ConocoPhillips

Sequoia 3D MSS Environment Plan

Appendicies

ABU2-000-EN-V01-D-00001

Rev 5 5 August 2021

ConocoPhillips

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Appendix A

ABU2-000-EN-V01-D-00001

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Sequoia Environment Plan - Appendix A

This spreadsheet contains tools which generated information that supports the Environmental Impact Assessments (EIA) and Environmental Risk Assessments (ERA) completed by ConocoPhillips Australia in preparing an Environment Plan (EP) for submission to NOPSEMA. It has been used in the development of the EP so that a systematic, reproducible, and thorough process is followed.

There are eight (8) sections in the spreadsheet that contain the following information:

	Title	Purpose	Inputs	Output	Process Notes
1	EP Summary	A summary of the outcomes of the EIA and ERA process and outcomes.	The EP Appendix A	Summary of EP acceptability for the Executive Summary.	Following completion of the EIA and ERA processes the planned and unplanned aspects are checked by using the questions in Row 5 to: - Ensure there is no gap in logic in the demonstration of acceptable levels of impact. - To support reproducibility for people unfamiliar with the activity. - To support simpler communication of the whole EP to a public audience.
2	Cumulative impact assessment	To ensure that previous, current, and future surveys have been properly considered in the EP as to whether the Sequoia seismic survey represents a tipping point for impacts or whether cumulative impacts are of an acceptable level.	Previous seismic surveys from NOPSEMA website The EP	Existing pressures Cumulative impact assessment	This tab shows a two stage process. Firstly, a matrix of receptors identified in previous seismic surveys in the region is compiled so that the impact assessment can properly consider the existing pressures on the environmental receptors. Secondly, after the impact assessment is complete the receptors are assessed for new or increased impacts as a result of the activities described in the EP.
3	Activity- Aspect Tool	A matrix to show the relationship between the operational details of the activity against planned and unplanned aspects.	Activity description	List of aspects that need to be considered in the Aspect-Impact-Receptor Tool.	The tool allows for screening of activities against possible cause effect pathways that need to be assessed.
4	Aspect-Impact-Receptor Tool	A matrix to show the relationships that need to be assessed in the EIA and ERA between the environmental aspects and the impacts that arise against the typical marine environmental receptors. This tool is used to screen out negligible impacts and risks and a justification for this screening is provided in the EP - Appendix B	Activity-Aspect Tool	Screened impacts and risks into lower and higher order matters to be assessed.	Using environmental knowledge from external consultants and relevant experts this step is critical in determining the level of detail and scope of assessments that need to be carried out. Once the higher order impacts and risks have been screened then effect level distances need to be researched and included in the 'Scope of Assessment' in each receptor/aspect section of the EP.
5	Receptor Values and Sensitivities	A detailed record of knowledge gathered about the receptors identified through the Protected Matter Search Tool (PMST). This section also includes information about the relevant conservation actions required for that receptor which become inputs in to the EIA and ERA processes.	Aspect-Impact-Receptor Tool No effect distance based on research and justified thresholds.	Management actions required to meet EPBC Program requirements.	Using the justified thresholds the 'Environment that May Be Affected' (EMBA) for each receptor/aspect can be established and researched using the PMST search tool. The PMST outputs focus additional contextual research about each listed matter and is key to demonstrating that all legislative requirements associated with EPBC Act documentation has been properly considered.
6	Presence and Absence Tool	A detailed record of the presence and absence of all receptors and their critical life-stage activities shown across an annual period to identify the timing of the activity that would have the least environmental impact and risk exposure.	Receptor Values and Sensitivities Tool	Activity description (survey window).	Once all the matters protected by the EPBC Act and environmental law are known they need to be shown in context of their presence or absence throughout the year so that the activity window with the least impact can be selected and justified.
7	Requirements Tool	A matrix of the legislative and other requirements against the receptors, aspects, and activities that they apply to. An summary of the requirements is also provided and all requirements are met within the EIA/ERA sections and/or the Environmental Performance section of this spreadsheet.	Receptor Values and Sensitivities Tool Activity Description	Management actions required to meet environmental management laws.	This process identifies all the legislative and other requirements that may apply to the activity. The screening process assesses them against receptors, aspects, and the activity to determine which once apply. Finally Column AA describes how these requirements apply to the activity and will be met.
8	Environmental Performance	A matrix of control measures against the environmental aspects that they reduce impacts/risks for. There follows a list of the environmental performance standards that apply for each control measure. Indication is made about whether a control measure or performance standard was adopted because of the consultations in preparing the EP. Throughout the section the ALARP demonstration is made showing the consideration of additional/alternative and improved control measures.	Requirements Tool Impact/Risk Assessment Company standards	Environmental performance required to the titleholder to manage environmental impacts and risks to ALARP. Input into Stage 2 of the cumulative impact assessment.	This spreadsheet is developed alongside the impact/risk assessments. On completion the EP sections on 'Environmental Performance' explore holistically whether the combination of control measures and their performance are also effective at managing environmental impacts and risks to below an acceptable level.

