the Zoom meeting 2 attendees (Stakeholder Record ZOOM-02) to commence engagement to develop suitable spatial and temporal controls with the commercial fishing industry. Based on feedback it was determined that background information would be provided and to meet to gather views around the factors that should be taken into consideration when planning seismic surveys under the CSEP.	Provision of information for the engagement with the fishing industry on developing CSEP spatial and temporal controls.
Adjustment and Operational Protocol Zoom Group	OP-ZOOM-02	2/12/2020	Meeting	ZOOM-OP-MEET1a CSEP Spatial Temporal seismic survey controls meeting background paper	Meeting held with Adjustment and Operational Protocol Zoom Group (see Stakeholder Record ZOON-02 invitees) to discuss spatial temporal seismic survey controls. Prior to the meeting the CSEP Spatial Temporal seismic survey controls meeting background paper was provided.	Outputs from this meeting were used to develop the draft Operational Protocol that was provided to the group for comment as per Stakeholder Record ZOOM-03.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-07	23/11/2020	Meeting	N/A	CSEP Project briefing at WAFIC for new WAFIC CEO. Full briefing on the CSEP Project goals and timeframes provided, including discussion regarding Draft Commercial Fishing Industry Adjustment Protocol and Draft Operational Protocol.	Consultation was maintained with WAFIC.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-08	05/02/2021	Email	WAFIC-OP-EM2 WAFIC-OP-DOC1	5/2/21: CSEP Project Team emailed Executive Officer Resource Access – Oil and Gas (WAFIC) with Operational Protocol Draft Rev B, for review and comment (WAFIC-OP-EM2, WAFIC-OP-DOC1). 11/2/21: WAFIC provide suggested edits.	WASFIC-08 details how WAFIC comments addressed.

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Western Australian Fishing Industry Council (WAFIC)	WAFIC-08	08/02/2021	Meeting	WAFIC-OP-EM3 WAFIC-OP-DOC2	Virtual meeting between CEO and Executive Officer Resource Access – Oil and Gas (WAFIC) and CSEP Project Team members to discuss progress with the Adjustment and Operational Protocols. 8/2/21: After meeting email from CSEP Project Team for next steps for the Adjustment and Operational protocols. Adjustment Protocol – some further engagement and then 2nd round of full consultation. Operational Protocol -updated word version (Rev C) provided (WAFIC-OP-DOC2). Also acknowledged comments regarding Commitment #2 and comments around peak spawning times and areas, with CSEP Project Team to follow up with DPIRD.	Operational Protocol -updated word version (Rev C) provided to WAFIC (WAFIC-OP-DOC2). WA DPIRD provided information on the spawning season and grounds for a range of indicator species (DPIRD-03)
Western Australian Fishing Industry Council (WAFIC) Commonwealth Fisheries Association (CFA) Northern Territory Seafood Council (NTSC)	WAFIC-09	08/02/2021	Email	WAFIC-OP-EM4	Following virtual meeting earlier in day between CSEP Project Team and WAFIC (WAFIC-08), an email was sent from WAFIC to NTSC and CFA with suggestion relating to WAFIC hosting a "one-stop-shop website", co-branded with NTSC and CFA, for the dissemination of information for seismic survey projects under the CSEP, as part of the Operational Protocol commitment for improved communications. CFA replied 9/2/21 that supported the idea but would not be able to host a site due to lack of resources.	The Operations Protocol contains a requirement to establish an easy to access portal, for example on the WAFIC or other nominated, suitably managed website, covering CSEP updates and seismic survey schedules to ensure at any one time, the most recent and correct information is readily available as soon as is practical. This will be developed in consultation with WAFIC, NTSC and CFA.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-10	11/02/2021	Email	WAFIC-OP-EM5	Follow up email from CSEP Project Team to Executive Officer Resource Access – Oil and Gas (WAFIC) requesting marked up comments in Word version of Draft Operational Protocol Rev C.	WAFIC provided comment on Draft Operational Protocol Rev C see WAFIC-11
Western Australian Fishing Industry Council (WAFIC)	WAFIC-11	15/02/2021	Email	WAFIC-OP-EM6 CSEP Operational Protocol Rev C2	Email from CSEP Project Team to Executive Officer Resource Access – Oil and Gas (WAFIC) with attached Word document of Draft Operational Protocol, Rev C2. Document included edits and amendments based on WAFIC's first review and comment. i.e., more descriptive text to control in Commitment 2 and changes to reduce maximum seismic survey activities overlapping regularly fished areas.	Draft Operational Protocol Rev C2 provided to WAFIC for comment.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-12	15/02/2021	Email	WAFIC-OP-EM7 WAFIC-OP-DOC4	15/2/21: Email from Executive Officer Resource Access – Oil and Gas (WAFIC) to CSEP Project Team (WAFIC-OP-EM7) with attached Operational Protocol Rev C2 Word document, including WAFIC comments and feedback (WAFIC-OP-DOC4). Email stated that the changes from Rev B to Rev C2 were "extremely disappointing, very little uptake especially in Commitment 2." Comments also regarding lack of understanding of "industry jargon" and what each spatial and temporal commitment might mean to commercial fishers. 16/2/21: CSEP Project Team responded to Executive Officer Resource Access – Oil and Gas (WAFIC) with thanks for the feedback and expressing disappointment that the revisions in Ver C2 were not better received. A proposed telephone call with Executive Officer Resource Access – Oil and Gas (WAFIC) and CSEP Project Team was suggested for the following day.	Rev D2 of the Operational Protocol amended based on WAFIC's feedback – see WAFIC-15.

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Western Australian Fishing Industry Council (WAFIC)	WAFIC-13	17/02/2021	Phone	N/A	Telephone discussion between Executive Officer Resource Access – Oil and Gas (WAFIC) and CSEP Project Team relating to Executive Officer Resource Access – Oil and Gas (WAFIC) latest feedback on the Operational Protocol. Agreement reached for further document revisions to meet Executive Officer Resource Access – Oil and Gas (WAFIC) perceived shortcomings in the content and commitments in the document.	Rev D2 of the Operational Protocol amended based on WAFIC's feedback – see WAFIC-15.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-14	18/02/2021	Email	WAFIC_05_Consultation support by WAFIC WAFIC 06 Consultation support	WAFIC going to send out updated adjustment protocol for Consultation Round 2 to commercial fishers.	CSEP Adjustment Protocol Draft C sent for 2nd round of consultation as per COMFISH-06.
Commercial Fishers – Adjustment Protocol	COMFISH-06	19/02/2021	Email/Mail	WAFIC-ADJ-EM9 WAFIC-ADJ-EM10 NPLH 03 CSEP Adjustment Protocol NTFISH-ADJ-DOC1 NTFISH-ADJ-DOC2 NTMAIL-ADJ-DOC2 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Round 2 commercial fishing industry consultation. Draft C5 Commercial Fishing Industry Adjustment Protocol emailed/mailed to all commercial fishing licence holders in fisheries active in CSEP operational area. Western Australia • Pilbara Trawl Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Line Fishery • Pilbara Crab Managed Fishery • Mackerel Managed Fishery • Northern Demersal Scalefish Managed Fishery • Kimberley Prawn Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery • WA Northern Shark License Holders were included though the fishery is currently closed. Commonwealth • Northern Prawn Fishery – via NPF Industry Pty Ltd • North West Slope Trawl Fishery • Western Deepwater Trawl Fishery • Western Tuna and Billfish Fishery Northern Territory • Aquarium Fish/Display • Coastal Line • Demersal • Offshore Net and Line • Spanish Mackerel • Timor Reef Also sent to: AFMA - AFMA-02 APPEA – APPEA-02 CFA - COMFISH-07 DISER - DISER-02	Feedback on Draft C Commercial Fishing Industry Adjustment Protocol was received from: AFMA – AFMA-02 DISER - DISER-02 IAGC – IAGC-02

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					DPIRD - DPIRD-02 FRDC - FRDC-01 IAGC – IAGC-02 NOPSEMA -NOPSEMA-02 NTDITT - NTDITT-02 NTSC - COMFISH-07 SETFIA - SETFIA-01 Ship Agencies Australia Pty Ltd (SAA) – SAA-01 WAFIC – COMFISH-06 WRLC - WRLC-02 Documentation: WAFIC-ADJ-EM9 – list of recipients of WAFIC mail out WAFIC-ADJ-EM10 – WAFIC email to commercial fishers NPLH 03 CSEP Adjustment Protocol – email from WAFIC to NPFI NTMAIL-ADJ-DOC2 – NT fishery licence holders NTFISH-ADJ-DOC1 – NT mail out NTFISH-ADJ-DOC2 – letter with NT mail out 2020 Aug 21 - NERA - Adjustment protocol – email for previous Adjustment protocol Draft B consultation NERA CSEP 2nd Consultation Draft - Cover Letter – letter from NERA regarding 2nd round of consultation. Adjustment protocol Draft C summary of changes – changes since last round of consultation on Rev B. NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft – updated Adjustment Protocol for review.	
Australian Fishing Management Authority (AFMA)	AFMA-02	19/02/2021	Email	AFMA 02 CSEP 2nd round adjustment protocol email Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment. AFMA replied 26.2.2021 that they had no comments.	No follow-up required.
Australian Petroleum Production & Exploration Association (APPEA)	APPEA-02	19/02/2021	Email	APPEA 02 CSEP 2nd round adjustment protocol email Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	For information. No feedback received.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
				NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft		
Commonwealth Fisheries Association (CFA) Northern Territory Seafood Council (NTSC)	COMFISH-07	19/02/2021	Email	COMFISH 07 NERA CSEP 2nd round adjustment protocol email 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	For information. No feedback received.
Commonwealth Department of Industry, Science, Energy and Resources (DISER)	DISER-02	22/02/2021	Email	DIIS 02 NERA CSEP Adjustment Protocol email Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment. DISER responded on 8.3.21 and notes their previous comments have been incorporated in this recent draft and they have also included some feedback/queries to address: Text on page 10, line 360; where it is not clear whether the titleholder will provide the monetary adjustment to the claimant (if successful) within 60 days of claim lodgement or within 60 days of the claim outcome being determined – this could be re-worded slightly to clarify. Independent claim assessor (p9, line 315) – there is no information as to how this assessor will be selected, or what experience/qualifications they will need to be deemed suitable. It may be worth providing a little more information on this issue, if possible (our previous comments on this remain current). 11.3.21 CSEP responded via email and phone call to discuss the selection/appointment of adjustment assessors. Explained that we had noted their input but had decided to keep the protocol as simple as possible and DIIS seemed accepting of the feedback.	Issue of selection/appointment of adjustment assessors discussed and no further action required.
WA Department of Primary Industries and Regional Development (DPIRD): Fisheries	DPIRD-02	19/02/2021	Email	DPIRD 02 NERA CSEP Project Draft Commercial Adjustment protocol Draft C summary of changes NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft NERA CSEP 2nd Consultation Draft - Cover Letter	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	For information. No feedback received.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Fisheries Research and Development Corporation (FRDC)	FRDC-01	20/02/2021	Email	FRDC 01 NERA CSEP Adjustment Protocol Consultation 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Communication on the CSEP Adjustment Protocol.	For information. No feedback received.
International Association of Geophysical Contractors (IAGC) note know called Energeo Alliance	IAGC-02	19/02/2021	Email	IAGC 02 CSEP 2nd round adjustment protocol email Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft IAGC 02 Feedback on version C4	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment. 11.3.21 IAGC provided feedback of a strategic nature.	Feedback on Draft C Commercial Fishing Industry Adjustment Protocol, where appropriate to the CSEP project feedback was incorporated into the next version of the Adjustment Protocol for consultation.
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	NOPSEMA-02	19/02/2021	Email	NOPSEMA 02 CSEP 2nd round adjustment protocol email Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	No feedback received.
NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division	NTDITT-02	19/02/2021	Email	DITT 02 Draft Commercial Fishing Industry Adjustment protocol Adjustment protocol Draft C summary of changes	Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	No feedback received.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
				NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft		
Ship Agencies Australia Pty Ltd (SAA)	SAA-01	20/02/2021	Email	SAA 01 NERA CSEP Adjustment Protocol Consultation.pdf 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Draft adjustment protocol was not received by this stakeholder during the first round of consultation. Draft C Commercial Fishing Industry Adjustment Protocol provided for comment.	No feedback received.
South East Trawl Fishing Industry Association (SETFIA)	SETFIA-01	20/02/2021	Email	SETFIA 01 NERA CSEP Adjustment Protocol Consultation 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Communication on the CSEP Adjustment Protocol.	For information. No feedback received.
Western Rock Lobster Council (WRLC)	WRLC-02	20/02/2021	Email	WRLC 02 Potential impacts on commercial fishing by seismic surveys 2020 Aug 21 - NERA - Adjustment protocol Adjustment protocol Draft C summary of changes NERA CSEP 2nd Consultation Draft - Cover Letter NERA CSEP Adjustment Protocol Draft C 2nd Consultation Draft	Communication on the CSEP Adjustment Protocol.	For information. No feedback received.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Western Australian Fishing Industry Council (WAFIC)	WAFIC-15	24/02/2021	Email	WAFIC-OP-EM8 WAFIC-OP-DOC5	Email from CSEP Project Team to Executive Officer Resource Access – Oil and Gas and CEO (WAFIC) (WAFIC-OP-EM8) with attached Rev D2 of the Operational Protocol (WAFIC-OP-DOC5), amended based on Executive Officer Resource Access – Oil and Gas (WAFIC) feedback on previous Ver C2 document, with specific reference to changes made to maximum number of survey vessel days that can overlap regularly fished fishing grounds each year.	Provision of Rev D2 of the Operational Protocol for comment.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-16	04/03/2021	Email	WAFIC-OP-DOC5 WAFIC-OP-EM9	4/3/21: Email from CSEP Project Team to Executive Officer Resource Access – Oil and Gas and CEO (WAFIC) with Operational Protocol Draft Ver D, amended based on WAFIC 2ND Review and prepared for circulation to wider commercial fishing "Zoom Group" for discussion at Zoom meeting planned for March 9th. Executive Officer Resource Access – Oil and Gas (WAFIC) requested delayed sending of Rev D to Zoom Group until the following day. Email received from WAFIC with comments (WAFIC-OP-EM9) relating to negative opinions of the temporal commitments in the latest draft (Rev D). Specifically, concerns regarding the proposed 180 day maximum cumulative 3D survey period per year over regularly fished fishing grounds. WAFIC suggested changes to cover email for Zoom meeting invitees to add comment that WAFIC did not have a position of support for the Operational Protocol and had raised numerous concerns.	Further engagement undertaken with WAFIC in relation to Commercial Fishing Industry Adjustment Protocol.
Adjustment and Operational Protocol Zoom Group	ZOOM-03	05/03/2021	Email	ZOOM-OP-EM1 WAFIC-OP-DOC5	Email from CSEP Project Team to the Adjustment Protocol Zoom Group invite including a covering letter, as edited by WAFIC (ZOOM-OP-EM1) and Operational Protocol Rev D for review prior to the Zoom meeting on 9.3.21 (WAFIC-OP-DOC5). The Operational Protocol was put together following the first spatial-temporal controls Zoom meeting (se Stakeholder Record OP-ZOOM-02). Letter also included reference to Draft C Commercial Fishing Industry Adjustment Protocol sent out on the 19 March 2021 for discussion.	Meeting invitation to discuss Operational Protocol Rev D and Draft C Commercial Fishing Industry Adjustment Protocol
Adjustment and Operational Protocol Zoom Group	ZOOM-04	09/03/2021	Meeting	ZOOM-OP-MEET1	Zoom Meeting to discuss both Draft C5 Commercial Fishing Industry Adjustment Protocol (Meeting 3) and Draft Version D of the Operational Protocol (Meeting 1). Attendees: EO Northern Prawn Fishing Industry Pty Ltd, Sea Harvest Fishing Company (mackerel fishery), Pilbara and Northern Demersal Scalefish Fishery, EO CFA, MG Kailis Group (Pilbara Fish Trawl)/ Chair CFA, EO WAFIC. CSEP Project Team. **Draft Adjustment Protocol discussion** Key issues raised: • Fish market price – clarified that it is fisher/boat/company specific. • Calculation of catch rates – need to think about changing entitlement across licences. Agreement to review.	Feedback on draft protocols, where appropriate was incorporated into the next versions for consultation.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					• Displacement – suggestion of default set payment rate as alternative option to providing all running costs. Already mentioned in draft protocol, agreement to investigate, won't hold up completion and circulation. • Should acknowledge that often survey arrangements change at short notice relating mostly to adverse weather or vessel availability. Agreement to review text. • Loss of catch assessment process does not take account of catch rate trends and consortium need to acknowledge that they accept that and once the protocol is in use, not back away from the assessment formula. Agree to raise with consortium. • Should beef up lines 172-177 in loss of catch to clearly leave the way open for fishers to negotiate alternative adjustment arrangements. Agreement to revise text. • Could include more detail on what the adjustment protocol "isn't". Agreement to review text. • Suggestion of payment not to fish – it was explained that this is not within the context of the adjustment protocol. **Draft Operational Protocol** Key issues raised: • Clarification sought on definition of "regularly fished area". Provided. • Informal communications still very important e.g. when seismic vessel arrives in survey area should contact nearby fishing vessels. (Covered under Commitment 1, Detail g.) • Commitments appear to be outer limits and representing the worst-case scenario. This is not consistent with the text in the front of the protocol, where it talks about "coexistence". Re 180 days, there needs to be interim steps involved. • Operational protocol represents worst case scenario and like the adjustment protocol, needs to be used as a last resort. • Commitment 1, Detail (c) – this puts an unfair and potentially unachievable requirement on commercial fishing peak bodies. Agreement to review text to reflect regulators as the source of information for dissemination. • Commitment 2 – Controls will affect separate fisheries differently and could they be tailored to each fishery. Answer was yes, but not possible within current project timeframe. • C2b) – Understood and no objections raised in meeting. • C2c) – NPF only open for 6 months of each year, so 180 days means entire fishing season could be covered by seismic, which is unacceptable. Controls to be reviewed based on variable length seasons.	

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					• Noting spatial & temporal commitments are (historical) worst case scenarios for each year, then combining commitments means that there could, in any one year, be more than previous busiest seismic years (consecutive). • Opportunity for fishers to engage directly with titleholders on survey timing needs to remain and not be replaced by Operational protocol. • Ongoing EP and protocol governance and maintenance costs raised and explained. • Suggestion of a round table with consortium, NOPSEMA and commercial fishers regarding CSEP and associated protocols ahead of its implementation. • C2c) - There should be no overlapping of seismic surveys with regularly fished grounds at all within a calendar year. • What sort of forward planning do O&G companies have available? This was explained. • Second suggestion of fishery specific Commitment 2 controls. • Second suggestion that the protocol should not limit existing interaction between commercial fishers and survey titleholders – and this should be included into the Operational protocol. • CSEP Team requested direct feedback on the Ops protocol from fishers to avoid a very iterative process with respect to establishing tolerable controls.	
Adjustment and Operational Protocol Zoom Group	ZOOM-05	17/03/2021	Email	ZOOM-OP-EM2	Email from CSEP Team to Zoom Group confirming that CSEP Consortium members are open to holding a roundtable discussion on the protocols once consultation was completed. Response received same day from Executive Officer Northern Prawn Fishing Industry Pty Ltd with thanks for the follow-up as requested during the Zoom meeting of March 9.	Close out of action for CSEP team from Adjustment Protocol Zoom Group – see ZOOM-04.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-17	23/03/2021	Email	WAFIC-OP-EM10	Email received from Executive Officer Resource Access – Oil and Gas (WAFIC) requesting an update on both the Adjustment and Operational Protocols due to impending departure from WAFIC and a need to compile handover material for a future replacement.	Response provided – see WAFIC-18.
Adjustment and Operational Protocol Zoom Group	ZOOM-06	27/03/2021	Email	ZOOM-OP-EM3 CSEP Commercial Fishing Operational Protocol Draft Rev F	Email from CSEP Project Team to the Operational Protocol Zoom Group with attached Operational Protocol Draft Rev F, requesting feedback up until April 9th. Email included list of amendments to the protocol from Rev E to Rev F resulting from feedback from Zoom meeting of March 9. Specific amendments included: • Minor changes to the introduction page format and structure • Additional definition to include "future appointed CSEP governance body".	Operational Protocol Draft Rev F provided for comment.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					• Commitment 1, detail a. changed to allow for a web portal other than WAFIC's web site, if needed. • Commitment 1, detail b. onus to provide updated information relating to changes to commercial fishing regulations removed from peak industry bodies. • Commitment 2 added a "primary control" for titleholders to work with commercial fishers to avoid most actively fished periods of any directly affected managed fishery. • Commitment 2, detail b. reduced the annual cumulative total size of 3D seismic surveys conducted under the CSEP from 60,000 km^2 to 40,000 km^2 in line with historic averages. • Commitment 2, detail c. defined the size limit on 3D seismic surveys to relate to Acquisition Area for added clarity. • Commitment 2, detail d. Changed from 180 days per annum for overlapping individual fisheries to 33% of the regulated fishing season to account for various fishery season durations. • Commitment 2, detail e. Added an exception to detail d. for Pilbara Trap and Trawl to only 25% overlap in any regulated season. • Commitment 2, detail f. Clarified difference between single phase multi-azimuth 3D surveys versus overlapping an existing 3D survey acquired previously in the same year. • Commitment 2, Note iii, added reference to the "future appointed CSEP governance body" and the protocol compliance monitoring role the body will undertake.	
Western Australian Fishing Industry Council (WAFIC)	WAFIC-17	31/03/2021	Email	WAFIC-OP-EM11 WAFIC-OP-EM12 CSEP Commercial Fishing Operational Protocol Draft Rev F	Email from CSEP Project Team to Executive Officer Resource Access – Oil and Gas and CEO (WAFIC) with requested status updates on the two draft protocol documents and the strategies going forward (WAFIC-OP-EM11). Also included attachment of amended Operational Protocol (Rev F) with changes resulting from March 9th Zoom Group meeting plus a summary of amendments within the email text. Response received from Executive Officer Resource Access – Oil and Gas (WAFIC) (WAFIC-OP-EM12) with comment that it is essential both protocols are circulated the fisheries in the "oil and gas zone" to ensure quality input is received, with hopes to achieve an outcome "which is workable/palatable for the commercial fishing sector".	Further engagement undertaken with WAFIC in relation to the Adjustment Protocol and Operational Protocol.
Adjustment and Operational Protocol Zoom Group	ZOOM-07	05/04/2021	Email	ZOOM-OP-EM4 ZOOM-OP-EM5	Emailed meeting invitation from CSEP Project Team to the Operational Protocol Zoom Group for a Zoom Meeting to be convened on April 7th to discuss the latest (Rev F) version of the Operational Protocol. (ZOOM-OP-EM4) 06/04/2021 - CSEP Project Team emailed Operational Protocol Zoom Group with meeting link and phone in details. (ZOOM-OP-EM5)	Invitation to Zoom meeting to discuss (Rev F) version of the Operational Protocol – See ZOOM-08.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Operational Protocol Zoom Group	ZOOM-08	07/04/2021	Meeting	ZOOM-OP-MEET2	Zoom video meeting to discuss Operational Protocol Rev F (Meeting 2) as amended based on feedback from the Zoom meeting of March 9. Attendees included: Executive Officer Northern Prawn Fishing Industry Pty Ltd, Seaharvest Fishing Company – mackerel fishery, MG Kailis Group (Pilbara Fish Trawl), Chair CFA, Pilbara Trap and Northern Demersal Scalefish fisheries, Executive Officer Resource Access – Oil and Gas (WAFIC), CEO of Commonwealth Fisheries Association, CSEP Project team Key issues raised: • Definition of Regularly Fished Area needs amending to remove reference to individual commercial fisher. Agreed to amend. • Protocol currently covers actions before and during seismic surveys, but not after in respect to notifying commercial fishers regarding performance of the protocol commitments. Suggestion to include a reporting process to inform commercial fishers regarding performance of titleholders against protocol commitments. Agree to include in protocol. • Could add statistical grid references into Appendix B. Agreed to consider. • Question regarding how noise modelling is being done under the CSEP. Took question on notice with commitment to respond via email to attendees. • Recommendation by commercial fisher to proceed to broader commercial fishing consultation as soon as possible. Agreed by CSEP project team. • Suggestion to include in protocol consultation cover letter reference that peak commercial fishing bodies have been and will continue to be engaged to protocol development process. Agreed.	Feedback on draft protocols where appropriate was incorporated into the next version for consultation.
MG Kailis Group	MGK-01	08/04/2021	Phone	N/A	Telephone conversation between CSEP Project Team and MG Kailis Group (Pilbara Fish Trawl) where he informed MG Kailis Group of new amendments to the Operational Protocol (Rev G) that had been made based on the feedback from the Zoom Group meeting the previous day, highlighting how each issue raised had been addressed.	For information.
NT Department of Industry, Tourism and Trade (DITT) - Fisheries Division	NTDITT-01	09/04/2021	Email	DITT-OP-EM1 DITT-OP-EM2	Email from CSEP Project Team to Manager Client & Corporate Services, Senior Licensing Officer, Fisheries Division, Department of Industry, Tourism and Trade, Northern Territory Government of Australia (DITT). Request seeking advice as to whether to remove duplicate license holder addresses from mailout of the Operational Protocol for the first round of commercial fishing licensee feedback. (DITT-OP-EM1). Response from Manager Client & Corporate Services, Senior Licensing Officer, Fisheries Division, DITT to CSEP Project Team advising to send only one copy of the Operational Protocol to licensees with the same address, regardless of whether license is for a different fishery or company. (DITT-OP-EM2).	Feedback in relation to send only one copy of the Operational Protocol to licensees with the same address undertaken.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Western Australian Fishing Industry Council (WAFIC)	WAFIC-18	12/04/2021	Email	WAFIC-OP-EM13 WAFIC-OP-DOC6	Email from CSEP Project Team to WAFIC CEO (WAFIC-OP-EM13) with attached proposed cover letter to accompany the draft Operational Protocol for the first round of full consultation with licensed commercial fishers (WAFIC-OP-DOC6). Response from WAFIC CEO that he was comfortable with the letter.	Finalisation of letter to accompany draft Operational Protocol for the first round of full consultation with licensed commercial fishers.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-19	14/04/2021	Email	WAFIC-OP-EM14 WAFIC-OP-DOC7 WAFIC-OP-DOC8 WAFIC-OP-EM15	Email from CSEP Project Team to WAFIC CEO (WAFIC-OP-EM14) with Operational Protocol documents to circulate to all relevant WA and Commonwealth commercial fishery license holders for seeking feedback (WAFIC-OP-DOC7, WAFIC-OP-DOC8) Response from WAFIC CEO that the aim was to send out on or before the feedback commencement date of April 19th (WAFIc-OP-EM15).	Finalisation of mail out for Operational Protocol for the first round of full consultation with licensed commercial fishers.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-20	19/04/2021	Email	WAFIC-OP-EM16 CSEP Operational Protocol Consultation List CSEP Operational Protocol Cover Letter CSEP Operational Protocol Rev G	WAFIC circulation email to WA and Commonwealth commercial fishing license holders operating in the "oil, gas and seismic" zone in Western Australia (WAFIC-OP-EM16) with requests for feedback on the attached Operational Protocol (Rev G). Email included direct contact details for CSEP Project Team. Feedback was requested by May 17th, 2021. Mail out to WA and Commonwealth fisheries in CSEP Operational Protocol Consultation List.	Draft CSEP Operational Protocol Rev G provided for comment.
Commercial Fishers – Operational Protocol	NTFISH-01	19/04/2021	Mail	CSEP Operational Protocol Cover Letter CSEP Operational Protocol Rev G CSEP Operational Protocol Consultation List NT Fisheries 01 Mailing List	Round 1 commercial fishing industry consultation (19 April – 17 May 2021) of Draft CSEP Operational Protocol Rev G circulated via mail to NT fishers mailing list (NT Fisheries 01 Mailing List). Mail out to NT fisheries in CSEP Operational Protocol Consultation List.	Draft CSEP Operational Protocol Rev G provided for comment.
Commercial Fishers – Adjustment Protocol	COMFISH-07	18/05/2021	Email/Mail	WAFIC-ADJ-EM11 WAFIC-ADJ-EM12 WAFIC-ADJ-EM13 WAFIC-ADJ-DOC12 COMFISH-ADJ-EM2 NTMAIL-ADJ-DOC3	Circulation of final Commercial Fishing Industry Adjustment Protocol to commercial fishers. Including a reminder that the CSEP Commercial Fishing Operational Protocol sent out on 19 April and concludes on 17 May, Email/letters sent commercial fisheries as per COMFISH-06 and also provided to WAFIC, NTSC and CFA. Documentation: WAFIC email to fishers (WAFIC-ADJ-EM11, WAFIC-ADJ-DOC12) WAFIC summary fishery licensee list (WAFIC-ADJ-EM12, WAFIC-ADJ-EM13) Distribution confirmation to WAFIC, NTSC and CFA (COMFISH-ADJ-EM2) and NT fishery licensee mailout list (NTMAIL-ADJ-DOC3).	Final Commercial Fishing Industry Adjustment Protocol provided.
Commonwealth Fisheries Association (CFA) Northern Territory Seafood Council (NTSC)	COMFISH-08	20/05/2021	Email	ZOOM-OP-EM9 ZOOM-OP-EM9a CSEP Operational Protocol Rev G	Email from CSEP Project Team to CEO WAFIC, CEO NTSC and CEO CFA (ZOOM-OP-EM9) to confirm that the full commercial fishing industry licensee round of consultation for the Operational Protocol had concluded and that there was no additional feedback received beyond that during the	No feedback from commercial fishers on the Draft CSEP Operational Protocol.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Western Australian Fishing Industry Council (WAFIC) Northern Prawn Fishery Industry Pty Ltd				CSEP Operational Protocol Consultation List	development of the protocol with the Zoom Group. A list of the commercial fisheries that received the consultation material was attached to the email, along with the circulated version of the draft protocol document (Rev G).	
Pilbara and Norther Demersal Scalefish Fishery Licensee 1 Northern Prawn Fishery Industry Pty Ltd	COMFISH-09	20/05/2021	Email	ZOOM-OP-EM6 ZOOM-OP-EM7 ZOOM-OP-EM8	Email from CSEP Project Team to stakeholder (ZOOM-OP-EM7) and Executive Officer (Northern Prawn Fishing Industry) (ZOOM-OP-EM6) requesting information relating to preferred map file formats and datums for inclusion in Appendix C of the Operational Protocol. Response received from stakeholder Fishing with confirmation that either KML or GPX files would be suitable for his navigation plotter (ZOOM-OP-EM8).	Request for information regarding map format for Operational Protocol.
Northern Territory Seafood Council (NTSC)	NTSC-04	20/05/2021	Email Phone call	NTSC 04 OP-EM1 CSEP Operational Protocol Cover Letter CSEP Operational Protocol Rev G	Email received by CSEP Project Team from CEO NTSC seeking confirmation on what consultation was done with the NT fisheries on the list (CSEP Operational Protocol Consultation List) and when/how it was done. CSEP Project Team replied 24.5.21 provided NTSC with cover letter and CSEP Operational Protocol Rev G that was sent out to the NT fisheries in the CSEP Operational Protocol Consultation List in April. CSEP Project Team would hold off sending final Operational Protocol until NTSC had confirmed with NT fishery committee chairs, they had received the material. NTSC also raised a question regarding CSEP sound modelling.	Provision of information in relation to NT fishery engagement on Operational Protocol. Information in relation to CSEP sound modelling is available in the CSEP Acoustic Modelling records section.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-21	26/07/2021	Email	WAFIC-OP-EM18 CSEP FINAL Operational Protocol Cover Letter_final_14Jul21 CSEP Operational Protocol Rev 1	Email from CSEP Project Team to WAFIC Industry Development Manager (WAFIC-OP-EM18) with copies of the final Operational Protocol (Rev 1) and cover letter for mailout to all relevant commercial fishers, to be circulated on Friday, July 30th. Response received from WAFIC Industry Development Manager with confirmation of intention to send out the documents on 30th July.	Preparation for mail out of the final Operational Protocol (Rev 1) mail out.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-22	27/07/2021	Meeting	N/A	Meeting at WAFIC with Industry Development Manager (WAFIC) and CSEP Project Team to demonstrate how the spatial and temporal control parameters within the Operational Protocol were derived. CSEP Project Team provided a presentation showing how all of the 2D and 3D seismic surveys were on the Northwest Shelf between 2010 and 2020 were analysed for timing, size and duration and that an approximate annual average was used to produce the final parameters. Industry Development Manager (WAFIC) reported being very comfortable that the process was robust and satisfied that the outcomes appeared fair and equitable.	Provision of information. No follow-up required.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-23	30/07/2021	Email	WAFIC-OP-EM19 CSEP Operational Protocol Consultation List CSEP Final Operational Protocol Cover Letter 14Jul21	Email from WAFIC to all WA and Commonwealth commercial fishers within CSEP Operational Area (WAFIC-OP-EM19) with final Operational Protocol and covering letter. Mail out to WA and Commonwealth fisheries in CSEP Operational Protocol Consultation List.	Final Commercial Fishing Industry Operational Protocol provided.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
				CSEP Operational Protocol Rev 1		
Commercial Fishers – Operational Protocol	NTFISH-02	30/07/2021	Mail	CSEP Operational Protocol Cover Letter CSEP Operational Protocol Rev G CSEP Operational Protocol Consultation List NT Fisheries 01 Mailing List	Final Operational Protocol and covering letter provided by mail to NT fishers mailing list (NT Fisheries 01 Mailing List). Mail out to NT fisheries in CSEP Operational Protocol Consultation List.	Final Commercial Fishing Industry Operational Protocol provided.
Commonwealth Fisheries Association (CFA) Northern Prawn Fishery Industry Pty Ltd Northern Territory Seafood Council (NTSC) Western Australian Fishing Industry Council (WAFIC)	COMFISH-10	30/07/2021	Email	ZOOM-OP-EM10 CSEP Final Operational Protocol Cover Letter 14Jul21 CSEP Operational Protocol Rev 1	Email from CSEP Project Team to CEO (WAFIC), EO (NTSC), CEO (CFA) and EO (NPFI) with copies of the final Operational Protocol and cover letter.	Final Commercial Fishing Industry Operational Protocol provided.
Australian Fishing Management Authority (AFMA)	AFMA-03	30/07/2021	Email	AFMA 03 OP-EM1 CSEP Final Operational Protocol Cover Letter 14Jul21 CSEP Operational Protocol Rev 1	Email from CSEP Project Team to Senior Manager Northern Fisheries, AFMA, that the CSEP Operational Protocol has been finalised and distributed to WA, NT and Commonwealth commercial fishery licensees active within the CSEP Operational Area. A copy of the letter and protocol was provided. Next steps for the project is Environment Plan consultation and currently in discussion with WAFIC and NTSC on a suitable commercial fishing industry framework to begin that process with copies of the final Operational Protocol and cover letter.	Final Commercial Fishing Industry Operational Protocol provided.
NT Department of Industry, Tourism and Trade (DITT) – Fisheries Division	NTDITT-03	30/07/2021	Email	DITT-OP-EM3 CSEP Final Operational Protocol Cover Letter 14Jul21 CSEP Operational Protocol Rev 1	Email from CSEP Project Team to Fisheries Manager, Fisheries Division, DITT, that the CSEP Operational Protocol has been finalised and distributed to WA, NT and Commonwealth commercial fishery licensees active within the CSEP Operational Area. A copy of the letter and protocol was provided. Next steps for the project is Environment Plan consultation and currently in discussion with WAFIC and NTSC on a suitable commercial fishing industry framework to begin that process.	Final Commercial Fishing Industry Operational Protocol provided.
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD-08	30/07/2021	Email	DPIRD-OP-EM1 CSEP FINAL Operational Protocol Cover Letter_final_14Jul21 CSEP Operational Protocol Rev 1	Email from CSEP Project Team to DPIRD Deputy Director General and Principle Management Officer, that the CSEP Operational Protocol has been finalised and distributed to WA, NT and Commonwealth commercial fishery licensees active within the CSEP Operational Area. A copy of the letter and protocol was provided. Next steps for the project is Environment Plan consultation and currently in discussion with WAFIC and NTSC on a suitable commercial fishing industry framework to begin that process.	Final Commercial Fishing Industry Operational Protocol provided.

Commercial Fishers CSEP Development

Note: Consultation records in this section are by date detailing the consultation undertaken with commercial fishers to provide input and review of the sections of the CSEP relevant to commercial fishers.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Northern Territory Seafood Council (NTSC) Commonwealth Fisheries Association (CFA) Western Australian Fishing Industry Council (WAFIC)	CFEP-01	11/06/2021	Email	CFEP 01 Consultation	NERA email to NTSC (CEO), WAFIC (Industry Development Manager) and CFA (CEO): To regroup and discuss where at with the NERA CSEP project, noting the Adjustment and Operational Protocols development is complete. Next task for the NERA CSEP team is to finalise the EP document and the formal process of submission and the public consultation on submission of the EP. We'd like to discuss with you the best way to move forward with the EP including consultation and information dissemination to the commercial fishing industry. 17.06.2021 - After receiving responses from WAFIC, NTSC and CFA, NERA confirmed meeting for 23 June 2021 with WAFIC and NTSC in attendance. See CFACSEP-01 as CFA advised they would leave for WAFIC and NTSC.	Information to engage with commercial fishers on CSEP.
Commonwealth Fisheries Association (CFA)	CFA-02	17/06/2021	Email	CFA 02 CSEP Consultation	17/06/2021 – CFA responded: I will leave discussions around the EP details to WAFIC, NTSC and individual Commonwealth fishery sectors bodies. I will still maintain an involvement at the NOPSEMA/DISER/DAWE discussions. 17/06/2021 – NERA responded that they would work with WAFIC and NTSC on the EP. 17/06/2021 – CFA responded: Still interested in how this CSEP will work and whether it will provide a model for other regions.	Ongoing information provided to CFA in relation to the CSEP.
Western Australian Fishing Industry Council (WAFIC)	CFEP-02	05/07/2021	Email	CFEP 02 Consultation Meeting	WAFIC email (cc to NTSC) with feedback following the meeting with NERA CSEP Team and NTSC on 23 June 2021: As discussed at the meeting, consultation with WAFIC, NTSC, WA and NT fishers on the CSEP project has focused on the operational and adjustment protocols and has not yet included anything on what else will be included in the EP, for example sound modelling, fish spawning, fish stock status, peak fishing times, air gun array volume, controls, pre-planning criteria etc. Can you also please provide clear guidance on the timeframes for this project. The Pre-Planning/criteria for each seismic survey should be clearly defined in the EP and may include (but not limited to): - Consultation process for each survey - Sound-modelling - Stock Status checking per annum – State of the Fisheries report is published each year - Under this EP only X number of surveys will occur each year - Regional meetings will be held per annum to discuss proposed surveys and timing for the next 12 month - Air gun array volume range - Impact controls	Feedback incorporated into CSEP Fishing Consultation Plan Phase 1B provided to WAFIC, NTSC and CFA (CFEP-03) that details the consultation to date, the process for engagement with the commercial fishing industry for the CSEP.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Northern Territory Seafood Council (NTSC) Commonwealth Fisheries Association (CFA) Western Australian Fishing Industry Council (WAFIC)	CFEP-03	08/07/2021	Email	CFEP 03 NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev B – Email CFEP 03 NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev B - For Review	CSEP email to WAFIC, NTSC, CFA: Based on the feedback from WAFIC and NTSC regarding EP development consultation with the commercial fishing industry we have developed a CSEP Fishing Consultation Plan Phase 1B (attached) for discussion and input. The document details the consultation to date, the process for engagement with the commercial fishing industry for input into the EP impact assessment and suggested workshops and timeframes. Note that the workshops topics and timeframes are suggestions and are open to change based on your feedback. It is suggested that the workshops are focused on demersal fish (see Table 6-1) as the other fisheries are mackerel (MMF), prawn and scampi (NWST, NPF, KPMF), pearl oyster and southern blue fin tuna. Consultation on the EP impact assessment on these species can be done through the relevant industry organisation. Again, this is open for discussion. In response to WAFIC's comments (CFEP-02): Guidance on timeframes for the project is provided in Table 2-1 of the document. Note the Project Execution Plan is being updated and once approved by the Consortium will be made available to you. The timeframes in the consultation document (Table 2-1) have been accepted by the Consortium. The aim of the workshops is to work through the topics you raised with alignment as how the outcome will be documented in the EP and managed for individual surveys. Please take some time to look at the document. Could you suggest a convenient time to discuss how to move forward? 09/07/2021 - WAFIC and NTSC both advised that they would respond in the next week. 14/07/2021 - NTSC provided feedback to the NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev B document.	Provision of CSEP Fishing Consultation Plan Phase 1B for discussion and input.
Northern Territory Seafood Council (NTSC) Commonwealth Fisheries Association (CFA) Western Australian Fishing Industry Council (WAFIC)	CFEP-04	22/07/2021	Email	CFEP 04 NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev B - Feedback and NERA Response CFEP 04 NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev B - For Review – Modified	CSEP responded to WAFIC and NTSC suggestions and proposed a meeting to discuss further: The following was provided: 1) A collated response to each of the comments (in red) below. 2) The Phase 1B Consultation Plan modified as per feedback received. Use 'Track Changes' to see the changes. The NERA CSEP consortium have endorsed the Phase 1B plan. We want to work with you both to complete Phase 1B of the project in a timely manner. Can I suggest we set up a short ZOOM/Team call next week to discuss: • Scope out the workshops and attendees. • Send out information regarding Phase 1B consultation and the workshops.	WAFIC and NTSC suggestions for CSEP Fishing Consultation Plan Phase 1B reviewed and document updated and provided for further comment.