Last updated:
12-Jul-21

Appendix A - EP Summary

	Internal Context		Comparison between predicted levels and acceptable levels						External Context				Legislation and Conventions		
	Titleholder internal processes	Demonstration of ALARP	Predicted Impact Levels						Principles of ESD		Consultation and public comment		Legislative requirements	EPBC Management Plans	OPGGS(E)R Section 10a
	Impacts and risks are of an acceptable level when they are predicted to be below Major (4).	Have all reasonably practicable control measures been adopted?	What is the predicted spatial extent of the impact or risk?	What is predicted severity of the impact or risk?	What is the predicted duration of the impact or risk?	Is there a pathway for cumulative impacts?	Is the predicted impact level at or below the acceptable levels?	What is the level of confidence in the prediction?	Does the uncertainty in the prediction result in serious or irreversible environmental impacts or risks?	If there is the potential for unacceptable impacts and risk because of predictive uncertainty, how has the precautionary principle been applied to remove threats of serious or irreversible harm.	Were there relevant objections or claims arising from the consultations and public comment period?	If yes, how is the impact or risk going to be managed to below an acceptable level?	Complies with relevant Australian environmental management laws	Has the impact or risk had regard to all relevant EPBC materials and has this been systematically assessed?	Does the EP meet all the criteria for acceptance?
Receptors (Planned Aspects)															
Water quality	Negligible (1)	Yes (See Appendix A)	Localised	Recoverable	<78 days	No	Below	High	No	N/A	No	N/A	Yes. See Legislative and Other Requirements Tab, Appendix A	Yes. See Receptor Screening Tool, Appendix A	Yes
Air Quality	Negligible (1)		Localised	Recoverable	<78 days	No	Below	High	No	N/A	No	N/A			
Benthic Assemblages	Negligible (1)		Nil			No	Below	High	No	N/A	No	N/A			
Plankton	Minor (2)		210 m	Mortality	<38 days	Yes	Below	High	No	N/A	No	N/A			
Invertebrates	Moderate (3)		414 m	Injury to individuals without population level effects	Individuals - permanent Population - nil	Yes	Below	Moderate	Yes	UTAS will be commissioned to undertake a literature review of the impacts of impulsive sound on GC and analogous species prior to commencement of the survey.	Yes	An excise area has been adopted to eliminate the possibility of unacceptable impact despite none being predicted.			
Birds	Minor (2)		< 20 km	Behavioural	<78 days	No	Below	High	No	N/A	No	N/A			
Fish	Minor (2)		Localised	Recoverable injury	<38 days	No	Below	High	No	N/A	No	N/A			
Marine mammals	Moderate (3)		56 km	Behavioural	<38 days	Yes	Below	Low	Yes	A monitoring programme to detect Southern Right Whales has been applied which informs adaptive management of the activity to limit impact within the acceptable level.	No	N/A			
Marine reptiles	Minor (2)		< 20 km	Behavioural	<38 days	No	Below	High	No	N/A	No	N/A			
Commercial Fisheries	Minor (2)		Localised	Behavioural	<38 days	No	Below	High	No	N/A	Yes	An adjustment protocol between fishers and COPA will be negotiated which will compensate fishers for unnecessary interference.			
Other Marine Users	Minor (2)		Localised	Behavioural	<38 days	No	Below	High	No	N/A	No	N/A			
Unplanned Aspects															
Loss of Materials or Waste Overboard	Negligible (1)	Yes (See Appendix A)	Localised	Nil	<78 days	N/A	Below	High	No	N/A	No	N/A	Yes. See Legislative and Other Requirements Tab, Appendix A	Yes. See Receptor Screening Tool, Appendix A	Yes
Vessel Collision with Marine Fauna	Negligible (1)		Localised	Mortality	<78 days	N/A	Below	High	No	N/A	No	N/A			
Introduction of IMS	Moderate (3)		Regional	Threat to ecosystem integrity	<78 days	N/A	Below	High	No	N/A	No	N/A			
MDO Release	Moderate (3)		Spill EMBA	Threat to ecosystem integrity	<78 days	N/A	Below	High	No	N/A	No	N/A			
Oil Spill Response Activities	Negligible (1)		Localised	Nil	Up to 60 days	N/A	Below	High	No	N/A	No	N/A			