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					• Discuss how we facilitate consultation with the other fishers identified.	
Northern Territory Seafood Council (NTSC) Western Australian Fishing Industry Council (WAFIC)	CFEP-05	05/08/2021	Meeting Email	CFEP 05 NERA CSEP Fishing Consultation Plan Phase 1 B Meeting 5 August 2021 – Email CFEP 05 NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev C CFEP 05 CSEP EP Commercial Fishery Workshops Presentation – Draft CFEP 05 CSEP EP Commercial Fishery Workshops Presentation Draft and WAFIC Feedback – Emails	CSEP Fishing Consultation Plan Phase 1B Meeting with WAFIC and NTSC on 5 August 2021. NERA sent meeting actions and amended NERA CSEP Commercial Fishers Consultation Plan Phase 1B Rev C requesting any additional comments. The actions from meeting are to design the EP workshop: • Using notes taken during the meeting, CSEP Team to draft up a strawman for the workshop • CSEP Team to add technical context • Test content with NTSC & WAFIC • Schedule multiple (4-6) online workshops about the CSEP 20/05/2021 – CSEP email following the 5 August 2021 meeting attaching a presentation for EP Consultation Workshops and requested feedback from WAFIC and NTSC. 25/08/2021 – WAFIC requested a change to slide 5. 25/08/2021 – NERA sent presentation with amended slide 5 for further review. 27/08/2021 – WAFIC sent further requested amendments to the CSEP EP Commercial Fishery Workshops Presentation providing DPBIRD Risk Assessment to be included in Slide 18.	Engagement with WAFIC and NTSC to develop CSEP Commercial Fishers workshop material.
Northern Territory Seafood Council (NTSC) Western Australian Fishing Industry Council (WAFIC)	CFEP-06	06/09/2021	Meeting Email	CFEP 06 NERA CSEP EP Commercial Fishing Workshops Meeting 6 Sep 2021 – Email CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice – Draft CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice - WAFIC Comments CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice - Draft 2 CFEP 06 NERA CSEP EP Commercial Fishing Draft Workshops Notice For Review CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice – Final CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice - Final for distribution CFEP 06 NERA CSEP EP Commercial Fishing	Meeting held with NTSC and WAFIC on 6 September. CSEP sent update email after the meeting regarding dates for workshops Invitations to go to WA, NT and Commonwealth fisheries within the CSEP OA. Notifying/inviting DPIRD, NT Fisheries and AFMA would be appropriate. CSEP team would update presentation as per meeting discussion. 07/09/2021 CSEP sent draft workshop notice and whether proposed workshop dates were acceptable to NTSC and WAFIC for feedback. 07/09/2021 WAFIC provided suggested changes and advised that they were happy for reference to be made that they would attend each workshop. 08/09/2021 CSEP acknowledged WAFIC's suggestions and requested NTSC feedback. 14/09/2021 NTSC provided feedback and CSEP confirmed that the changes requested by WAFIC and NTSC and attached the updated meeting notice for further review. 17/09/2021 CSEP sent final workshop notice for confirmation and a list of intended recipients to WAFIC and NTSC for feedback: Western Australia o Pilbara Trawl Managed Fishery o Pilbara Trap Managed Fishery o Pilbara Line Fishery o Pilbara Crab Managed Fishery o Mackerel Managed Fishery o Northern Demersal Scalefish Managed Fishery	Engagement with WAFIC and NTSC to develop CSEP Commercial Fishers workshop material and invitation.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
				Workshops Notice and Recipients - NTSC Comments CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice and Recipients - WAFIC Comments CFEP 06 NERA CSEP EP Commercial Fishing Workshops Notice - Final for distribution - Email	○ Kimberley Prawn Managed Fishery ○ West Coast Deep Sea Crustacean Managed Fishery ○ Marine Aquarium Managed Fishery ○ Fishing Tour Operators Commonwealth ○ Northern Prawn Fishery ○ North West Slope Trawl Fishery ○ Western Deepwater Trawl Fishery ○ Western Tuna and Billfish Fishery Northern Territory ○ Coastal Line Fishery ○ Aquarium/Display Fishery ○ Timor Reef Fishery ○ Spanish Mackerel Fishery ○ Offshore Net and Line Fishery ○ Demersal Fishery ○ Fishing Tour Operator Fishery ○ Special Permit (1) WAFIC CEO, NTSC CEO, CFA, NPFI, SBT, SBT Research, DPIRD, NT Fisheries, AFMA. 17/09/2021 NTSC responded with 'looks good'. 17/09/2021 WAFIC responded: The notice looks fine, let me know when you want me to press send. FYI - Fishing Tour Operators in WA are part of the recreational sector, you will have to go through Recfishwest or through the association https://www.marinetourismwa.com.au/ I'm not sure I have capacity to hold commercial and charter fishers in the boardroom and my preference would be the commercial fishers. 17/09/2021 CSEP noted WAFIC's response and advised that there was a separate mailout for the Tour Operators and would delete the 'attending in person' for the notice. 22/09/2021 CSEP email attaching the final workshop notice to WAFIC and NTSC for distribution:	
Commercial Fisheries EP Workshops - Australian Southern Bluefin Tuna Industry Association	CFEP-07	23/09/2021	Email	CFEP 07 NERA CSEP Workshops Meeting Set Up Email – Australian Southern Bluefin Tuna Industry Association CFEP 07 NERA CSEP Workshops Meeting Invitation – Australian Southern Bluefin Tuna Industry Association	CSEP Project Team invitation to Australian Southern Bluefin Tuna Industry Association for the CSEP Commercial Fisheries EP Workshop in October. Further emails regarding dates and availability. 23/09/2021 – NERA sent invitation for workshop on 14 October 2021. Further emails regarding availability at future workshops. 15/10/2021- NERA email offering to catch up one on one to go through the project.	Australian Southern Bluefin Tuna Industry Association did not attend Commercial Fisheries EP Workshops but was emailed workshop outcomes (CFEP-11) and CSEP for review.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
Commercial Fisheries EP Workshops - NT Fisheries	CFEP-12	23/09/2021	Email	CFEP 12 CSEP EP Workshops and WA DPBIRD Meeting Emails – NT Fisheries	CSEP Project Team invitation to NT Fisheries for the CSEP Commercial Fisheries EP Workshop in October and providing update on CSEP. 28/10/2021 – CSEP Project Team advised that the team was meeting WA DPIRD and extended an invitation if NT Government interested and available.	Invitation to Commercial Fisheries EP Workshops and Workshop with WA DPIRD and AFMA. No response.
Commercial Fisheries EP Workshops - AFMA	CFEP-08	05/10/2021	Email	CFEP 08 CSEP Workshops Meeting Invitation and Attendance Emails - AFMA	5/10/2021 – AFMA email expressing interest in attending one of the CSEP Commercial Fisheries EP Workshops in October. 05/10/2021 – NERA sent invitation for workshop on 12 October 2021. Further emails between NERA and AFMA regarding attendance at additional meetings in October and November 2021.	AFMA did not attend Commercial Fisheries EP Workshops but was emailed workshop outcomes (CFEP-11) and CSEP for review.
Commercial Fisheries EP Workshops -NPFI	CFEP-09	14/10/2021	Email	CFEP 09 CSEP Workshops Meeting Invitation and Attendance Emails – NPFI NERA CSEP Information Sheet April 2021	14/10/2021 – CEO NPFI request to register for CSEP EP Workshop on 19 October 2021. 15/10/2021 – CSEP Project Team advised invitation had been sent and attached a CSEP Information Sheet for background. 15/10/2021 – NFPI acknowledged receipt of email.	NPFI attended Commercial Fisheries EP Workshop (CFEP-11).
Commercial Fisheries EP Workshops	CFEP-10	14/10/2021	Email	CFEP 10 CSEP Workshops Meeting Invitation and Attendance Emails – RAPTIS NERA CSEP Information Sheet April 2021	14/10/2021 – A Raptis and Sons (Fishing Manager) advised they would be attending the CSEP EP Workshop on 19 October and requested background information. 15/10/2021 – CSEP Project Team sent a CSEP Information Sheet and a link to the NERA website for the Adjustment and Operational Protocols.	Raptis attended Commercial Fisheries EP Workshop (CFEP-11).
Commercial Fisheries EP Workshops	CFEP-11	22/10/2021	Meeting	CFEP 11 CSEP Workshops Outcomes and Presentation Email CFEP 11 CSEP EP Commercial Fishery Workshops Oct 2021 Outcomes – Draft CFEP 11 CSEP EP Commercial Fishery Workshops Presentation Oct 2021	Two CSEP Commercial Fishing Industry Workshops were held on 12.10.21 and 19.10.21 with attendees from: o Mackerel Managed Fishery o Northern Prawn Fishery Industry o NT Commercial Fisher Representative o Oceanic Trading o Paspaley Group of Companies o Raptis Seafoods o Sea Harvest Fishing Company o Tuna Australia o WAFIC The following did not attend but information from the workshops was provided to them: o Australian Southern Bluefin Tuna Industry Association (o AFMA o Marine Aquarium and Specimen Shell Fisher o NTSC NERA sent a copy of the CSEP EP Workshop Presentation (19 October 2021) and Draft Outcomes of the workshops requesting feedback. 25/10/2021 – WAFIC forwarded email to additional recipients as requested by NERA.	Outcomes from Commercial Fisheries EP Workshops provided.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD-05	21/10/2021	Email	DPBIRD 05 Commercial Fishing Workshop Email	CSEP Project Team Email to DPBIRD: Request to catch up to discuss the CSEP Environment Plan development and provide information on the commercial fishing workshops focusing on potential commercial fishing impacts and suitable controls to address those impacts. Key message from workshops was concern around long term potential impacts to fish stocks from seismic surveys – which would like to discuss in respect to the information flow through a CSEP 5 year EP and how best to interact with DPIRD, NT Fisheries and AFMA.	Information to set up meeting with fisheries departments to discuss outcomes from Commercial Fisheries EP Workshops.
Commercial Fisheries EP Workshops – WA DPIRD and AFMA	CFEP-13	12/11/2021	Meeting	CFEP 13 CSEP EP Commercial Fishery Workshops email CFEP 11 CSEP EP Commercial Fishery Workshops Oct 2021 Outcomes – Draft CFEP 11 CSEP EP Commercial Fishery Workshops Presentation Oct 2021	CSEP Team met with WA DPIRD and AFMA to go through the CSEP EP Commercial Fishery Workshop presentation and the outcomes. CSEP sent email to DPIRD and AFMA providing CSEP EP Commercial Fishery Workshop presentation and the outcomes and actions from the workshops held with commercial fishers. Confirmed that when the commercial fishing impact assessment section of the CSEP is sent to workshop attendees for review and input will also send to WA DPIRD and AFMA. This will be available on the 22nd November with comments requested by 17th Dec. The CSEP will document the annual review processes as we discussed and the engagement of the State and Commonwealth departments when there are changes to the fisheries over the 5-year period of the CSEP.	CSEP commercial fishing sections sent to WA DPIRD and AFMA (
EP Commercial Fishers Review	CFEP-14	22/11/2021	Email	CFEP 14 NERA CSEP Commercial Fishery Section Delay Email CFEP 14 NERA CSEP Commercial Fishery Section for Input Email CFEP 14 NERA CSEP Commercial Fishers Rev A For Input	Commercial fishing impact assessment section provided for review and input from attendees to the CSEP EP Commercial Fishery Workshop: o Australian Southern Bluefin Tuna Industry Association o AFMA o Mackerel Managed Fisher o Marine Aquarium and Specimen Shell Fisher o Northern Prawn Fishery Industry o NTSC o NT Commercial Fisher Representative o Oceanic Trading o Paspaley Group of Companies o Raptis Seafoods o Sea Harvest Fishing Company o Tuna Australia o WA DPIRD o WAFIC 22/11/2021 Email: At the CSEP Commercial Fisher Workshops we agreed to send out the commercial fishing impact assessment section of the CSEP to workshop attendees for review and input prior to the formal public comment period. This would be available on 22nd November, however, it has taken longer to put together so it will now be available on Thursday 25th November. This will push the comment period out till the	Provisions of commercial fishing impact assessment section provided for review and input from attendees to the CSEP EP Commercial Fishery Workshop. Feedback obtained from WAFIC (CFEP-15) and one commercial fisher (CFEP-16). Since providing the CSEP Commercial Fishing Section the percentage overlap calculations were reviewed as there were duplicate blocks counted in the original calculations. The resulted in the following changes: WDWT – original overlap was 12% this has increased to 15% as there was a reduction in the area that was fished when the duplicate blocks were removed. This was not identified as a significant change in area. Marine Aquarium and Specimen Shell Fishery – original overlap was 6.2% decreased to 2.6%.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					23rd Dec. As this is a busy time of year once you have received the document, please let me know if you will require additional time and if you want to catch up to review/discuss. 25/11/2021 CSEP email with commercial fishing impact assessment section of the CSEP attached. At the CSEP Commercial Fisher Workshops we agreed to send out the commercial fishing impact assessment section of the CSEP to workshop attendees for review and input with the aim to have a collaborative approach to the information that is provided in the CSEP. The document is larger than hoped so please let me know if you would like me to go over it with you or direct you to the sections relevant to your fishery. In relation to timing of comments we are looking to submit the CSEP in late February 2022 so if you can get comments prior to Xmas that would be good but if not, I will follow up in January 2022 as we will be finalising the EP content late Jan 2022. 11/01/2022 CSEP email following up on email of 25/11/2021 to see if anyone had comments or would like to catch in relation to the CSEP Commercial Fishery information. Noting that there had been comments received from WAFIC and NERA was meeting with them the following week. The plan is to finalise the EP content by the end of Jan 2022 for submission of the CSEP to NOPSEMA in February 2022.	
EP Commercial Fishers Review	CFEP-15	16/12/2021	Email	CFEP 15 NERA CSEP Commercial Fishers Section - WAFIC Feedback Email CFEP 15 NERA CSEP Commercial Fishers Section – NERA Response to WAFIC Feedback	WAFIC feedback on commercial fishing impact assessment section of the CSEP: Noted that only assessed the document at a high level, due to the volume of the information presented. CSEP response to feedback in red. • Page 28. The North West Slope Boundary is incorrect in the map, which means that the all the calculations will be incorrect - https://www.afma.gov.au/fisheries/north-west-slope-trawl-fishery and https://www.legislation.gov.au/Details/C2017G00026 CSEP: Updated. • Page 35. Please correct our name we are the Western Australian Fishing Industry Council – not Association. CSEP: Updated. • Page 122, 128, 149 etc. Review of stock status – please also include State of the Fisheries Report published annually by DPIRD - http://www.fish.wa.gov.au/About-Us/Publications/Pages/State-of-the-Fisheries-report.aspx CSEP: Control Measure 1 updated. • Page 120. There are better references regarding the distribution of pearling stock, perhaps refer to DPIRD – Dr Anthony Hart's publications. CSEP: Updated text as per Whalan et al. (2021) as Hart publication and it only talks in general terms about distribution of pearling stock. • Page 120. Based on the assessment that pearl stock distribution occur in the 40-60 metre water depths and these stocks contribute to the population, how have you	EP updated as per responses to WAFIC feedback. Note the change in the NWST to the updated boundary resulted in a change to the area of overlap with the CSEP OA. The original overlap was 80% and this has reduced to 72.5%.

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					accounted for the impacts to pearl stocks in those water depths, it is not clear in the EP. CSEP: Added the CSEP overlaps a very small area of water depths 40 m or less off Karratha and Broome, thus impacts could occur to a small proportion of pearly oysters within the waters < 40 m and waters > 40 m where pearl oysters are found but at much lower numbers. If impacts did occur to a small proportion of pearl oyster, significant impacts at a population level would be unlikely, as most of the population would be unaffected and able to maintain the population. • Page 152. "Displacement of fishing activities can be avoided by coordinating each party's activities so as not to restrict either party". It's not clear in the EP, that the displacement of commercial fishing operations are not always easily overcome by simply moving to another area to fish, as fish stocks distribution is not evenly spread over the boundary of the fishery. CSEP: Added to the Predicted impact section for Displacement of Commercial Fisheries and Damage to Fishing Gear: Displacement could result in reduced catches and income if a commercial fisher is required to move to another area to fish, as fish stocks distribution is not evenly spread over the boundary of a fishery. 17/12/2021 CSEP email thanking WAFIC for feedback and offering the opportunity to meet if more detail required. Further emails between NERA and WAFIC set up a meeting for 18 January 2022. 18/01/2022 CSEP met with WAFIC to discuss the email comments of 16/12/2021. 20/01/2022 CSEP email to WAFIC addressing the comments in WAFIC's 16/12/2021 email (see in red above) and summarising additional discussion from the meeting held on 18/01/2022 below. Identification of process for long term impacts to commercial fish catches: updated CM#1 Annual Review of Commercial Fisheries to include: • WA and NT reports. • Fishery association included in any consultation process to identify controls. • Process for when licence holder raises catch issues to titleholder outside of the timeframe of six months in the adjustment protocol.	

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
					CM#1a: Annual review of commercial fisheries — An annual review of the sustainability of fisheries will be undertaken to identify changes to stock status. The review will be undertaken within 1 month of the public release of the any of the following reports: • Status of Australian Fish Stock Report. • Status of Key Northern Territory Fish Stocks Report. • Status Reports of the Fisheries and Aquatic Resources of Western Australia. Where changes are identified consultation will be undertaken with the relevant fishery manager, licence holders and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant fishery fished area. In addition, where changes to a commercial fishing licence holder's catch are reported to a CSEP titleholder, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to identify additional controls that may be required prior to a seismic survey being conducted under the CSEP over the relevant licence holders fished area. Section 172 of the WA Fish Resources Management Act it is an offence to remove fish from any fishing gear or interfere with any fishing gear. I have included in the Section: Displacement of Commercial Fisheries and Damage to Fishing Gear. 27/01/2022 WAFIC advised that the comments and updated text provided was fine and thanked NERA for its time. 28/01/2022 NERA email to WAFIC: I will forward on the updated annual review control to Commercial Fisher (CFEP16). The CSEP will go to the consortium to review on the 7th Feb so we are currently looking at a mid to late March submission to NOPSEMA. We will send a last round of letters to all stakeholders, including commercial fishers, notifying them of when the submission will occur and the public comment period and will get your input etc.	
EP Commercial Fishers Review	CFEP-16	17/01/2022	Meeting Email	CFEP 16 NERA CSEP Commercial Fishers Section – Fisher Emails	CSEP team met with a commercial fisher on 17/01/2022 in relation to the CSEP Commercial Fishery information specifically in relation to when a licence holder raises catch issues to a titleholder outside of the timeframe of six months in the adjustment protocol. Based on feedback from fisher and WAFIC CM#1a: Annual review of commercial fisheries was updated to: Where changes to a commercial fishing licence holder's catch are reported to a CSEP titleholder in connection with a seismic survey conducted under the CSEP, consultation will be undertaken with the relevant fishery manager, licence holder and fishery association to discuss and evaluate the available information.	CSEP updated as per responses to fisher and WAFIC (CFEP-15).

Stakeholder	Stakeholder Record#	Date	Communication	Sensitive Information Record#	Description	Assessment of objection or claim
EP Commercial Fishers Review	CFEP-17	21/04/2022	Email	CFEP 17 02 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	NERA email to CSEP EP Commercial Fishery Workshop stakeholders providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. Sent to: ○ Australian Southern Bluefin Tuna Industry Association ○ AFMA ○ Mackerel Managed Fisher ○ Marine Aquarium and Specimen Shell Fisher ○ NT Commercial Fisher Representative ○ Oceanic Trading ○ Paspaley Group of Companies ○ Raptis Seafoods ○ Sea Harvest Fishing Company ○ Tuna Australia The following were provided an update separately: ○ Northern Prawn Fishery Industry – NPFI 04 ○ NTSC – NTSC 07 ○ WA DPIRD – WA DPIRD 07 ○ WAFIC – WAFIC 07	Provision of information. No feedback.

CSEP Acoustic Modelling

Note: Consultation records in this section are by date detailing the consultation undertaken in response to questions regarding to the CSEP acoustic modelling.