Sequoia MSS Cumulative Impact Assessment

Basis of Cumulative Impact Assessment

	Stage 1 Cumulative Impact Assessment																		
	Activity Name	Astrolabe MSS	La Bella MSS	Enterprise MSS	Flanagan 3D MSS	Ion Otway Span 2D MC MSS	Crows Foot MSS	Pelican MSS	CGG Gippsland 3D MSS	Schlumberger Otway 2D MSS	Beach Energy Otway Drilling Campaign	Sequoia MSS	Prion MSS						
	Activity Year	2013	2013	2014	2014	2015	2016	2018	2020	2020	2021/2022	2021	2021						
	Maximum Survey Duration	Unknown	Unknown	Unknown	<35 days	Unknown	38 days	27 days	193 days	100 days	640	82 days	40 days						
	Survey Season	Nov	Nov - Dec	Oct - Nov	Dec	Nov - May	Nov - Jan	Feb	Jan - July	Jan - Apr	Feb 21 - Oct 22	Aug - Oct	Oct - Dec						
	Region	Otway	Otway	Otway	Otway	Otway/Gippsland	Otway	Gippsland	Gippsland	Otway	Otway	Otway	Bass	**Stage 2 Cumulative Impact Assessment**					
	Receptor Impacted	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	Receptor Impacted?	**Sequoia Impact ranking**	**Residual cumulative impact pathway with existing control measures in place**	**Characterisation of new or increase cumulative impact?**	**Additional measures required**	**Residual cumulative impact ranking**	**Are predicted cumulative impacts within acceptable levels?**
Receptors	**Water quality**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Negligible (1)	Nil - recoverable within days	-	Nil	Negligible (1)	Yes
	Air Quality	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Negligible (1)	Nil - recoverable within days	-	Nil	Negligible (1)	Yes
	Benthic Assemblages	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	Negligible (1)	Nil - no pathway	-	Nil	Negligible (1)	Yes
	Plankton	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	Minor (2)	Nil - recoverable within days	-	Nil	Minor (2)	Yes
	Invertebrates - General	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	Minor (2)	Nil - recoverable within days	-	Nil	Minor (2)	Yes
	Invertebrates - GC	✗	✗	✓	✓	✗	✓	✗	✗	✓	✗	✗	✓	Moderate (3)	Nil - Sequoia does not overlap with excise area in place.	-	Nil	Moderate (3)	Yes
	Invertebrates - SRL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	Moderate (3)	Statocyst damage and impaired righting mechanism from sound exposure.	Uncertainty of effect from unknown increased predation across all surveys.	Nil - assessment of increased predation resulted in no change to the predicted impact level due to the broad distribution of the population and absence of effects from previous surveys.	Moderate (3)	Yes
	Birds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Moderate (3)	Nil - behavioural disturbance during survey only	-	Nil	Moderate (3)	Yes
	Marine reptiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Minor (2)	Nil - behavioural disturbance during survey only	-	Nil	Minor (2)	Yes
	Fish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Minor (2)	Nil - behavioural disturbance during survey only and TTS recoverable within 24 hours on completion of acquisition	-	Nil	Minor (2)	Yes
	Marine mammals - General	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Minor (2)	Nil - behavioural disturbance during survey only and TTS recoverable within 24 hours on completion of acquisition. Sequoia timing avoids overlap with biologically important foraging behaviours. No other biologically important behaviours identified.	-	Nil	Minor (2)	Yes
	Marine mammals - BW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	Negligible (1)	Nil - Sequoia timing avoids overlap with biologically important foraging behaviour.	-	Nil	Negligible (1)	Yes
	Marine mammals - SRW	✗	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	Moderate (3)	Migratory pathway changes - fitness across seasons Fitness within season Calf mortality	Population levels take longer to recover Increase energy expenditure for critical life stages Population levels take longer to recover	No survey in same location in repetitive years. No surveys with overlapping area of impact. No surveys with overlapping area of impact. SRW monitoring program and adaptive management to ensure cow-calf pairs migrate unimpeded.	Moderate (3)	Yes
	Commercial Fisheries - SESSF Shark Gillnet, Shark Hook and Otter Board trawl	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Minor (2)	Nil - displacement during survey only	-	Nil	Minor (2)	Yes
	Tasmanian SRL	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✓	✗	Minor (2)	Nil - displacement during survey only	-	Nil	Minor (2)	Yes
	Tasmanian GC	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	✗	Minor (2)	Nil - Sequoia does not overlap with excise area in place.	-	Nil	Minor (2)	Yes
	Victorian SRL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	Minor (2)	Nil - displacement during survey only	-	Nil	Minor (2)	Yes
	Victorian GC	✓	✗	✗	✓	✓	✓	✗	✗	✓	✓	✗	✗	Minor (2)	Nil - Sequoia does not overlap with excise area in place.	-	Nil	Minor (2)	Yes
	Other Marine Users	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Moderate (3)	Nil - displacement and impacts to divers during survey only	-	Nil	Moderate (3)	Yes