Northern Territory Seafood Council (NTSC)	NTSC-05	19/04/2021	Phone	NTSC 05 NERA CSEP Noise Modelling Phone Call with NTSC NTSC 05 CSEP NERA Noise Modelling Phone Call	19/04/2021 - Summary of telephone conversation between NERA CSEP Project Team Member and NTSC CEO. NTSC appreciated the phone contact to further discuss the issues around their recent email regarding noise modelling before responding by email. NTSC raised the issue in response to their recent engagement with an oil and gas company on an upcoming seismic survey. They have not explained how their noise modelling was done sufficiently and that they have not considered and /or responded to the Duncan report. NTSC said a key issue was that modelling needed to consider the noise emissions not in isolation for each pass but include the cumulative effects of before and after passes that are close by. NTSC thinks NERA's offer to contact CMST to discuss his report is a good idea ahead of responding via email. NTSC would like a response that explains how the CSEP modelling was done and takes into account and covers off on the elements of the Duncan report. NTSC also asked the CSEP Team member to contact a stakeholder to further understand the issue. 21/04/2021 Summary of telephone conversation with stakeholder regarding the CSEP project and the noise modelling issue raised by the NTSC: Issue 1: there is no industry standard or minimum requirements, for noise modelling and then reporting/information sharing with the commercial fishing industry. Issue 2: concerned at how the cumulative impacts of subsequent acquisition lines are modelled. As an example, that while lines could be 5 km apart, the return pass 24-30 hours later (depending on the size of the survey) could be 500m from the previous pass and that those impacts aren't clear or modelled. Agree that NERA talks with CMST and then we send them an email response outlining how the CSEP modelling/impact assessment has been done and including in the context of the Duncan report. Also noted that he hasn't seen the adjustment protocol so sending him the two protocols for information.	CSEP Project Team consulted with CMST (CMST-01) and provided a response to NTSC outlining how the CSEP modelling/impact assessment had been done including in the context of the Duncan report (NTSC-06).
Centre for Marine Science and Technology (CMST)	CMST-01	30/04/2021	Email	CMST 01 NERA CSEP Noise Modelling Meeting	CSEP email to CMST: Thank you for meeting and providing insight into your report titled "A comparison study of cumulative sound exposure levels (CSELs) from typical 3D seismic surveys'. Request to clarify figures. 30/04/2021 - CMST response: The two figs show the same thing but were calculated using different assumptions about the beam pattern of the array in the horizontal plane (the amount of sound energy that goes in each direction). Fig. 19 assumes the same amount of energy goes in every direction (i.e. the beam pattern is omnidirectional) whereas Fig. 22 uses the actual beam pattern for a typical array. Fig. 22 would be expected to be the more accurate of the two. Your notes are correct – the left side of both plots is the outside of the racetrack. Your 10 km buffer is therefore about right for	Emails between CSEP Project Team and CMST in relation to the CSEP modelling in the context of the Duncan report provided to NTSC (NTSC-06).

					scenario 3 for an omidirectional beam pattern but is conservative when the actual beam pattern is taken into account, as in that case the levels are reaching the threshold at about 5 km. I hope this helps 07/05/2021 – CSEP email to clarify notes in relation to what had been discussed and additional information that was agreed would be provided. Request for CMST to review and agree that the notes could be passed onto the NTSC and for them to be able to contact you to discuss if required. 07/05/2021 - CMST responded: Happy that your summary is an accurate reflection of what we talked about, and happy to be cc'd into your communication with NTSC and to discuss this matter with them if required. 07/05/2021 – NERA confirmed they would action accordingly.	
Northern Territory Seafood Council (NTSC)	NTSC-06	7/5/2021	Email	NTSC 06 NERA CSEP Noise Modelling Meeting 27 April 2021 Notes NTSC 06 NERA CSEP Noise Modelling Meeting 27 April 2021 Notes - NTSC Comments NTSC 06 NERA CSEP Noise Modelling Meeting 27 April 2021 Notes - Comments NTSC 06 NERA CSEP Noise Modelling Meeting 27 April 2021 Notes - CFA and Additional NTSC Comments	7/05/21NERA email to NTSC and stakeholder with notes of the 27 April 2021 meeting with CMST and subsequent emails regarding CSEP noise modelling. 20/05/2021 – NTSC response: Thanks for below, my query was raised in the Zoom meeting with regards to how is noise modelling is to be addressed in the consultation protocol. My email on the 7th April was to provide context as to why noise modelling is important from an industry perspective. Below does not answer that query and I note that the CSEP Operation Protocol V8 post my raising this question at the 7 April 2021 meeting still doesn't mention noise modelling. My question remains unanswered, yet you have just sent me a finalised version of the CSEP Operational Protocol which has been out for industry consultation (which I am unsure of what this was/when and to whom). 24/05/2021 NERA response to NTSC comments: Thank you for your email of 20 May and our telephone conversation this morning. Whilst you raised the sound modelling question in the 7 April zoom meeting, sound modelling does not sit within the Operational Protocol and is addressed within the Environment Plan (EP) for the CSEP. The EP is still under development and expected to be lodged over the next couple of months. There will be additional consultation for the EP, including the statutory 30 day period conducted by NOPSEMA after lodgement. To summarise our previous email response to you regarding sound modelling: There has been no new sound modelling conducted under the CSEP project, but a review of existing modelling available through CSEP consortium members and modelling that is publicly available. Based on a compilation of the modelling (>25 reports, refer figure below) for seismic source arrays from 2390 to 4130 cui the 186 dB SELcum threshold is typically reached within < 8 km with one modelled scenario being ~ 14 km. Based on this data, for the CSEP a distance of 10 km has been used as the area the maybe potentially impacted. In line with our previous discussion, the CSEP Project Team met with Dr Duncan, the author of the report titled "A comparison	Information on the CSEP modelling in the context of the Duncan report provided to NTSC. In addition, an overview of the CSEP modelling was provided in the CSEP Commercial Fishers Workshops (see Record CFEP-11). WAFIC, NTSC and CFA were consulted in the update of the Commercial Fishers Consultation Plan Phase 1B and development of the CSEP Commercial Fishers Workshops content (see records in CSEP Fishers CSEP Development).

study of cumulative sound exposure levels (CSELs) from typical 3D seismic surveys", a report commissioned by the NTSC. The aim of the meeting was to understand the outcomes of Dr Duncan's report and to discuss the CSEP modelling approach in the context of Dr Duncan's report. The email meeting notes from the discussion with Dr Duncan were provided in my earlier email.

The conclusion reached and agreed with Dr Duncan is that the CSEP distance of 10 km as the area the maybe potentially impacted is conservative when compared to the CSELs modelled output for the actual beam pattern for a typical array of about 5 km for the 186 dB SEL24h threshold. This position is consistent with the outcomes of Dr Duncan's report.

I trust that this information addresses your question regarding noise modelling.

24/05/2021 stakeholder response to NERA's email (24/05/2021):

For clarification the report was not commissioned to even consider the area that may be impacted. I will liaise with NTSC tomorrow but responses to date have not addressed any of concerns regarding sound modelling and use in risk assessment.

25/05/2021 NTSC response to NERA's email (24/05/2021):

Thanks for below confirming noise impacts are to be addressed in the EP (not the operational protocol) and to highlight some key areas of discussions between CSEP Project Team and Dr Duncan as follow up to my comment/email. I have gone back to the Project Execution plan 3 August 2018 (which I assume is still current??) and it is not clear to me if Phase 1B (Consultation and environmental assessment) has been completed or where/when we might be in progressing this.

One of the key issues raised by the seafood industry in this space is the concerns about the impacts of noise generated from seismic surveys on the marine fauna and flora. Statements in consultations (or EPs) such as the "fish swim away" or "no significant impacts" do not address the concerns raised by industry (and can heighten a lack of trust/confidence in the risk assessment process). Industry concerns have been in relation to both the short and long term effects and about inadequacies of the modelling information being provided to the risk assessment is an accurate reflection of what happens out of the water (i.e. it is not just a single pass for one area in 24hrs, depending on the size of the survey area and speed of the boat after a turnaround an area will receive more than one pass within 100m, 300m or 500m etc and that modelling for this cumulative noise exposure isn't done).

I appreciate there are scientific gaps in understanding the impacts, but how existing knowledge and modelling is fed into a risk assessment process is a key area of interest/concern. I would appreciate further information on how that will be addressed in this process, as it is not clear to me.

Also, is it the intention to provide relevant sections of the EP relating to noise modelling and the risk assessment prior to its lodgement?

26/05/2021 CFA email in response to NTSC's email (25/05/2021) supporting NTSC's comments in regard to sound modelling:

	This is a complex field of science and one that is still in it's relative infancy. As NTSC says the conclusions drawn from modelling can be quite simplistic and can lead to a lack of trust. It's also difficult and costly for the seafood industry to have modelling reviewed. I have been dealing with an EP in Bass Strait and looking at the potential impacts to scallops. I have questioned the modelling and to their credit the Oil and Gas company (in this case Beach) have agreed to run a ground truthing experiment during their survey to monitor sound at the seabed. Whilst it won't address concerns before the testing commences it's a responsible course of action by the proponent and will add to volume of science around noise intensity and impacts. (Note: Beach have also committed to additional research regarding alternative sound gun technology and impacts onspecific species, once again in order to build on our knowledge base). I am of the strong belief that this is the direction that oil and gas companies (and NOPSEMA) should be heading in this space. A final comment regarding NTSC's question about the relevant sections of the EP. I found it incredibly hard to find and review the data that was presented in the initial EP submission by Beach. Assistance from proponents around these key issues would also be greatly appreciated. 01/06/2021 NERA email in response to CFA and NTSC concerns: Thank you for your recent emails regarding sound modelling under the CSEP Project. As noted in my previous responses, sound modelling is dealt with in the Environment Plan (EP). After discussion with the project team, as a way forward to further consider these matters, we would like to provide the relevant sections of the EP, or the entire EP if preferred, for review by WAFIC, NTSC and CFA prior to lodgement with NOPSEMA. We expect the EP/sections to be available in 4-6 weeks. Prior to sending them out for review I will be in touch to arrange a catch up to walk through the construction of the EP and answer initial questions. 01/06/2021 NTSC response to NERA email (01/06/2021): Thanks for alerting us to the option to provide sections of the EP. However, I am concerned that a step has been missed which is the consultation of industry about issues or concerns to inform the EP's development. This doesn't appear to have been done yet. Could you please confirm if the 2018 project execution plan is current and if so, where are we at within the consultation and issues identification stage.

CSEP Consultation

Note: Consultation records in this section are by stakeholder detailing the consultation undertaken in the development of the CSEP.

Amateur Fishermen's Association of the Northern Territory (AFANT)	AFANT-01	12/04/2021	Email	AFANT 01 NERA CSEP Project NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Amateur Fishermen's Association of the Northern Territory (AFANT)	AFANT-02	6/04/2022	Email	AFANT 01NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Automatic response received from AFANT.	Provision of information. No feedback.
Arafura Bluewater Charters	ABC-01	18/05/2021	Email	ARAFURA 01 NERA CSEP Project NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet including a link to the NERA website and a map of CSEP Operational Areas. The email noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like. • If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list.	Provision of information. No feedback.
Arafura Bluewater Charters	ABC-02	6/04/2022	Email	ARAFURA 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Australian Communications Media Authority (ACMA)	ACMA-01	12/01/2021	Email	ACMA 01_Seismic Survey and Subsea Cables	Enquiry made as to whether marine seismic surveys pose a risk to subsea cables and if so what the risk is and any mitigations required as the project may require marine seismic surveys to be undertaken in the area of the North West Cable System. ACMA replied on the 21 Jan 2021 and advised that NERA contact Vocus to determine whether they have any concerns about seismic surveys being undertaken within the vicinity of the North West Cable System. A contact at Vocus was provided. NERA replied that they would follow-up with Vocus.	Consultation undertaken with Vocus. See stakeholder records for Vocus.
Australian Fishing Management Authority (AFMA)	AFMA-04	14/04/2022	Email	AFMA 04 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision to AFMA of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No feedback.

Australian Institute of Marine Science (AIMS)	AIMS-01	04/02/2021	Email	AIMS 01 NERA CSEP Project NERA CSEP Operational Areas Map NERA CSEP Information Sheet February 2021	Information sheet and map of operational areas sent in relation to the CSEP project. NERA is developing the CSEP and is engaging with AIMS to: • Identify any issues or concerns AIMS may have that need to be considered in developing the CSEP. • Identify areas where AIMS is undertaking or planning to undertake research within the CSEP Operational Areas and type of research planned or being undertaken. Obtain advice on other research organisations that are active within the CSEP Operational Areas. • Clarify ongoing information AIMS may require and consultation requirements for individual surveys. 3.3.21 Follow-up on previous email as no response.	Provision of information.
Australian Institute of Marine Science (AIMS)	AIMS-02	02/06/2021	Email	AIMS 01 NERA CSEP Project	AIMS provided feedback regarding the CSEP Project: This information was circulated to key areas of AIMS and we can advise we do not have any comments to offer on the CSEP project. We can confirm AIMS does undertake dive activities within 45 km of the proposed operational area you identified from time to time, and it is expected we would receive consultation from you to manage any future SIMOPS that may possibly be planned so we can address for our field programme. 04.06.2021 – NERA advised that once the CSEP is accepted and becomes operational the CSEP project team will implement a 6 monthly look-ahead to identify upcoming seismic surveys proposed to be conducted under the CSEP. This look-ahead can be provided to AIMS who can then determine which surveys they would like to be consulted on. Consultation will then be undertaken by the appropriate survey titleholder. 04.06.2021 – AIMS advised acceptance of the proposed 6 monthly look-ahead. 15.06.2021 – NERA confirmed it would be in contact once the CSEP was approved and a 6 month look-ahead was available.	Requirement for 6 monthly look-ahead included in Table 6-3: Ongoing stakeholder consultation and notification requirements.
Australian Institute of Marine Science (AIMS)	AIMS-03	06/04/022	Email	AIMS 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Confirmed that the once the CSEP is accepted and becomes operational the CSEP project team provide a 6 monthly look-ahead to AIMS.	Requirement for 6 monthly look-ahead included in Table 6-3: Ongoing stakeholder consultation and notification requirements.
Australian Maritime Safety Authority (AMSA)	AMSA-01	04/02/2021	Email	AMSA 01 NERA CSEP Project AMSA 01 AMSA Response	Information provided to Nautical Service regarding the CSEP project and detailing the following controls: • Australian Hydrographic Office (AHO) at datacentre@hydro.gov.au will be contacted no less than four weeks before the start of a seismic survey, with details relevant to the operations to allow for the appropriate Notice to Mariners (NTM) to be issued. • AMSA's Joint Rescue Coordination Centre (JRCC) at rccaus@amsa.gov.au will be contacted for promulgation of radio-navigation warnings at least 24-48 hours before the start of a seismic survey. The following will be provided:	Provision of information. AMSA response assessed and included in CSEP: Notification requirements included in Table 6-3: Ongoing stakeholder consultation and notification requirements. CM#26: Support Vessel CM#28: Navigation Act and Marine Orders CM#36: AIS Transponders CM#20: Marine Order 97: Marine pollution prevention – air pollution CM#24: Marine Order 96: Marine pollution prevention – sewage CM#25: Marine Order 95: Marine pollution prevention – garbage

					○ vessel details including name, callsign and Maritime Mobile Service Identity (MMSI)) satellite communications details including INMARSAT-C and satellite telephone numbers. ○ area of operation. ○ requested clearance from other vessels and any other information that may contribute to safety at sea. ○ when operations will start and end. • The AHO and JRCC will be kept up to date with any changes to seismic surveys. A support vessel will be engaged during seismic surveys to direct vessels away from the seismic vessel and streamers. • Survey and support vessels will maintain appropriate lighting, signals, navigation, and communication in compliance with the Navigation Act 2012 and associated Marine Orders. • Streamer tail buoys will be fitted with lights and radar reflectors. A visual and radar watch will be maintained on the survey and support vessel's bridge. • Vessel emissions, discharges and waste management will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL), the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and associated Marine Orders. Vessels will have a Shipboard Oil Pollution Emergency Plan with appropriate training, equipment and testing to ensure efficient implementation in the event of a spill. 4.3.21: AMSA replied we have received your email and are happy with the indicated control measures as outlined. 9.3.21 CSEP project replied thanks for the response and confirmation that are controls are appropriate. We will ensure that the CSEP includes these controls.	CM#39: SMPEP or equivalent
Australian Maritime Safety Authority (AMSA)	AMSA-04	13/04/2022	Email	AMSA 04 NERA CSEP Project NERA CSEP Information Sheet April 2022	Information provided to AMSA regarding the CSEP project and to confirm that controls provided in Feb 2021 were still appropriate. 20.4.21 AMSA replied asking to continue to provide AMSA updates regarding this project as appropriate.	Provision of information. AMSA included in Table 6-3 notification requirements for 6-monthly update as well as pre-survey notifications.
Australian Southern Bluefin Tuna Industry Association Ltd (ASBTIA)	ASBTIA-01	23/09/2021	Email	ASBTIA 01 SBT Spawning CSEP Adj Prot Rev 1 – Final Formatted	CSEP Project contacted ASBTIA to provided information on the CSEP Project, noting that whilst SBT isn't active within the CSEP Operational Area, there is a spawning ground that does overlap. Also noted that the Commonwealth Fisheries Association (CFA) had been involved in the consultation for the project to date regarding commercial fishing protocols relating to adjustment for lost catch, displacement and gear damage, and communication and spatial temporal controls for surveys conducted under the EP. 23/09/2021- ASBTIA responded: SBT purse-seine surface fishery is not active in the project area. The overlap with the spawning area is a little trickier to define and quantify for the purpose of lost catch/loss adjustment, we are data deficient in that area, though do have reasonable indications of spawning periods. 05/10/2021 – CSEP Project sent a map of the CSEP Operations Areas overlap with the spawning area and requested the sharing	Provision of information and confirmation that the CSEP OA does not overlap active fishery area of the SBT but does overlap CBT spawning area. ASBTIA did not attend Commercial Fisheries EP Workshops but was emailed workshop outcomes (CFEP-11) and CSEP for review. See Commercial Fishers CSEP Development records for further information.

					of information regarding spawning periods and any information relating to spawning. 07/10/2021 – CSEP Project point regarding loss of catch and attached CSEP Adj Prot Rev 1: The protocol developed to deal with loss of catch adjustment (copy attached) is based on a comparison of historical catch per unit of effort (CPUE) to a commercial fishers CPUE experienced during and up to 6 months after a seismic survey carried out under an approved CSEP project Environment Plan. So for SBT, a fisher would need to be fishing at the same time as a survey to potentially qualify for loss of catch adjustment. The long term absence of fishing activity in the CSEP operational area is also an issue we would need to address.	
Balanggarra Aboriginal Corporation	BAC-01	15/04/2021	Email	BAC 01 NERA CSEP Project	CSEP email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters including a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Balanggarra Aboriginal Corporation	BAC-02	13/04/2022	Email	BAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Received out of office till 19 April 2022.	Provision of information. No feedback.
Bardi and Jawi Niimidiman Aboriginal Corporation	BJNAC-01	18/05/2021	Email	BJNAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021 CSEP eBase BrowseOA AMPs	CSEP email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Bardi and Jawi Niimidiman Aboriginal Corporation	BJNAC-02	13/4/2022	Email	BJNAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Chevron Australia Pty Ltd	CVX-01	28/04/2022	Email	CVX 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	Information provided to Chevron in relation to the CSEP noting that the CSEP OA overlaps the Wheatstone 4D Marine Seismic Survey OA and timing period. As per the Wheatstone 4D Marine Seismic Survey EP the CSEP commits to a separation distance of 40 km between seismic sources. Requested that Chevron put the CSEP Feedback email (CSEPFeedback@nera.org.au) on the stakeholder list so that we get updates for Wheatstone 4D Marine Seismic Survey. Chevron replied that they had included the CSEP feedback email address to their notification. The Wheatstone 4D MSS is scheduled to occur late 2022 or early 2023 (subject to vessel availability and regulatory approvals) and the proposed duration is 75 days with more detail provided in a fact sheet).	Requirement for 6 monthly look-ahead included in Table 6-3: Ongoing stakeholder consultation and notification requirements. Information on Wheatstone 4D Marine Seismic Survey included in Table 5-18. CM#42: Seismic Survey Separation Distance included in Section 7.1.15 and Section 7.12.

					CSEP replied that they had included ABU Environment Plan Information email onto their list to provide 6 monthly updates which will let you know what surveys coming up.	
Commonwealth Fisheries Association (CFA)	CFA-03	14/04/2022	Email	CFA 03 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No reply.
Commonwealth Commercial Fishing Licensees	CCFL-01	14/04/2022	Email	CSEP Final Project Cover Letter Updated - Commercial Fishers NERA CSEP Information Sheet April 2022 WACFL 01 CSEP Final Project Fisheries	NERA letter to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Note email was sent by WAFIC on behalf of CSEP. Sent to Commonwealth fishery licence holders in the following fisheries: • Northern Prawn Fishery • North West Slope Trawl Fishery • Western Deepwater Trawl Fishery • Western Tuna and Billfish Fishery	Provision of information. No reply.
Dambimangari Aboriginal Corporation	DAC-01	15/04/2021	Email	DAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021 CSEP eBase BonaparteOA AMPs	NERA email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Dambimangari Aboriginal Corporation	DAC-02	13/04/2022	Email	DAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Department of Agriculture, Water and the Environment (DAWE): Seaports and Pest Marine	DAWEMP-01	04/02/2021	Email	DAWE 01 NERA CSEP Project NERA CSEP Operational Areas Map	Email from CSEP Team providing background to the CSEP Project including the CSEP Operational Areas map and a link to the NERA website. NERA is currently engaging with stakeholders as part of developing the CSEP. As per the NOPSEMA Guideline: Consultation with Agencies with Responsibilities in the Commonwealth Marine Area the Department of Agriculture, Water and the Environment - Biosecurity is a relevant agency where: • the movement of aircraft or vessels between Australia and offshore petroleum activities either inside or outside Australian territory.	Provision of information. No reply. Controls implemented to manage IMS risk are detailed in Section 7.9.

- the exposure of an aircraft or vessel (which leaves Australian territory not subject to biosecurity control) to offshore petroleum activities.
- the movement of goods or personnel to or from offshore petroleum activities.
- an offshore activity has the potential to transfer marine pests between installations and mainland Australia.

Seismic surveys conducted under the CSEP will be undertaken within Commonwealth waters and will typically consist of a seismic survey vessel with two support vessels. Vessels may be sourced from within or outside of Australia and will use ports such as Darwin, Broome, Dampier for crew change and resupply. Helicopters may also be used for crew change.

As detailed in the NOPSEMA Information paper: Reducing Marine Pest Biosecurity Risk through Good Practice Biofouling Management the following will be implemented for seismic surveys conducted under the CSEP to support Objective 1 of Australia's National Strategic Plan for Marine Pest Biosecurity (2018-2023) – 'Minimise the risk of marine pest introduction, establishment and spread':

- National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Australian Government, V1, 2009) and Guidelines for the Control and Management of a Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species (IMO, 2011) specifically:
  - vessels will be required to have a biofouling management plan and biofouling record book consistent with the guidelines.
- Australian Ballast Water Management Requirements (Australia Government, 2020) specifically:
  - vessel ballasting operations will be undertaken as per an approved Ballast Water Management Plan, where required.
  - international vessels entering Australian waters require an International Ballast Water Management Certificate.
  - vessels that carry ballast water must maintain a complete and accurate Ballast Water Record System (record book).
- Prior to a seismic survey commencing a biosecurity risk assessment will be undertaken to ensure that vessels have a low/acceptable level of risk. Where the risk is not low/acceptable level management responses will be implemented to reduce the risk to low/acceptable. The biosecurity risk assessment and management responses will be based on the requirements in the National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry and NOPSEMA's Information paper: Reducing Marine Pest Biosecurity Risk through Good Practice Biofouling Management.

NERA is developing the CSEP and is engaging with DAWE – Biosecurity to ensure all requirements in relation to biosecurity and marine pests are identified and implemented for seismic surveys.

					NERA provided the opportunity for DAWE to request further information or the opportunity to meet to discuss the CSEP project. 03/03/2021 – Follow up email to confirm DAWE had received previous email and whether any further information or a meeting was required.	
Department of Agriculture, Water and the Environment (DAWE): Seaports and Pest Marine	DAWEMP-02	13/04/2022	Email	DAWE 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	Information provided to DAWE regarding the CSEP project and to confirm that controls provided in Feb 2021 were still appropriate.	Provision of information. No reply. Controls implemented to manage IMS risk are detailed in Section 7.9.
Department of Defence (DoD) - Commonwealth	DoD-01	04/02/2021	Email	DoD 01 NERA CSEP Project DoD 01 CSEP Figures DoD 01 NERA CSEP DoD- advice to contact NOTAM DoD 01 CSEP military restricted airspace DoD 01 NERA CSEP DoD notifications	DoD provided with information regarding the CSEP, including a map of the operational areas (Defence CSEP Figures.pdf) identifying overlap with DoD training areas and requested DoD confirm if correct and how and when DoD would like to receive notification of activity commencement. 05/02/2021- DoD replied stating that Figures 2 and 4 were correct but there is also a large area of military airspace in Figure 3. A map of the military airspace was provided by DoD (DoD_01_ CSEP military restricted airspace.pdf). DoD advised there is a potential for unexploded ordnance (UXO) on or in the sea floor. Therefore, Permit holders should be aware of the risks involved in conducting offshore exploration and development activities. DoD also advised that a Notice to Airmen (NOMAN) was to be raised with Air services Australia when operating within a restricted airspace. DoD advised notification would be needed 5 weeks prior to the commencement of activities located within 40 km of an exercise area. Notifications to be provided to Offshore.Petroleum@defence.gov.au. DoD also advised that the Australian Hydrographic Service should be notified 3 weeks prior to commencement. 05/02/2021 – CSEP replied inquiring how the CSEP can be keep up to date with any DoD operations or practices within the CSEP operational area. Could DoD share information on a 6 monthly basis. 08/02/2021 - DoD advised that they cannot release an overview of activities in Defence Practice and Training Areas and that each survey proposal must be individually assessed. 12/02/2021 – CSEP responded stating that they would provide DoD with six monthly updates on likely surveys then further engagement can be undertaken on those surveys that may overlap DoD activities. The CSEP would also be updated with the information provided by DoD. 18/03/2021 – CSEP advised that the mapping team wished to update the mapping data in relation to defence training and restricted air space areas and requested whether DFAT could share shape files of this information. 19/03/2021 – DoD responded with links to Defence Training & Practice Area data and Restricted Airspace data.	Provision of information. Confirmation of DoD areas and maps updated. See Section 5.7.7. Notification requirement included in Table 6-3: Ongoing stakeholder consultation and notification requirements.
Department of Defence (DoD) - Commonwealth	DoD-02	13/04/2022	Email	DoD 02 NERA CSEP Project NERA CSEP Information Sheet April 2022	Information provided to DoD regarding the CSEP project and to confirm that controls provided in Feb 2021 were still appropriate. DoD replied that the requirements have not changed,	Provision of information. Confirmation of DoD areas and maps updated. See Section 5.7.7. Notification requirement included in Table 6-3

Department of Foreign Affairs and Trade (DFAT) - Commonwealth	DFAT-01	15/03/2021	Email	DFAT 01 NERA CSEP Project – DFAT Oil Spill risk to international jurisdictions DFAT 01 NERA CSEP Ops Areas and Spill EMBA NERA CSEP Information Sheet February 2021	15/03/2021 - Information provided to DFAT in relation to the CSEP, including map and NERA CSEP Information Sheet February. CSEP requested information from DFAT in relation to the arrangements the CSEP needs to detail for contacting DFAT in the event of a spill incident that poses a risk to international jurisdictions. 30/03/2021 - Follow up email as no response received from DFAT. 01/04/2021 - DFAT replied they were consulting within the Department. 30/04/2021- Follow up email as no further response received from DFAT. 18/05/21 - DFAT replied: In the unlikely event of a spill incident that poses a risk to international jurisdictions we request that you provide us with details of the incident as soon as is practicable by emailing sea.law@dfat.gov.au. We will act as a contact point with other areas of the Department (such as the relevant country sections) to provide further information on how NERA should contact and liaise with foreign governments at that time. 18/05/2021 - CSEP replied: We will include the reporting requirement into our environment plan and oil spill plan reporting requirements. 25/05/2021 - CSEP requested 24 hour contact number in the event of an oil spill and DFAT needed to be contacted.	Provision of information to confirm notification requirements for an oil spill that may enter international waters. Notification requirements included in CSEP OPEP.
Department of Foreign Affairs and Trade (DFAT) - Commonwealth	DFAT-02	13/04/2022	Email	DFAT 02 NERA CSEP Project NERA CSEP Information Sheet April 2022	Information provided to DFAT regarding the CSEP project and to confirm that notification details provided in March 2021 were still appropriate. 21/04/22 DFAT confirmed that notification details were correct.	Provision of information to confirm notification requirements for an oil spill that may enter international waters. Notification requirements included in CSEP OPEP.
Director of National Parks (DNP)	DNP 01	04/02/2021	Email	DNP 01 NERA CSEP Information DNP Feb 2021 DNP 01 NERA CSEP Information Email Feb 2021 NERA CSEP Operational Areas Map	CSEP provided information to Marine Parks in relation to the CSEP project and Australian Marine Parks. 03/03/2021 – A follow up email was sent including a map of the CSEP Project's Operational Areas. Following several emails between NERA and DNP a meeting was arranged with Marine Parks on 29 March 2021 - see stakeholder record DNP 02.	Provision of information.
Director of National Parks (DNP)	DNP 02	29/03/2021	Meeting	DNP 02 NERA CSEP Parks Australia Meeting 29 Mar 2021 Agenda DNP 02 NERA - DNP Presentation 29.3.21 DNP 02 NERA CSEP Parks Australia Meeting 29 Mar 2021 Minutes DNP 02 NERA CSEP Parks Australia Meeting 29 Mar 2021 email DNP 02 NERA CSEP Parks Australia Meeting 29 March 2021 Minutes - DNP Feedback DNP 02 NERA CSEP Parks Australia Meeting 29 March 2021 Minutes - Updated 14 May 2021	A meeting was held with Parks Australia and CSEP project team. 26.3.2021 CSEP provided agenda and presentation to attendees. 29.3.2021 CSEP provided minutes and actions from meeting. Actions or agreements from meeting were: • Ensure the CSEP identifies and assesses all marine park values (including cultural and ecosystems representative values) for those marine parks potentially impacted by a seismic survey i.e. within and outside the operational areas. No surveys or survey equipment (vessels, streamers) to go outside of the operational areas into marine parks that do not allow mining. • Identify and engage with indigenous groups who have cultural values within marine parks within the operational area or outside the operational areas that may be impacted by the seismic surveys.	Outcomes from meeting: CSEP identifies and assesses impacts to marine park values. Marine Park values are identified in Section 5.2.4. Assessment of impacts against values are: Acoustic emissions – Section 7.1.12 and Oil spill impacts – Section 7.10.2.3. Surveys and equipment cannot occur outside of the CSEP OA. The CSEP OA only overlap AMPs where zoning allows for mining. See Section 5.2.4. Indigenous groups as identified within Australian Marien Park plans where provided with CSEP information. See the following records: • Balanggarra Aboriginal Corporation- BAC-01, BAC 02 • Bardi and Jawi Niimidiman Aboriginal Corporation - BJNAC-01, BJNAC 02 • Dambimangari Aboriginal Corporation – DAC-01, DAC 02

	DNP 02 CSEP Operational Protocol Rev G DNP 02 CSEP Commercial Fishers Adjustment Protocol May 2021 DNP 02 NERA CSEP Parks Australia Meeting 29 March 2021 - Feedback and Follow Up Emails DNP 02 NERA CSEP Parks Australia Meeting 29 March 2021 - Follow Up Contact Details Email	• Assurance program so that Parks Australia could determine that controls to manage impacts to marine parks had been implemented. • Parks Australia to engage with NOPSEMA to ensure that Marine Parks assurance requirements are met in a manner that does not require seismic activities to have separate government inspection processes for environment plans. • Seismic data and research programs - use of data to inform marine park management. • Provide Marine Parks with a copy of the fisheries adjustment to understand and operational protocol for Parks Australia to understand engagement with commercial fishers and operational restrictions in relation to survey areas and timing between surveys over the same location. • Undertake engagement with tour operators within marine parks that maybe affected. • Keep Marine Parks informed of when the CSEP is ready for public comment and provide a copy to Marine Parks (CT) with guidance of which sections address marine park values, implementation and engagement with indigenous groups. 12.4.21 Parks Australia provided comments/follow-ups and suggested changes to the minutes (minor wording and clarifications). Noting that: On the one action for us, I can confirm that if DNP seeks to undertake additional assurance activities, where able, we will work with NOPSEMA to utilise the current inspection processes. 23.4.21 NERA acknowledged receipt for Parks Australia email and that they would reply to the email and send through updated minutes. 17.5.21 NERA sent updated minutes to reflect Parks Australia's suggestions and attached: Information on the comments in the minutes and a couple of requests to DAWE: • The CSEP has sent information to the indigenous groups who have cultural values within marine parks within the operational area or outside the operational areas that may be impacted by the seismic surveys. Contact details for the Bardi and Jawi Niimidiman Aboriginal Corporation could not be found, and DAWE has been contacted twice to obtain the contact details but have not yet had a reply. To date we have had no reply from any of the indigenous groups contacted. • Attached is the finalise adjustment protocol and the draft operational protocol which is out for consultation with fishers till the 19th May 2021. In the minutes DNP asked does the operational protocol outline how the survey locations will be decided each year? The survey locations will depend on the requirements of the CSEP members to meet their permit requirements. The operational protocol details the process by which survey schedules will be communicated such as online portal, annual industry forum, pre-survey notifications. The Commitment Table under Commitment 1 of the operational protocol provides this detail. • Last week DAWE sent the details of authorisation holders for the AMPS that the CSEP overlaps or is adjacent to. Information will go out this week to those authorisation	• Kimberley Land Council - KLC-01, KLC 02 • Miriuwung and Gajerrong Aboriginal Corporation - MGAC-01, MGAC 02 • NT Aboriginal Areas Protection Authority - NTAAPA-01 CSEP information was provided to Tour Operators based on the authorisation list DNP provided of operators who operate within AMPs. See Tour Operators records. CSEP provided to DNP to review see DNP 04.

					holders that have activities that could be potentially impacted. • In the minutes DNP asked "Will the DNP be consulted prior to the EP open for public comment? Or is that when we review the proposed EP? The CSEP can provided a copy of the EP prior to it going on public comment if that is DNP's preference. If this is DNP's preference, could you let me know how long you will need to review and provide comment? 17.5.21 Parks Australia advised they would chase down the contacts from within DNP / DAWE and get back to you. The following two points are noted. On the last point, 10 business days should be enough for us to provide any response, noting the consultation undertaken to date. Longer is always better. 17.5.21 Parks Australia provided contact details for Bardi and Jawi Niimidiman Aboriginal Corporation. 18.5.21 NERA responded: Thanks for the contacts for the Bardi and Jawi Niimidiman Aboriginal Corporation. I have sent information to both the Bardi and Jawi Niimidiman Aboriginal Corporation and KLC. If I don't get a reply I will follow them up. For the EP review – we will provide the EP and guidance of which sections address marine park values, implementation and engagement with indigenous groups, to yourself for a 10 business day review prior to submission to NOPSEMA. I will give you a weeks' notice as to when the EP will be ready for review.	
Director of National Parks (DNP)	DNP-03	30/04/2021	Email	DNP 03 NERA CSEP Marine Park Authorisation Holders Email DNP 03 CSEP Project - List of authorisations	NERA email requesting: the contact details of authorisation holders for the following Australian Marine Parks that our survey area overlaps or is adjacent to: • Oceanic Shoals • Joseph Bonaparte Gulf • Kimberley • Cartier Island • Ashmore Reef • Argo-Rowley Terrace • Mermaid Reef • Montebello • Ningaloo • Gascoyne Would we be able to get the following information: • Authorisation holder • Authorisation holder contact details • Authorisation number • Issue date • Expiry date • Marine park • Authorisation type • Primary activity • Secondary activity	CSEP information was provided to Tour Operators based on the authorisation list DNP provided of operators who operate within AMPs.

					13/05/2021 Parks Australia responded: Unfortunately, we are not able to provide authorisation holder contact details for privacy reasons. As discussed, you can access the list of authorisations issued on the website here. I have also compiled a more up to date list of the relevant authorisations in the attached excel document. (DNP 03 CSEP Project – List of authorisations). 17/05/2021 NERA acknowledged receipt.	
Director of National Parks (DNP)	DNP-04	28/03/2022	Email	DNP 04 NERA CSEP Review	Notification to DNP that the CSEP will be available for DNP review in the next week. 6/04/22 provided DNP link to a folder with a copy of the CSEP and the CSEP Existing Environment Addendum. Email provided detailing what sections of the CSEP and the CSEP Existing Environment Addendum cover marine parks values and assessment of impact. 13/04/22 email to check DNP had received access to the folder for the review of the CSEP and the CSEP Existing Environment Addendum. DNP replied that they had received the documents.	Provision of CSEP and the CSEP Existing Environment Addendum for review.
Director of National Parks (DNP)	DNP-05	29/04/2022	Meeting	DNP 05 NERA CSEP Review	Meeting held with CSEP Team and DNP to go over feedback on CSEP information provided in relation to marine parks. DNP followed up with written feedback as follows: *DNP comment:* Include sentence / amend final sentence to set maximum speed of vessel speed of 6 knots as per cetacean guidelines. We note the current the current speed is under this, but it is of use to include the maximum allowed for clarity. *CSEP Response:* have added in the controls section for vessels the following: The requirements to manage interactions between vessels, helicopters and cetaceans as detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be applied to vessels. This includes: • Travel at less than 6 knots within the cautionary zone of a cetacean (150 m radius for dolphins, 300 m for whales. • Do not approach closer than the caution zones for a cetacean. • If a cetacean shows signs of disturbance move away at a constant speed less than 6 knots. *DNP comment:* Table 7.1 Include a definition for the operation Seismic and Vessel. From the table it is assumed that the operation Seismic only includes the act of firing the airguns; whereas Vessel includes towing of the streamers themselves. If Seismic does include the act of deploying, towing and firing airguns I would then expect the aspect to mirror that of Vessel. *CSEP Response:* Section 7 updated to include the following: For the seismic operation impacts and risks associated with the deployment, towing and use of the seismic streamers and source are identified. For vessel operations impacts and risks always associated with the operation of the vessel during the seismic survey are identified. Table 7-1 updated, and a copy provided to DNP explaining that the differences between the identification of impacts/risks between the vessel and seismic operations are that the seismic	As per response to DNP the following were updated: • CM#18: EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans. • Section 7 and Table 7-1. • Section 4.3 Seismic Survey Areas.

					operations don't emit light or discharge waste water these come from the vessel not from the seismic equipment. *DNP comment:* Want to reiterate that should vessels need to transit through marine parks that have not been included in accepted EP operational area, it is our expectation that all equipment is stowed (i.e. streamers away). This includes where the vessel is turning / repositioning or exiting the field due to conditions at sea. The operational area is not just the firing of airguns, but the deployment of equipment – this is a distinction that we are making with all parties conducting seismic surveys. *CSEP Response:* Section 4.3 Seismic Survey Areas details that the Survey Operational Area (OA): an area encompassing the Active Source Area in which survey vessel activities other than actively operating the seismic source will be conducted, such as line turns, equipment maintenance and deployment/recovery, crew change and resupply. Have added to this: Should vessels need to transit through marine parks that are not within the CSEP OA all equipment is to be stowed (i.e., streamers away). This includes where the vessel is turning, repositioning, or exiting the field due to conditions at sea. *DNP comment:* We note that the Acceptability Evaluation Criteria is being used to determine predicted levels against acceptable levels of risk. Our only comment is that you note that Australian Marine Park thresholds, while taking into account such methodologies, may utilise stricter thresholds depending upon the values present, the level protection afforded to specific zones and the needs / pressures of the broader Marine Park Network(s). *CSEP Response:* As we have applied the values of the whole marine park, which depending on the park, will include the stricter thresholds which are typically applied to sanctuary, National Park and habitat protection zones we have taken into account these values associated with these more significant protected areas in the assessment. *DNP comment:* Is there further evidence available on the nutrients that are available from plankton and krill that die vs those that still alive? We note that impacts do not remove them from the food web; but it could conceivably have an impact on the nutrient density. We note that there is an underlying argument in this section that the impacts of seismic are within natural mortality rates *CSEP Response*: Of the studies undertaken in relation to plankton/krill and seismic surveys, impact on nutrient density has not been noted. Typically impacts associated with acoustic injury such as barotrauma or damage to external sensory hairs are not likely to impact nutrient density. DNP replied they appreciate your consultation with DNP to ensure marine park values are protected. Please keep us in the loop as to progress and will let you know should we have further questions or comments.	
Diversity Charters	DIVERSITY-01	18/05/2021	Email	DIVERSITY 01 NERA CSEP Project NERA CSEP Operational Areas Map	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet including a link to the NERA website and a map of CSEP Operational Areas. The email noted that: We are consulting with you as may undertake diving	Provision of information. No reply.

				NERA CSEP Information Sheet April 2021	activities within 45 km of the proposed offshore seismic survey operational area of the Collaborative Seismic Environmental Plan (CSEP) Project. It was identified that you undertake diving tours to the Rowley Shoals. Though seismic surveys will not be undertaken within the Rowley Shoals they may occur within 45 km of them (see attached map). The DMAC Safe Diving Distance from Seismic Surveying Operations Guidance recommends where diving and seismic activity are scheduled to occur within a distance of 45 km, it is good practice for all parties to be made aware of the planned activity where practicable. NERA is developing the CSEP and is engaging with you to ensure that we can undertake surveys in a manner that does not unduly impact on your business. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310.	
Diversity Charters	DIVERSITY-02	13/04/2022	Email	DIVERSITY 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Exmouth Game Fishing Club	EGFC-01	14/04/2021	Email	EGFC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet April 2021 including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No reply.
Exmouth Game Fishing Club	EGFC-02	13/04/20221	Email	EGFC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
INPEX Browse E&P Pty Ltd	Inpex-01	28/04/2022	Email	Inpex 01 CSEP Survey Timings	Request for status on Inpex 2D Seismic Survey WA-532-P, WA-533-P and WA-50-L. Inpex replied they are currently implementing the scope in WA 532 and expect to be finished in mid-May with no plans to revisit the area using this EP in 2023.	Section 5.7.4 Oil and Gas Facilities and Activities updated with information provided by Inpex.
Kimberley Land Council	KLC-01	18/05/2021	Email	NERA CSEP Information Sheet April 2021 CSEP eBase BrowseOA AMPs KLC 01 NERA CSEP Project	NERA email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Kimberley Land Council	KLC-02	13/04/20221	Email	KLC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Minderoo Foundation	MF-01	18/05/2021	Email	MF 01 NERA CSEP Project	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet April 2021 including map of CSEP Operational Areas and a link to NERA website. The email	Provision of information. No reply.

				NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	included a request that should the stakeholder require any further information or wish to provide feedback to contact the CSEP Project. The email noted that CSEP is consulting with Minderoo: as you may undertake diving activities within 45 km of the proposed offshore seismic survey operational area of the Collaborative Seismic Environmental Plan (CSEP) Project (see attached map). The DMAC Safe Diving Distance from Seismic Surveying Operations Guidance recommends where diving and seismic activity are scheduled to occur within a distance of 45 km, it is good practice for all parties to be made aware of the planned activity where practicable.	
Minderoo Foundation	MF-02	13/04/20221	Email	MF 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Miriuwung and Gajerrong Aboriginal Corporation	MGAC-01	15/04/2021	Email	MGAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021 CSEP eBase BonaparateOA AMPs	NERA email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Miriuwung and Gajerrong Aboriginal Corporation	MGAC-02	13/04/20221	Email	MGAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	NCWHAC-01	04/02/2021	Email	NCWHAC 01 NERA CSEP Project Consultation – Emails NCWHAC 01 NCWHAC Consultation NERA April 2021 NCWHAC 01 NERA CSEP NWHA Map NERA CSEP Information Sheet Feb 2021 NCWHAC 01 NCWHAC Consultation NERA April 2021 Letter	4.2.21 Information on the NERA CSEP, including the NERA CSEP Information Sheet and map of CSEP operational area in relation to the Ningaloo Coast World Heritage Area provided with a request to engage with the NCWHAC to provide an overview of the CSEP project and obtain the NCWHAC's feedback. 3.3.21 CSEP followed up. 14.4.21 Phone and left message. 16.4.21 NCWHAC email advising that they were appreciative of early engagement opportunity and would aim to get feedback to NERA in the next week. 19.4.21 NERA responded advising that they have met with the DBCA and are also engaging with Marine Parks. 3.5.21 Correspondence received from NCWHAC detailing: The role and members of the NCWHAC. The Ningaloo Coast World Heritage Area 'Statement of Outstanding Universal Value. The IUCN World Heritage Outlook assessment (2020) downgrading of the Ningaloo Coast from 'GOOD' to 'GOOD WITH SOME CONCERNS' is related to several significant threats affecting the OUV: climate change; oil and gas	Meeting held with NCWHAC to discuss feedback – see NCWHAC-02.

					exploration/development; increasing visitation; recreational fishing; and invasive species. With reference to the above-mentioned IUCN attributes that express the OUV and identified threats to the OUV, the Committee notes with concern in relation to the CSEP EP (operations and area scope), the potential impact of seismic surveys to the OUV, in particular the suggested reduction in the current minimum mitigation measures. Given the international importance of the Ningaloo Coast World Heritage property, the Committee recommends any activity or operation that has the potential to impact the OUV, both within and adjacent to the World Heritage property, be an appropriate distance from the NCWHA to ensure the integrity of the property remains intact. The Committee supports the implementation and use of buffer zones adjacent to World Heritage property boundaries which exclude operations and activities. For example, any proposals whereby operations or activities including seismic surveys are to be carried out within the buffer zone should be required to undergo an individual assessment. Should there be a reduction in mitigation measures in relation to the CSEP EP, the Committee recommends project proposals are supported by a comprehensive literature review which includes recent literature and research to ensure proposed activities will not adversely impact the OUV, both within and adjacent to the World Heritage property. 5.5.21 CSEP replied to arrange to discuss some of the points raised in the letter to ensure we have a clear understanding of the committees' expectations. 17.5.21 NERA followed up regarding dates for a meeting to discuss the points raised in the letter.	
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	NCWHAC-02	21/07/201	Meeting	NCWHAC 02 NERA CSEP Project Consultation Meeting 21 July 2021 Outcomes	CSEP Project Team met with NCWHAC to discuss the points raised in NCWHAC's consultation letter (April 2021). 21/07/2021 NCWHAC email advising that the committee appreciates the opportunity to provide further feedback on the CSEP in relation to the outstanding universal value of the Ningaloo Coast World Heritage Area and would be interested in viewing any draft strategy/environment plan prior to submission to NOPSEMA. Further contacts were given who may be of use to provide further feedback to the CSEP proposal. 22/07/2021 CSEP Project Team responded that they would get a plan together and speak with the contacts provided. CSEP Project Team advised they would keep NCWHAC in the loop going forward and once they had a plan, they would see what points the NCWHAC would like to be involved/provide feedback.	Meeting to provide and discuss information regarding the CSEP.
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	NCWHAC-03	28/03/2022	Email	NCWHAC 03 NERA CSEP Project NERA CSEP Information Sheet March 2022	Update in relation to the NCWHAC had raised concerns about the potential impacts of seismic surveys on the outstanding universal value of the NCWHA. On review of potential impacts to the NCWHA the following exclusion zone will be put in place: • The acoustic source will not be operated within 70 km of the NCWHA. This 70 km exclusion zone is based on the furthest distance to a noise effect criteria for receptors other than for whales.	Provision of information in relation to CM#6 NCWHA Exclusion Zone and CM#14: Marine Mammal Exclusion Zones to ensure no impacts to the outstanding universal value of the NCWHA.

As the furthest distance to a noise effect criteria for whales ranges from metres up to 100 km, a whale exclusion zone will be applied during the period when pygmy blue whales and humpback whales are present with biologically important areas off Ningaloo as per the below:

- There will be no operation of the seismic source within 100 km of a humpback whale BIA during the following periods:
  - Exmouth Gulf BIA: August to end of November to take into account that humpback whales reach the north-west marine region in early June (TSSC 2015) and adults and calves leaving Exmouth Gulf by the end of November (Irvine and Salgado Kent 2018).
  - Migration BIA within the Carnarvon Operating Area: June to the end of November to take into account that humpback whales reach the north-west marine region in early June (TSSC 2015) and adults and calves leaving Exmouth Gulf by the end of November (Irvine and Salgado Kent 2018).
- There will be no operation of the seismic source within 100 km of a pygmy blue whale BIA during April to August and October to December to take into account that pygmy blue whales migrate north from the Perth Canyon / Naturaliste Plateau region in March / April reaching Indonesia by June where they remain until at least September. Southern migration from Indonesia may occur from September and finish by December in the subtropical frontal zone after which the animals may make their way slowly northwards towards the Perth Canyon by March / April (DoE 2015).

The whale exclusion zone distance of 100 km may be lessened if survey specific underwater acoustic modelling is undertaken and the furthest distance to a low-frequency whale sound effect criteria (relevant to humpback and pygmy blue whales) is less than 100 km. The acoustic modelling must be undertaken using a numerical model as detailed in NOPSEMA Information Paper (N-04750-IP1765 A625748) Acoustic Impact Evaluation and Management. This still affords protection to pygmy blue whales and humpback whales as the impact criteria will not be exceeded within a BIA.

If there is a situation where the survey specific underwater acoustic modelling furthest distance to a low-frequency whale sound effect criteria is less than 70 km, the exclusion zone where the acoustic source will not be operated within 70 km of the NCWHA remains.

No new acoustic modelling was conducted for the CSEP project, but a review of existing modelling, available publicly or from CSEP consortium members, was undertaken to identify distances to published sound effect criteria. The review was based on a compilation of the modelling (20 surveys with 69 modelled locations) for seismic source arrays from 2360 to 4130 cui and waters depths from 38 m to 959 m. Hence, why a caveat has been added for if site specific modelling is undertaken, however, the 70 km exclusion zone from the NCWHA will always be in place.

Requested feedback or to discuss these controls.

Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	NCWHAC-04	13/06/2022	Email	NCWHAC 04 NERA CSEP Project NCWHAC 04 NCWHAC Consultation NERA CSEP June 2022 NCWHAC 04 NCWHAC Consultation NERA CSEP 24 June 2022	NCWHAC provided the following feedback on the information provided to them relating to exclusions zones to protect the universal value of the NCWHA. They commended NERA on the implementation of exclusion zones from the NCWHA and the mitigation of potential impacts to the outstanding universal values. They requested more information on the following points which was provided in a letter (NCWHAC 04 NCWHAC Consultation NERA CSEP 24 June 2022). 1. To understand the justification for lessening the whale exclusion zone distance to less than 100 km and therefore seeks further advice on how the modelling will be reported or declared by the proponent. *CSEP Response:* The whale exclusion zone of 100 km was determined based on the furthest distance to the noise effect criteria for whales from existing proponent acoustic modelling. These distances ranged from 2 km to 92.6 km with the majority between 10 km and 60 km (Figure 7-50 distance to SEL24h for low frequency whales provided). If a proponent commissions survey specific modelling which shows that the furthest distance to the noise effect criteria for whales is less than 100 km, they would be able to use this more accurate distance for their survey. In the specific case of the NCWHA, the 70 km exclusion zone from the NCWHA would override any survey specific modelling. The modelling and change in whale exclusion zone will be reported or declared by the proponent by: Pre-survey review of the controls within the CSEP to identify those that are applicable to a survey including detailing exclusion zones. • Proponent to complete a Pre-survey CSEP Review Form that is reviewed by the CSEP Consortium Steering Committee to ensure that the survey meets the CSEP requirements. • NOPSEMA inspection of seismic activities where a proponent would need to provide information on any site-specific modelling and a change in the whale exclusion zone. • Survey Performance Report. A proponent is required to submit a performance report to NOPSEMA at the end of a survey detailing their performance against the CSEP controls for the survey. This would include detailing how a change in the whale exclusion zone was implemented. 2. Clarification around the approvals process for the EP, such as whether the EP will be provided to NOPSEMA for consideration and adoption. *CSEP Response:* The CSEP will be submitted to NOPSEMA for assessment, and acceptance if it meets the requirements of the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations. On submission of the CSEP to NOPSEMA it will go on a 30-day public consultation period. Any submissions received during this period are required to be addressed in an updated version of the CSEP and resubmitted to NOPSEMA for assessment. A link was provided to were you can register to be notified of new environment plans that are released for public comment. 3. Recommended sharing this information with the lead state regulator, the Department of Mines, Industry Regulation and Safety (DMIRS) which control seismic approvals in waters	Responses were provided to NCWHAC. As the response were clarifications no updates to the CSEP were required.

					adjacent to the boundary to enable consistency across jurisdictions. *CSEP Response:* The CSEP Project Team has engaged with DMIRS in relation to the CSEP since September 2020. The CSEP Project Team met with DMIRS in April 2022 to provide an update on the CSEP and the controls to be implemented to managed impacts and risks associated with seismic surveys. The CSEP Project Team will continue to provide DMIRS updates in relation to the CSEP and is required under the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations to notify them of any surveys that will be conducted under the CSEP.	
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	NCWHAC-05	11/07/2022	Email	NCWHAC 05 NERA CSEP Consultation Aug 2022	NCWHAC replied that in relation to the information provided in NCWHAC-04 the Ningaloo Coast World Heritage Advisory Committee would like to be notified of any seismic surveys conducted under the CSEP EP, relevant to the Ningaloo Coast World Heritage Area. The Committee would also like the opportunity to review any results from monitoring under the EP. 12.7.22 CSEP responded with some clarifications: Regarding notification of seismic surveys, we can put the committee on the 6 month look ahead (which will cover all proposed surveys) and the 3 month 'notice of intent' for proposed surveys within 100 km of the Ningaloo Coast World Heritage Area, would that be suitable? For any results from monitoring under the EP. Is this for all surveys or those say within 100 km of the Ningaloo Coast World Heritage Area. And for monitoring results are you meaning any fauna sightings or any noise monitoring? 26.7.22 NCWHAC replied: Regarding notifications of seismic surveys, please be advised the NCWHAC advises early consultation for the proposed seasonal time is the most effective way the NCWHAC can be involved. The proposed 6-month outlook and 3-month intent are probably too late to change should the intent be inappropriate. Regarding monitoring fauna sightings, the NCWHAC would like the results to include both fauna sightings and noise monitoring. The NCWHAC recommends the inclusion of power down/shuts downs. The NCWHAC is interested in other monitoring which demonstrates current and potential impacts on other attributes of the NCWHAC, such as whale sharks, migratory fish etc.. 28.7.22 CSEP replied: Regarding notifications of seismic surveys, if you would like a longer look ahead we can provide an annual update for seismic surveys proposed under the CSEP in addition to the 6-month outlook and 3-month intent. Regarding monitoring if we put the commitment as we will provide NCWHAC with any fauna sightings data, noise monitoring and other monitoring relevant to the attributes of the NCWHA, such as whale sharks, migratory fish etc. Also, the EP already covers the use of power downs and shutdowns. Could you let me know if the above is acceptable to the NCWHAC. 12.8.22 NCWHAC replied. 1. Thank you for accommodating timeframes for notification for seismic surveys, the time frame required by the	Requirements to provide annual and 6-monthly look-ahead to and applicable monitoring data NCWHAC included in ongoing consultation and notifications in Table 6-3.

					committee will depend on when time frames can be altered in response to any potential concerns. As suggested, an annual update may allow for any advice to be addressed. 2. Regarding monitoring, the commitment below does not clarify what monitoring will be routinely undertaken (i.e. are all fauna sightings recorded or just whales, are whale sharks routinely recorded, is noise monitored continuously and where is it monitored from etc. 15.8.22 CSEP replied: 1. Regarding the monitoring. Routine monitoring consists of recording and reporting fauna sightings including whales, whale sharks and turtles. Other monitoring such as noise may be undertaken depending on the survey requirements but this is not routinely undertaken. 2. We can provide routine fauna sighting data (whales, whale sharks and turtles) for a survey and as part of the notification process for any surveys could let you know what non-routine monitoring such as noise is being undertaken and can then share the results.	
Northern Prawn Fishery Industry Pty Ltd	NPFI-04	14/04/2022	Email	NPFI 04 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No reply.
NT Aboriginal Areas Protection Authority	NTAAPA-01	17/02/2021	Email	AAPA 01 NERA CSEP Information Sheet February 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. NERA requests departments requirements for engagement. AAPA responds on February 17 stating the Aboriginal Areas Protection Authority is established by the Northern Territory Aboriginal Sacred Sites Act 1989 (the Act) and that the activities of the CSEP are within Commonwealth waters beyond the jurisdiction of the Act. If there are possibility of impacts on scared sites within coastal waters refer to the Authority and Act and a link provided. NERA responds to say this advice will be taken as part of our risk assessment.	Provision of information. No impacts to sacred sites were identified from the potential impacts in State waters of by light, underwater sound or in the unlikely event of an oil spill.
NT Chief Minister and Cabinet	NTCMC-01	17/02/2021	Email	CMC 01 NERA CSEP- NT government departments consultation NERA CSEP Information Sheet- February 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. Requests departments requirements for engagement. 3.3.21 CMC replied, stating that they had circulated the email to relevant managers and were waiting on feedback. NERA asked if these managers included the Chief Minister and Cabinet - Oil and Gas Division, as their email was rejecti.ng (noting a follow up email had been sent on March 3).	Information provided to CM&C Gas Taskforce (Record NTCMC-02)

					4.3.21 CMC advised that CMC Environment had no concerns on the proposed project. They suggested that the required stakeholders were CM&C Gas Taskforce, who were not included in the circulation. They provided the emails for this taskforce. 9.3.21 NERA replied thanks for your reply. We will get in contact with the CM&G Taskforce using the contacts you have provided below.	
NT Chief Minister and Cabinet	NTCMC-02	09/03/2021	Email	CMC_02_NERA CSEP- NT Government Departments Consultation CSEP NERA CSEP Information Sheet February	Information regarding the CSEP was provided, including the NERA CSEP Information Sheet February, to the NT CMC as detailed by the NT DITT Senior Director Petroleum Operations, Petroleum Operations. NT CMC did not have any comments on the project and responded that the NT DITT Senior Director Petroleum Operations, Petroleum Operations is the appropriate NTG contact for seismic survey notifications.	Information provided to NT DITT Senior Director Petroleum Operations, Petroleum Operations. See Records for NT Department of Industry, Tourism and Trade (DITT).
NT Commercial Fisher Representative	NTCF-01	17/11/2021	Phone	NTCF 01 Ongoing Monitoring Programs	Stakeholder concerns remain about using Operational Protocols as management controls for identified risks. However, we believe it would be more beneficial to consider how we may work in collaboration to measure long-term impacts through fisheries' ongoing monitoring programs. An NT fishery has recently implemented a program of biomass assessment and habitat mapping. Is collaborating on this ongoing monitoring something that could be considered through this process? 18/11/2021 CSEP responded that a member of the CSEP Project Team would be in contact to discuss. 23/11/2021 CSEP Project Team phoned stakeholder. In respect to comment regarding concerns around the protocols being used as management controls, I outlined the early discussions (which stakeholder was not party to) with WAFIC, NTSC and CFA in the loop where it was agreed that the key policy issues of adjustment and spatial temporal controls needed to be settled ahead of the CSEP development. In respect to the potential for the CSEP consortium collaborating/contributing to the fsihery stock biomass assessment process. Stock assessment research trip was planned to take place every 2 years to monitor fish abundance and stock structure. The survey was funded by industry at a cost of approx. $1.6m. The CSEP project has indicated that it would note the stock assessment status of fish stocks within the CSEP operational area each year and take note of any changes through the annual forum process. Noting the CSEP commitment to monitor stock status, stakeholder proposing that the consortium should consider contributing to the stock assessment process. Explained that; • the issue of potential long term impacts by seismic on fish stocks does not sit within the CSEP project scope. • the consortium is not involved in contributing to any existing Govt fisheries stock assessment processes. • the proposed annual information update of the EP including the annual forum would take note of the stock status as published by the relevant Govt fishery	No change to the information or controls in the CSEP were identified.

					jurisdictions only, and provide relevant information to Govt. Stakeholder would like the consortium to consider the matter and will therefore provide further advice for consideration.	
NT Commercial Fishing Licensees	NTCF-01	14/04/2022	Mail	CSEP Final Project Cover Letter – Commercial Fishers NERA CSEP Information Sheet April 2022 2022 NT Licensee List Mail Out	NERA letter to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Sent to licence holders in the following fisheries: • Aquarium Fish/Display • Coastal Line • Demersal • Offshore Net and Line • Small pelagic Development Fishery • Spanish Mackerel • Timor Reef • Fishing Tour Operators Note the NT Fishing Tour Operators in the mail out list has had those tour operators removed that do not fish in the CSEP Operational Area – see NTDITTF-01 for list received from NT DITT.	Provision of information. No reply.
NT Department of Environment Protection Authority	NTEPA-01	17/02/2021	Email	DEPA 01 NERA CSEP Project NT government departments consultation NERA CSEP Information Sheet February 2021 DEPA 01 NT government departments consultation response DEPA 01 NT government departments follow up	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. NERA requests departments requirements for engagement. 17.2.21 automatic response from the NT EPA that the email was referred for consideration by the Environment Division of the Department of Environment, Parks and Water Security, acting on behalf of the NT EPA. 3.3.21 – NERA sent a follow up email as no response had been received.	Provision of information. No reply.
NT Department of Environment, Parks and Water Security	NTDEPWS-01	17/02/2021	Email	DEPWS 01 NERA CSEP Information Sheet February 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. NERA requests departments requirements for engagement.	Provision of information. No reply.
NT Department of Industry, Tourism and Trade (DITT)	NTDITT-01	05/02/2021	Email	DITT NT 03 Consultation with NT Departments advice DITT NT 03 NERA CSEP map	NERA provided information regarding the Collaborative Seismic EP project (CSEP) with an attached map of the location. NERA requested information in relation to other NT departments that should be consulted with and who to contact. The Department of Industry, Tourism and Trade responded with a list of departments/ divisions to contact. NT EPA	As per recommendation from NT DITT CSEP information was provide to: NT EPA - NTEPA-01 Department of Chief Minister and Cabinet Oil and Gas Division - NTCMC-01, NTCMC-02

					Department of Chief Minister and Cabinet Oil and Gas Division Department of Chief Minister and Cabinet Environment DITT Fisheries - General Manager Fisheries and Product Integrity, Aquatic Resource Manager DIPL, Marine Safety DEPWS Marine Ecosystems Department of Chief Minister and Cabinet Environment Aboriginal Areas Protection Authority DITT Energy Titles Northern Land Council Tiwi Land Council	Department of Chief Minister and Cabinet Environment - NTCMC-01, NTCMC-02 DITT Fisheries - General Manager Fisheries and Product Integrity, Aquatic Resource Manager – see engagement in relation to Adjustment and Operational protocols. DIPL, Marine Safety - DIPL-01 DEPWS Marine Ecosystems - NTDEPWS-01 Aboriginal Areas Protection Authority - NTAAPA-01 DITT Energy Titles - NTDITT-02 Northern Land Council – no impact to NLC identified. Tiwi Land Council – no impact to TLC identified.
NT Department of Industry, Tourism and Trade (DITT)	NTDITT-02	17/02/2021	Email	NERA CSEP Information Sheet February 2021 DITT NT 04 NERA CSEP Project	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. NERA requests departments requirements for engagement. 3.3.21 NERA sent a follow up email as no response had been received.	Provision of information.
NT Department of Industry, Tourism and Trade (DITT)	NTDITT-03	30/03/2021	Email	DITT NT 05 NT Government Departments Consultation	Response from Energy Division Branch detailing that the department of the responsible Northern Territory Minister is required to be notified in advance of undertaking the offshore seismic activity. Please notify Senior Director Petroleum Operations at DITTPetroleumOperations@nt.gov.au. 1.4.21 – CSEP responded that the notification requirement will be included in the CSEP.	Requirement included in ongoing consultation and notifications in Table 6-3.
NT Department of Industry, Tourism and Trade (DITT) - Fisheries	NTDITTF-01	31/03/2022	Email	NT Fisheries 02 Updated Licensee List 2022 NT Licensee List	Request and provision of NT commercial fishing licensee details for fisheries that operated within the CSEP Operational Areas. Note that the NT Fishing Tour Operators in NTTO-02 has had those tour operators removed that do not fish in the CSEP Operational Area. Note the NT Fishing Tour Operators in NTTO-02 and NTCF-01have had those tour operators removed that do not fish in the CSEP Operational Area.	Provision of NT commercial fishing licensee details used for final CSEP mailout. See NTTO-02 and NTCF-01.
NT Department of Industry, Tourism and Trade (DITT) - Fisheries	NTDITTF-02	14/04/2022	Email	NTDITTF-02 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No reply.
NT Department of Infrastructure, Planning and Logistics - Marine Safety (DIPL)	DIPL-01	17/02/2021	Email	NERA CSEP Information Sheet February 2021 DIPL 01 NT departments marine safety response DIPL 01 NERA CSEP EP NT departments DIPL 01 NT departments marine safety CSEP follow up	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet February 2021 including map of CSEP Operational Areas and a link to NERA website. Email details that there is the potential that NT waters and land may be impacted by light, underwater sound or in the unlikely event of an oil spill. NERA requests departments requirements for engagement. NERA received an automated email response, that as of 1 July 2018 the Australian Maritime Safety Authority (AMSA) will provide full service delivery for owners, operators, and crew of	See engagement with AMSA under OPEP Consultation.

					domestic commercial vessels. Marine safety responds for recreational boating enquires and waterways management. 3.3.21 – NERA sent follow up email and received the same automated response as detailed above.	
NT Fishing Tour Operators	NTTO-01	16/04/2021	Mail	NT Fishing Tour Operators Letter Mar 2021 NERA CSEP Information Sheet April 2021 NT Fishing Tour Operators Mailing List	Mailout sent to NT Fishing Tour Operators (NT Fishing Tour Operators Mailing List) including cover letter dated 16 March 2021 (NT Fishing Tour Operators Letter Mar 2021) and information sheet (NERA CSEP Information Sheet April 2021) which included a map of the CSEP Project operational areas. The cover letter included background information regarding NERA and the CSEP Project including a link to the NERA website. The letter noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like. • If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310	Provision of information. No reply.
NT Fishing Tour Operators	NTTO-02	14/04/2022	Mail	CSEP Final Project Cover Letter – Tour Operators NERA CSEP Information Sheet April 2022 2022 NT Licensee List Mail Out	NERA letter to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Note the NT Fishing Tour Operators in the mail out list has had those tour operators removed that do not fish in the CSEP Operational Area – see NTDITTF-01 for list received from NT DITT.	Provision of information. No reply.
Northern Territory Seafood Council (NTSC)	NTSC-07	14/04/2022	Email	NTSC-07 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No reply.
Peak Sportfishing Adventures	PEAK-01	18/05/2021	Email	PEAK 01 NERA CSEP Project.pdf NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet including a link to the NERA website and a map of CSEP Operational Areas. The email noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like.	Provision of information. No reply.

					• If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310	
Peak Sportfishing Adventures	PEAK-02	27/04/2022	Email	PEAK 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Recfishwest	RFW-01	12/04/2021	Email	Recfishwest 01 NERA CSEP Project NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet April 2021 including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Recfishwest	RFW-02	27/04/2022	Email	Recfishwest 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Reel Teaser Fishing Adventures	RTF-01	18/05/2021	Email	REEL 01 NERA CSEP Project NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching NERA CSEP Information Sheet including a link to the NERA website and a map of CSEP Operational Areas. The email noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like. • If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310 19/05/2021 – Reel Teaser responded: Thanks for the information. We operate in both the Carnarvon and Browse operational areas as follows. We would like to receive advanced notice of any operations within these areas for the times we are scheduled to operate. Carnarvon – Dec – April each year Browse – April – Dec each year We operate live aboard fishing charters and travel extensively through these regions and often out to sea at depths over 300mt. Majority of our fishing is trolling for pelagic species during this time. 21/05/2021 – CSEP responded: We will add Reel Teaser as a stakeholder for our ongoing stakeholder notifications for when	Provision of information Reel Teaser requirement for notification have been added to Table 6-3: Ongoing stakeholder consultation and notification requirements.

					surveys are proposed in the Carnarvon and Browse operational area during your charter period. This will include a 6 month look-ahead and a 3-month notice of intent which will include estimated commencement date and maps, and if you would like chart plotter/GIS data files. 22/05/2021 – Reel Teaser responded advising 'all good'.	
Reel Teaser Fishing Adventures	RTF-02	27/04/2022	Email	REEL 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. Also confirmed that the notifications as per Stakeholder Record RTF-01 still apply. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback. Reel Teaser requirement for notification have been added to Table 6-3.
Reef Life Survey	RLS-01	25/05/2021	Email	REEF 01 NERA CSEP Project REEF 01 NERA CSEP Operational Areas Map	NERA sent email via web contact form to find the appropriate person to contact regarding the CSEP Project as it is planning to undertake offshore seismic surveys within and adjacent to a number of Commonwealth Marine Parks for which Reel Life Survey holds research and monitoring authorisations. 23/05/2021 – Reef Life Survey responded: Reef Life Survey holds research and monitoring authorisations for a number of Australian Marine Parks. It would help to know which Marine Parks you are referring to, and to ascertain the specific monitoring sites within these MPAs that will be in proximity to the proposed testing. To do so, we can send you a site list for the Marine Parks in question. Based on this list, please let us know which sites are near the proposed activity. Once I have a better idea of which areas you are wishing to enquire about, I can pass you on to the appropriate person. 25/05/2021 – NERA responded including a NERA CSEP Operational Areas map: The Australian Marine Parks we may potentially operate in are: • Gascoyne – Multiple Use Zone • Montebello - Multiple Use Zone • Argo-Rowley - Multiple Use Zone • Kimberley - Multiple Use Zone • Joseph Bonaparte Gulf - Multiple Use Zone, Special Purpose Zone • Oceanic Shoals - Multiple Use Zone, Special Purpose Zone (Trawl) We would also be interested in any areas where diving may occur within 45 km of the operational area in the attached map.	Provision of information.
Reef Life Survey	RLS-02	27/04/2022	Email	REEF 02 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Shimano Explorer	SHIMANO-01	18/05/2021	Email	SHIMANO 01 NERA CSEP Project	NERA email to stakeholder regarding the CSEP Project attaching a NERA CSEP Information Sheet including a link to the NERA	Provision of information. No reply.

				NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	website and a map of CSEP Operational Areas. The email noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like. • If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310	
Shimano Explorer	SHIMANO-02	13/04/2022	Email	SHIMANO 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Ship Agencies Australia Pty Ltd (SAA)	SAA-02	14/04/2022	Email	SAA 02 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information.
Top Gun Charters	TGC-01	18/05/2021	Email	TOP GUN 01 NERA CSEP Project NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching a NERA CSEP Information Sheet including a link to the NERA website and a map of CSEP Operational Areas. The email noted that: We are consulting with you as may undertake diving activities within 45 km of the proposed offshore seismic survey operational area of the Collaborative Seismic Environmental Plan (CSEP) Project. It was identified that you undertake diving tours to the Montebellos. Though seismic surveys will not be undertaken within the Montebellos they may occur within 45 km of them (see attached map). The DMAC Safe Diving Distance from Seismic Surveying Operations Guidance recommends where diving and seismic activity are scheduled to occur within a distance of 45 km, it is good practice for all parties to be made aware of the planned activity where practicable. NERA is developing the CSEP and is engaging with you to ensure that we can undertake surveys in a manner that does not unduly impact on your business. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310.	Provision of information. No reply.
Top Gun Charters	TGC-02	27/04/2022	Email	TOP GUN 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.

University of Western Australia (UWA)	UWA-01	18/05/2021	Email	UWA 01 NERA CSEP Project NERA CSEP Operational Areas Map NERA CSEP Information Sheet April 2021	NERA email to stakeholder regarding the CSEP Project attaching a NERA CSEP Information Sheet April 2021 including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a time to meet to contact the CSEP Project. The email noted that CSEP is consulting with UWA: as UWA may undertake research and monitoring within the proposed offshore seismic survey operational area of the Collaborative Seismic Environmental Plan (CSEP) Project. We are particularly interested in any diving activities that may occur within the CSEP Operational Area detailed in the attached map. The DMAC Safe Diving Distance from Seismic Surveying Operations Guidance recommends where diving and seismic activity are scheduled to occur within a distance of 45 km, it is good practice for all parties to be made aware of the planned activity where practicable. 18/05/2021 – Received automatic response from UWA stating that the person responsible was on leave until 24 May 2021.	Provision of information. No reply.
University of Western Australia (UWA)	UWA-02	27/04/2022	Email	UWA 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Vocus Communications	VC-01	27/01/2021	Email	VOCUS 01 Seismic Survey and Subsea Cables Emails VOCUS 01 NERA CSEP Operational Areas VOCUS 01 ICPC Recommendation for Offshore Seismic Survey Work	As recommended by the Australian Communications and Media Authority (ACMA 01) contact was made with Vocus to determine if they had any concerns about seismic surveys within the vicinity of the North West Cable System. Information in relation to the CSEP project provided to Vocus including shape files of the CSEP operational areas. Information was provided as per ICPC Recommendation No.8 in relation to where the seabed is exposed to a 2.0 bar pressure wave. From acoustic modelling undertaken of seismic surveys in Northern Western Australia in water depths from 28 to 350 m the sound level of 226 db peak, which is the equivalent of 2.0 bar, is reached at a maximum of 20 m from the acoustic source. 23/03/2021 NERA sent a follow-up email as had not received a reply. 30/04/2021 Vocus responded: It appears from the data you have provided, after 20m of depth the sound wave has attenuated below the 2.0bar (226db peak equivalent) and therefore should pose very little risk to the NWCS. When doing any surveys within 5km of the North West Cable System - NWCS, Vocus would need to be informed of the survey area at least one month in advance with a survey area or shape map. Once notification of survey area is received, Vocus will review and provide feedback on requirements during the survey activities. Vocus provide notification email addresses. 30/04/2021 NERA responded: You are correct that the modelling shows after 20m of depth the sound wave has attenuated below	Vocus requirement for notification have been added to Table 6-3: Ongoing stakeholder consultation and notification requirements.

					the 2.0bar (226db peak equivalent) and therefore should pose very little risk to the NWCS. I will add the contacts below to our stakeholder notification process that will be reviewed when we undertake a survey. If the survey is to be within 5 km of the NWCS we will provide details of the survey, including a shape file, at least one month in advance of the survey commencement to these contacts.	
Vocus Communications	VC-02	27/04/2022	Email	VOCUS 02 NERA CSEP Project VOCUS 02 Submarine Cables & OAs	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided map of the OA and subsea cables. And requested to confirm that the controls agreed in Stakeholder Record VC-01 are still appropriate. Vocus replied requirements were the same.	Vocus requirement for notification have been added to Table 6-3: Ongoing stakeholder consultation and notification requirements
WA Commercial Fishing Licensees	WACFL-01	14/04/2022	Email	CSEP Final Project Cover Letter Updated - Commercial Fishers NERA CSEP Information Sheet April 2022 WACFL 01 CSEP Final Project Fisheries	NERA letter to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project. Note email was sent by WAFIC on behalf of CSEP. Sent to WA licence holders in the following fisheries: • Pilbara Trawl Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Line Fishery • Pilbara Crab Managed Fishery • Mackerel Managed Fishery • Northern Demersal Scalefish Managed Fishery • Kimberley Prawn Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery • North Coast Shark	Provision of information. No reply.
WA Commercial Fishing Tour Operators	WACFL-01	14/04/2022	Mail	CSEP Final Project Cover Letter Updated – Tour Operators NERA CSEP Information Sheet April 2022 WA Fishing Tour Operators Pilbara Kimberley	NERA letter to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No reply.
WA Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA-01	08/02/2021	Email	DBCA 01 CSEP Project DBCA 01 NERA CSEP State Protected Areas NERA CSEP Information Sheet February 2021	Introductory email to DBCA to introduce NERA and the CSEP Project. NERA is developing the CSEP and DBCA has been identified as a relevant stakeholder as though seismic surveys will not be undertaken within a WA protected area some protected areas may be potentially impacted by light, underwater sound or in the unlikely event of an oil spill. The attached map shows the State marine and terrestrial protected areas in relation to the CSEP Operational Areas and the area that maybe affected (EMBA) by a spill event. For impacts and risks to WA protected areas the CSEP will detail the controls to ensure seismic surveys conducted under the CSEP are not inconsistent with a management plan for a WA protected area, are of an acceptable level and reduced to as low as reasonably practicable ALARP. NERA is developing an Oil Pollution	Meeting with DBCA held as per Record DBCA-02.

					Emergency Plan in relation to managing oil spill risks to WA waters and land and will consult with the WA Department of Do as part of the development of that plan. NERA is developing the CSEP and is engaging with DBCA to obtain the following information: considerations and expected outcomes that need to be considered in developing the CSEP. advice on known activities of other WA protected area users such as research or commercial tourism and how we obtain contact details for engagement. clarify ongoing DBCA information and consultation requirements. Please let me know if you require further information or would like to arrange a suitable time to discuss the CSEP project. 16.2.21 DBCA responded that they would appreciate the opportunity for a briefing on the project. In particular, DBCA is interested in how the proposed Environment Plan will address potential impacts of seismic surveys on marine fauna. 16.2.21 NERA advised that they would get back with suitable dates and times to meet.	
WA Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA-02	16/03/2021	Meeting	DBCA 02 NERA - DBCA Presentation 16.3.21 DBCA 02 NERA CSEP DBCA Meeting 16 March 2021 Minutes DBCA 02 NERA CSEP DBCA Meeting 16 March 2021 Emails	15.3.2021 CSEP sent DBCA a presentation of the information relating to fauna impact management that we will go over with DBCA. 16.3.2021 Meeting held with DBCA to discuss the CSEP project in relation to fauna impact management. CSEP project team provided an overview of the CSEP project, seismic surveys and noise modelling. Also covered potential impacts to WA conservation estate and threatened species, and controls to manage impacts. DBCA asked for the citations for the noise thresholds used to assess potential impacts to fauna. These were provided with the minutes. Discussed oil spill response and that the CSEP project team was engaging with WA DoT who would be the Control Agency if a spill were to impact State waters or land. WA DoT will review the CSEP Oil Pollution Emergency Plan (OPEP). DBCA would like to see how the controls for managing impacts to WA conservation estate and threatened species are detailed in the EP. CSEP project team would let DBCA know the EP is available on the NOPSEMA website for public comment so they can access. Seismic surveys conducted under the CSEP are restricted to Commonwealth waters. DBCA would like to be notified of surveys in proximity of WA conservation estate. DBCA provided information in relation to accessing information about marine tourism operators via the Karratha and Broome regional offices. 25.3.2021 CSEP sent minutes of the meeting held 16 March 2021: Sorry for the delay in getting minutes to you – see attached. Please feel free to update or add to. As discussed, I have included information on the noise threshold citations used to inform the CSEP noise impact assessment. If you would like any further information in relation to this information, the CSEP Project or seismic surveys please let me know. 6.4.21 DBCA response: Apologies for the delay in responding, and thanks again for your time and the attached minutes. As	Requirement to provide 6 monthly look-ahead to DBCA added to Table 6-3.

					discussed, we will be in touch regarding DBCA's degree of involvement in Environment Plan consultation for marine seismic surveys going forward. In the meantime, we will let you know if we have any additional questions or comments. 14.4.21 NERA response: Thanks for ringing on Monday and discussing DBCA's requirements for consultation in relation to seismic surveys conducted under the CSEP. As discussed once the CSEP is accepted and becomes operational the CSEP project team will implement a 6 monthly look-ahead to identify upcoming seismic surveys proposed to be conducted under the CSEP. This look-ahead can be provided to DBCA who can then determine which surveys they would like to be consulted on. Consultation will then be undertaken by the appropriate survey titleholder. Could you please let me know if this arrangement meets DBCA's consultation requirements? 14.4.21 DBCA response: Thanks for following up after our discussion. DBCA is comfortable to be consulted on the 6-monthly look-ahead for the CSEP and determine on which seismic surveys we would like to receive further consultation. 14.4.21 NERA response: Will include this in the EP ongoing consultation section. The only other action is that I will let you know when the EP is submitted to NOPSEMA and available on their website. FYI – I have left messages for the Ningaloo Coast World Heritage Advisory Committee and Exmouth licencing person regarding marine charter licence holders. Thanks for the contact information.	
WA Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA-03	30/04/2021	Email	DBCA 03 NERA CSEP Project – State Marine Protect Areas Commercial Operator Licensees – Email 1 NERA CSEP Information Sheet April 2021 DBCA 03 NERA CSEP Project – State Marine Protect Areas Commercial Operator Licensees – Email 2 DBCA 03 State Marine Protect Areas Commercial Operator Licensee Details 26 May 2021	NERA email with background of the CSEP Project attaching information sheet including a map of the operational areas. Though the activities will not be undertaken in State waters, and hence State Marine Protect Areas, there is a potential for increased noise levels within State Marine Protect Areas adjacent to our operational area. Requested licensee details for marine tourism and research organisations for the following State Marine Protect Areas: • Scott Reef • Rowley Shoals • North Kimberley • North Lalang-garam • Lalang-garam/Camden Sound • Montebello Islands • Barrow Island • Murion Islands • Ningaloo 30.4.21 DBCA advised they were following up internally. 5.5.21 NERA sent thank you email and to contact them if any further details required. 17.5.21 NERA follow up email. 25.5.21 DBCA advised they had followed up internally.	DBCA tourism and research organisations list used to identify tourism and research organisations that may operate within the CSEP OA or may be impacts by the activity in areas outside of the CSEP OA. See Record for WA Tour Operators.

					26.5.21 NERA thanks for following up. 26.5.21 DBCA sent email with ALL marine parks/licence status/operator details.	
WA Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA-04	28/04/2022	Email	DBCA 04 NERA CSEP Project – State Marine Protect Areas Commercial Operator Licensees DBCA 04 State Marine Protect Areas Commercial Operator Licensee Details 28 April 2022	CSEP requested an updated list of marine tourism and research organisations for the following State Marine Protect Areas as per DBCA-03.	DBCA tourism and research organisations list used to identify tourism and research organisations that may operate within the CSEP OA or may be impacts by the activity in areas outside of the CSEP OA. See Record for WA Tour Operators.
WA Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS-02	20/01/2021	Email	DMIRS 02 CSEP Consultation Requirements DMIRS 02 NERA CSEP Operational Areas Map	Email correspondence with NERA and DMIRS to provide details of the CSEP (including Operational Areas Map) and let them know we had commenced stakeholder engagement. Request was to gain an understanding of DMIRS expectations regarding engagement prior to submission of the CSEP to NOPSEMA and for individual surveys to be conducted under the CSEP. Agreed to meet once stakeholder engagement on both the EP and OPEP had progressed.	Provision of information.
WA Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS-03	24/03/2022	Email	DMIRS 03 CSEP Consultation DMIRS 03 CSEP DMIRS Presentation 30.3.22	Re-engagement with DMIRS to determine engagement process for CSEP. DMIRS requested to meet to reintroduce the project. Meeting set up for 1.4.22. Information sent through prior to meeting.	Provision of information.
WA Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS-04	1/04/2022	Meeting	DMIRS 04 CSEP Consultation DMIRS 03 CSEP DMIRS Presentation 30.3.22 DMIRS 04 NERA CSEP DMIRS Oil Spill and Reporting Information 1.4.22	CSEP Project Team went over the presentation provided to DMIRS. DMIRS requested more information regarding oil spill scenarios, modelling, impact assessment and the assessment of spill response strategies. Also, notification and reporting requirements relevant to DMIRS and for spills that may impact on WA waters. Information was provided as per DMIRS 04 NERA CSEP DMIRS Oil Spill and Reporting Information 1.4.22.	Provision of information.
WA Department of Mines, Industry Regulation and Safety (DMIRS)	DMIRS-05	29/04/2022	Email	DMIRS 05 CSEP Consultation	DMIRS replied they had reviewed the information provided and does not require any further information at this stage. Please provide a notification to petroleum.environment@dmirs.wa.gov.au when the CSEP has been submitted to NOPSEMA for consideration.	DMIRS notification requirements are detailed in Table 6-3: Ongoing stakeholder consultation and notification requirements.
WA Department of Primary Industries and Regional Development (DPIRD): Fisheries	DPIRD-03	10/02/2021	Email	DPIRD 03 Table of Info on Indicator Species DPIRD 03 Info on Indicator Species	WA DPIRD provided information on the spawning season and grounds for a range of indicator species. This information is only updated when new information becomes available.	Information provided on spawning season and grounds for a range of indicator species included in Section 5.8.4.
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD-04	19/05/2021	Email	DPIRD 04 Fishcube Data 2020	DPIRD email advising that 2020 Fishcube data is available. 20/05/2021 - Further email from CSEP Team to advise that they had phoned DPIRD and was advised that at this point there is no date that they can provide as to when the 2019-20 State of the Fisheries and Aquatic Resources Report will be available.	Section 5.8.2 covering WA fisheries updated with: • Review of DPRID Status Reports of the Fisheries and Aquatic Resources of Western Australia 2019/20 (Gaughan and Santoro 2021). • Analysis of DPIRD FishCube Data 2016 – 2020.
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD-06	4/04/2022	Email	DPIRD 06 Fishing Tour Operators Email DPIRD 06 Fishing Tour Operators	Provision of WA northern Fishing Tour Operator Licence holder details.	This list was reviewed to target consultation to those Fishing Tour Operators that operate or may potentially operate within the CSEP OA. Information on the CSEP was provided to the Fishing Tour Operators as per WATO-02.
WA Department of Primary Industries and Regional Development (DPIRD)	DPIRD-07	14/04/2022	Email	DPIRD 07 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the	Provision of information. No reply.

				NERA CSEP Information Sheet April 2022	Environment Plan to be submitted to NOPSEMA in the near future.	
WA Fishing Tour Operators	WATO-01	16/04/2021	Mail	WATO-01 WA Tour Operators Letter April 2021 NERA CSEP Information Sheet April 2021 WATO-01 WA Fishing Tour Operators Mailing List	Mailout sent to WA Fishing Tour Operators (WA Fishing Tour Operators Mailing List) including cover letter dated 8 April 2021 (WA Tour Operators Letter April 2021) and information sheet (NERA CSEP Information Sheet April 2021) which included a map of the CSEP Project operational areas. The cover letter included background information regarding NERA and the CSEP Project including a link to the NERA website. The letter noted that: NERA is developing the CSEP and is engaging with you to obtain the following information to ensure that we can undertake surveys in a manner that does not unduly impact on your business. • If you operate in the CSEP operational area, the areas where you operate. • How would you like to be engaged and what further information would you like. • If you would like to receive advanced notifications of surveys within certain area. • If you would like to be removed from our mailing list. For feedback we can be contact via email to CSEPfeedback@NERA.org.au or via phone 1300 589 310	Provision of information.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-06	20/02/2021	Email	WAFIC_06_DPBIRD Table of Info on Indicator Species WAFIC_06_DPBIRD Info on Indicator Species	NERA email to WAFIC with WA DPIRD information on the spawning season and grounds for a range of indicator species. This information is only updated when new information becomes available.	Provision of information from WA DPIRD Fisheries as per DPIRD-03.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-08	25/03/2022	Email	WAFIC-08 NERA CSEP Project	Email from WAFIC. Thank you for the opportunity to review the final notice regarding the CSEP project, I have no specific comments on the attachments. WAFIC would like to formally acknowledge the outstanding work done throughout the CSEP project, every comment raised by a commercial fisher was genuinely considered and addressed in the adjustment and operational protocols and the environment plan.	Feedback from WAFIC in relation to CSEP consultation process.
Western Australian Fishing Industry Council (WAFIC)	WAFIC-07	14/04/2022	Email	WAFIC-07 NERA CSEP Project CSEP Final Project Cover Letter Updated – Commercial Fishers NERA CSEP Information Sheet April 2022	Provision of CSEP project update sent to WA, NT and Commonwealth fishers within the project operational area. Noting that the project is nearing completion with the Environment Plan to be submitted to NOPSEMA in the near future.	Provision of information. No reply.
Woodside Energy Ltd	WEL-01	12/04/2021	Email	WOOD 01 NERA CSEP Project and GHMSS NERA CSEP Information Sheet April 2021 WOOD 01 Galactic Hybrid MSS Information Sheet WOOD 01 Galactic Hybrid MSS Seismic Survey Lines WOOD 01 Galactic Hybrid MSS Update Email	CSEP email to Woodside regarding the CSEP Project in relation to the Galactic Hybrid Marine Seismic Survey (GHMSS) attaching a NERA CSEP Information Sheet April 2021 including a map for the CSEP Operational Areas. The email requested that: As the CSEP Operational Area and the Galactic Hybrid Marine Seismic Survey area overlap could you put the CSEP onto your stakeholder list for any future information and notifications. Could you also let us know controls you will be implementing in relation to cumulative impacts from seismic surveys within the same region. The CSEP will implement that seismic acquisition will not be undertaken within 40 km of another vessel that is also acquiring data.	Woodside Galactic Hybrid Marine Seismic Survey included in Section 5.7.4. CM#42: Seismic Survey Separation Distance included in Section 7.1.15 and Section 7.12.

					16/04/2021 – Woodside responded including a GHMSS information sheet. In response, we have included NERA on our stakeholder list for any future information and notifications about the Galactic Hybrid MSS. A copy of existing consultation material is attached for reference. As to concurrent seismic activities, we are not aware of any NOPSEMA accepted seismic surveys in this region at the proposed timing of the Galactic survey. We will continue to monitor NOPSEMA's web site for accepted petroleum activities prior to and following the submission of our Environment Plan for assessment. In the unlikely event of two seismic surveys working in the same area at the same time we will manage this by way of a 40 km separation distance. For reference we are also engaging neighbouring titleholders (Santos and Inpex) to manage potential interactions in the event of simultaneous activities in the field. We look forward to keeping NERA informed about the Galactic Hybrid MSS and please get back to me of you need any additional information at this stage. 23/04/2021 – NERA responded that both Santos and Inpex are members of the CSEP. 30/06/2021 – Woodside sent an update attaching the GHMSS Seismic Survey Lines: Further to previous consultation advice, Woodside has further defined the survey type, coverage and duration of the proposed Galactic Hybrid Marine Seismic Survey (MSS) in Commonwealth waters offshore Northern Territory. Key clarifications comprise: • Elimination of 3D survey acquisition option. • Confirmation of 2D survey option, with a minimum and maximum kilometre line length, which will be finalised closer to start date of the survey. • A minor adjustment to the Operational and Acquisition Areas as previously advised to accommodate the revised planned survey lines. There has been no change to the planned source size and survey timing, with commencement from around May 2022. An updated activity scope was provided, and feedback was sought. 08/07/2021 – NERA responded with no comments.	
Woodside Energy Ltd	WEL-02	28/04/2022	Email	WOOD-02 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas. Reiterated agreed control as per Stakeholder record (WEL-01) in the unlikely event of two seismic surveys working in the same area at the same time we will manage this by way of a 40 km separation distance. Requested for CSEP Feedback email be put on the stakeholder list for the Woodside Scarborough 4D B1 Marine Seismic Survey as the CSEP OA overlaps the survey area.	Provision of information
Woodside Energy Ltd	WEL-03	2/05/2022	Email	WOOD-02 NERA CSEP Project	Notification from Woodside that the Galactic Hybrid 2D MSS is planned to start at the earliest on 6 May, with the survey duration now reduced to approximately 17 days.	Table 5-18: Seismic Surveys Proposed within the CSEP OA updated with timing for the Galactic Hybrid 2D MSS and Scarborough 4D B1 Marine Seismic Survey

					Woodside also provide an Information sheet for the Woodside Scarborough 4D B1 Marine Seismic Survey.	
Wunambal Gaambera Aboriginal Corporation	WGAC-01	15/04/2021	Email	WGAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021 CSEP eBase BrowseOA AMPs	NERA email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching a NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No reply.
Wunambal Gaambera Aboriginal Corporation	WGAC-02	27/04/2022	Email	WGAC 02 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.
Yamatji Marlpa Aboriginal Corporation	YMAC-01	15/04/2021	Email	YMAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2021 CSEP_eBase_Carnarvon OA_AMPs	NERA email to stakeholder regarding the CSEP Project in relation to the relevant marine park and surrounding waters, attaching a NERA CSEP Information Sheet April 2021, map of CSEP Operational Areas and relevant marine park, and a link to NERA website. The email included a request that should the stakeholder require any further information or would like to arrange a meeting to contact the CSEP Project.	Provision of information. No feedback.
Yamatji Marlpa Aboriginal Corporation	YMAC-02	27/04/2022	Email	YMAC 01 NERA CSEP Project NERA CSEP Information Sheet April 2022	NERA email to stakeholder providing an update on the CSEP Project and the CSEP will be submitted to NOPSEMA in the next few months. Provided NERA CSEP Information Sheet including map of CSEP Operational Areas and a link to NERA website. The email included a request that should the stakeholder require any further information to contact the CSEP Project.	Provision of information. No feedback.

OPEP Consultation

Note: Consultation records in this section are by stakeholder detailing the consultation undertaken in the development of the CSEP OPEP.

Australian Maritime Safety Authority (AMSA)	AMSA-02	23/03/2021	Email	AMSA 02 Oil Spill Response Arrangements AMSA 02 Oil Spill Response Arrangements AMSA Feedback	CSEP Project Team followed up regarding oil spill response arrangements for seismic surveys and the development of the Oil Pollution Emergency Plan seeking AMSA's advice as to whether AMSA needed to be engaged and/or an MOU developed as per AMSA's offshore petroleum advisory note. https://www.amsa.gov.au/safety-navigation/navigating-coastal-waters/offshore-activities/offshore-petroleum-industry-advisory CSEP Project also noted: we have contacted NT Marine Safety in relation to oil spill response and their email details that from the 1 July 2018 AMSA will provide full service delivery for owners, operators, and crew of domestic commercial vessels. Could you confirm if this is also for oil spill response. (AMSA 02 Oil Spill Response Arrangements.pdf). 04/05/2021- AMSA responded: We can advise that you do not need to engage AMSA in this instance or develop an MOU in relation to pollution response requirements for a seismic survey. As the vessel is in survey it will be required to have a detailed Shipboard Oil Pollution Emergency Plan and all relevant NOPSEMA permits and approvals. We treat seismic survey vessels as being a very low risk of any form of oil pollution do to their sophistication and requirements for passage. From a safety of navigation perspective, AMSA expects compliance with the International Regulations for the Prevention of Collision at Sea 1972 (or COLREGS), including the display of appropriate lights and shapes. AMSA Marine Notice 2/2019 (https://www.amsa.gov.au/about/regulations-and-standards/22019-responsible-navigational-practices) draws attention to navigational practices that masters and officers in charge of a navigational watch on ships operating in Australian waters should follow. 13/05/2021: CSEP Project Team advised that they had been engaging with AMSA on the Oil Pollution Emergency Plan that CSEP Project is required to submit to NOPSEMA as part of the Collaborative Seismic Environment Plan (CSEP). See Stakeholder Record AMSA-03. CSEP Project confirmed that all vessels used on the CSEP project will be in survey for their class and comply with the International Regulations for the Prevention of Collision at Sea 1972 (or COLREGS), including the display of appropriate lights and shapes. (AMSA 02 Oil Spill Response Arrangements AMSA Feedback.pdf).	Feedback from AMSA that they do not need to review the OPEP. AMSA requirements are included in CM#28: Navigation Act and Marine Orders and CM#39: SMPEP or equivalent.
Australian Maritime Safety Authority (AMSA)	AMSA-03	23/04/2021	Email	AMSA 03 NERA Collaborative Seismic OPEP and Bridging Plan Template NERA CSEP Oil Pollution Emergency Plan 20042021 NERA CSEP Oil Spill Response and Monitoring Implementation Plan Template 20042021	Following on from the phone conversation in March a copy of the NERA Collaborative Seismic Oil Pollution Emergency Plan (NERA CSEP Oil Pollution Emergency Plan 20042021) and supporting Collaborative Seismic Oil Spill Response and Monitoring Bridging Plan Template (NERA CSEP Oil Spill Response and Monitoring Implementation Plan Template 2004202) provided for AMSA consultation. This is due to be submitted to NOPSEMA in early June.	OPEP and supporting documentation provided to AMSA for information. No comments received. As per Stakeholder Record AMSA-02 AMSA has advised that engagement with AMSA in this instance or develop an MOU in relation to pollution response requirements for a seismic survey.

					Also attached a link to presentation previously sent, just as a refresher to the background of this project. https://bluesandsenvironmental.sharepoint.com/:b:/r/sites/Projects/Shared%20Documents/NERA/Stakeholder%20consultation/NERA%20-%20WA%20DoT%20Presentation%20%20March%202021%20Rev%20A[1].pdf?csf=1&web=1&e=Wkwlsk This has a focus on AMSA as a Control Agency, but as discussed, still provides direction and highlights the titleholder's role as a Support Agency. Please let me know if you require any additional information. If AMSA have any comments on the documents, if you could please send them to me by 25th May.	
NT Department of Environment, Parks and Water Security	DEPWS 02	22/03/2021	Email	DEPWS 02 Email DEPWS 02 Spill Management Arrangements DEPWS 02 CSEP OPEP Consultation NERA CSEP Oil Pollution Emergency Plan 20042021 NERA CSEP Oil Spill Response and Monitoring Implementation Plan Template 20042021	NERA sent email to DEPWS regarding the CSEP Project including a link to a presentation given to the WA DoT. Requested: 1) would you be interested in reviewing a draft copy of the documents in a week or so before they are sent to NOPSEMA? 2) would like to check that the information attached document is still correct (DEPWS 02 Spill Management Arrangements). 25.03.2021 DEPWS responded: The NT Oil Spill Contingency Plan (NT OSCP) arrangements are currently being revised. In response to the questions in your email: 1) Interested in seeing a copy of your documents but will not be in a position to make any comment prior to you needing to submit to NOPSEMA. 2) Reviewed Spill Management Arrangements, which look good and fit our current arrangements. Made corrections as track changes in Table 2-2 on the basis that: • There is no current NT OSCP documentation available. Earlier versions that may be on the NT government webpage are out of date and no longer relevant. • Following the NT general election in 2020, this Department became known as the Department of Environment, Parks and Water Security (DEPWS). 3) The current POLREP reporting requirements are available on the NTG webpage at Report marine pollution - NT.GOV.AU (https://nt.gov.au/marine/marine-safety/make-a-report/report-marine-pollution). Have downloaded a copy of the presentation you provided to the WA Department of Transport. I will ask the NT OSCP Upgrade project team to include you in any stakeholder consultation for the revised version of the NT OSCP. 23.4.2021 NERA sent copy of the OPEP and supporting Collaborative Seismic Oil Spill Response and Monitoring Bridging Plan Template for DEPWS consultation. This is due to be submitted to NOPSEMA in early June. CSEP asked if NT were developing its own OWR Plan (expected to be finalised June 2021). Is that in addition to the NT OSCP updates? Also, are the jurisdictional arrangements for OWR in the NT still as per Section 10.3, or have these changed now with the change to DEPWS? Please let me know if you require any additional information.	Provision of DEPWS Spill Management Arrangements. Comments on the arrangements included in the OPEP and supporting documentation provided for comment. No comments provided.

					Followup undertaken: 7.6.22. 30.6.22 CSEP ask if the draft version of the NT Oil Spill Contingency Plan had been released.	
NT Department of Environment, Parks and Water Security	DEPWS 03	11/05/2022	Email	DEPWS 02 CSEP OPEP Consultation	Engagement with DEPWS after work on the CSEP OPEP put on hold while consultation was undertaken on the CSEP. Rev C of the OPEP (with tracked changes) and supporting Bridging Implementation Plan Template were provided for review noting that they had been updated based on WA DoT and titleholder reviews. 28.6.22 Followed up. 29.6.22 DEPWS replied will get to in the next week. 14.7.22 DEPWS replied that at this stage we can only endorse the following under section 2.8.2. If a Level 2/3 spill arises which has potential to enter Territory waters, the titleholder must notify the Regional Harbourmaster and the NT Pollution Hotline 1800 064 567. And that the following link needs to be included as well which provides comprehensive reporting requirements: https://nt.gov.au/marine/marine-safety/make-a-report/report-marine-pollution 20.7.22 CSEP asked for clarification if NT wanted the text in the OPEP updated with the text provided on the 14.7.22. As the previous text had been developed in consultation with the NT and is in numerous accepted OPEPs. 28.7.22 NT confirmed NERA will remove the information highlighted blue below and replace it with your highlighted (yellow) text in your email dated 14th July. In addition, NERA shall add the following text to the Environment Plan (EP) to ensure the EP satisfies regulation 13(4) of the OPGGSA (Env) Regulations which requires titleholders to identify national, state and territory requirements relevant to oil pollution risk management and demonstrate how these requirements will be met through the titleholder's response planning and during response operations. *The NT Government is currently in a transitional phase with its spill management arrangements. Prior to a seismic survey occurring that has the potential to impact NT waters, the titleholder will contact DEPWS and confirm the NT arrangements.*	Updated OPEP and Bridging Implementation Plan Template provided for review. The OPEP was updated to the wording requested by DEPWS. Link and Hotline phone number included in OPEP external notification and reporting table. The requirement to confirm NT arrangements prior to a seismic survey occurring that has the potential to impact NT waters has been included in Table 6-3: Ongoing stakeholder consultation and notification requirements.

WA Department of Transport (WA DoT)	WA DoT 01	4/03/2021	Meeting	DoT 01 NERA WA DoT Presentation 4.3.2021 DoT 01 NERA CSEP Meeting Notes and Actions	CSEP Project Team met with WA DoT to provide an overview of the CSEP and OPEP. Key points/actions from the meeting were: CSEP OPEP to cover spill response strategies applicable to diesel spills. Due to the large CSEP area where individual seismic surveys can be undertaken, the OPEP will cover shoreline protection, shoreline clean-up and oiled wildlife response strategies. When titleholders plan to undertake a survey, they will develop a survey specific implementation plan which will detail the spill risk, potential impacts and appropriate spill response strategies based on the potential for shoreline impacts. A template for the development of the survey specific implementation plan will be provided in the OPEP. The CSEP covers seismic surveys within Commonwealth waters and in the event of a spill AMSA will be the control agency with the titleholder providing support as requested by AMSA. Where a spill will impact State Waters the WA DoT becomes the control agency. The OPEP notifications need to include notifying the WA DoT in the event that a spill will or has the potential to impact State waters. Where a spill will impact State waters the WA DoT expects titleholders to be able to provide support, based on the potential impacts, as per the WA DoT Guidance Note. WA DoT would like to review the full OPEP and require 6 weeks to review. Though they typically don't take the full 6 weeks. The CSEP OPEP should be ready for WA DoT to review in 2-3 weeks. We will let WA DoT know a week in advance. WA DoT would like to review survey implementation plans where there is the potential for impacts to State waters or land. CSEP will provide a 6-monthly look ahead to the WA DoT identifying those surveys that have the potential for impacts to State waters. For these surveys WA DoT will be provided the survey implementation plan for review.	OPEP Section 3 details notification requirements include notifying the WA DoT in the event that a spill will or has the potential to impact State waters. The OPEP details the support titleholders will provide to the WA DoT. The OPEP was provided to WA DoT for review – see Stakeholder Record WA DoT 02. Requirement for 6 monthly look-ahead included in Table 6-3: Ongoing stakeholder consultation and notification requirements. Section 1.3 of the CSEP Oil Spill Response and Monitoring Plan Bridging Template details that where there is the potential for a spill to impact State waters or land the survey implementation plan is to be submitted to the WA DoT for review.
WA Department of Transport (WA DoT)	WA DoT 02	12/04/2021	Email	DoT 02 NERA CSEP OPEP Document Review - Status Emails DoT 02 NERA DoT Consultation Table 21042021 DoT 02 NERA CSEP OPEP and Implementation Plan for Review – Emails	CSEP Project Team updated WA DoT regarding the status of the OPEP and Implementation Plan. WA DoT acknowledged the email. 23/04/2021 CSEP Project Team sent a copy of the CSEP OPEP and supporting Oil Spill Response and Monitoring Bridging Plan Template for DoT review and consultation. In accordance with the Offshore Petroleum Industry Guidance Note Marine Oil Pollution: Response and Consultation Arrangements, a table was provided outlining where the relevant information listed in Appendix 6 of the Guidance Note is located. 28/04/2021 WA DoT advised they will review and respond with any comment. 30/04/2021 CSEP Project Team offered to also send a copy of the oil spill risk section from the EP if the WA DoT wanted to review that also.	Provision of the CSEP OPEP and supporting Oil Spill Response and Monitoring Bridging Plan Template for DoT review.

WA Department of Transport (WA DoT)	WA DoT 03	21/05/2021	Email	DoT 03 NERA CSEP OPEP and Implementation Plan - DoT Comments Email DoT 03 NERA Collaborative Seismic Oil Pollution Emergency Plan - Rev B - DoT Review	WA DoT provided feedback on the OPEP and associated documents.	Comments from DoT addressed as per Stakeholder Record WA DoT 04.
WA Department of Transport (WA DoT)	WA DoT 04	28/04/2022	Email	DoT 04 CSEP OPEP Consultation DoT 04 NERA DoT Response to comments 11052022	Engagement with DoT after work on the CSEP OPEP put on hold while consultation was undertaken on the CSEP. DoT clarified that the Department's Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020) applies to all petroleum activities, including seismic survey activities. Rev C of the OPEP (with tracked changes) and supporting Bridging Implementation Plan Template were provided for review. In addition, a table was provided to show how the DoT comments from 21/5/21 were addressed.	OPEP and Bridging Implementation Plan Template updated as per response to DoT. Updated OPEP and Bridging Implementation Plan Template provided for review.
WA Department of Transport (WA DoT)	WA DoT 05	10/06/2022	Email	DoT 05 CSEP OPEP Consultation	DoT replied that they had no further comments on the Collaborative Seismic Oil Pollution Emergency Plan (OPEP) (Rev C), the Collaborative Seismic Oil Spill Response and Monitoring Bridging Plan Template (Rev C) and response to our comments on Rev B of the OPEP. They do not have any further queries and would like a final version once accepted by NOPSEMA. CSEP replied that a final version will be provided.	Requirement to provide final version of the OPEP and Seismic Oil Spill Response and Monitoring Bridging Plan Template included in Table 6-3: Ongoing stakeholder consultation and notification requirements.