Appendix A - Activities and Aspects Matrix

Activity	Seismic Survey		Support Activities		Spill Response Activities
Aspect	Seismic source	Streamers	Vessel activities	Aircraft activities	
Planned Events					
Emissions – Underwater Sound (Continuous)			✓	✓	
Emissions – Underwater Sound (Impulsive)	✓		✓		
Emissions – Light			✓		
Emissions – Atmospheric			✓		
Planned Discharge – Vessels			✓		
Interference with other marine users		✓	✓		
Unplanned Events					
Loss of Materials or Waste Overboard		✓	✓		
Vessel Collision with Marine Fauna		✓	✓		
Introduction of IMS		✓	✓		
MDO Release			✓		
Spill Response Activities					✓

Appendix A - Aspect-Impact-Receptor Screening Tool

Aspects	Receptors	Physical						Ecological								Social, Economic and Cultural	
	Impacts	Water quality	Sediment quality	Air quality	Climate	Ambient light	Ambient sound	Benthic Assemblages	Plankton	Invertebrates	Fish	Birds	Marine mammals	Marine reptiles	Coastal habitats and communities	Commercial Fisheries	Other Marine Users
Planned																	
Emissions – Underwater Sound (Continuous)	Change in ambient sound				✓		✓										
	Injury/mortality to fauna							X	X	X	X		X	X			
	Change in fauna behaviour							X	X	X	✓		✓	✓			
Emissions – Underwater Sound (Impulsive)	Change in ambient sound				✓		✓										
	Injury/mortality to fauna							X	✓	✓	✓	X	X	X			
	Change in hearing via permanent and temporary threshold shift							X		X	✓	X	✓	✓			
	Change in fauna behaviour							X	✓	✓	✓	X	✓	✓			
Emissions – Light	Change in ambient light					✓											
	Change in fauna behaviour								X	X	X	✓	X	✓			
Emissions – Atmospheric	Change in air quality			✓													
	Change in climate				✓												
	Injury/mortality to fauna											X	X				
	Change in ecosystem dynamics							X	X	X	X	X	X	X	X		
Planned Discharges – Vessels	Change in water quality	✓															
	Change in fauna behaviour								X	X	X	X	X	X			
	Injury/mortality to fauna								X	X	X	X	X	X			
Interference with Other Marine Users	Changes to the functions, interests or activities of other users															✓	✓
Unplanned																	
Loss of Materials or Waste Overboard	Change in water quality	✓															
	Injury/mortality to fauna										✓	✓	✓	✓			
	Change in habitat							✓									
	Changes to the functions, interests or activities of other users															✓	✓
Vessel Collision with Marine Fauna	Injury/mortality to fauna										✓		✓	✓			
	Changes to the functions, interests or activities of other users															X	
Introduction of IMS	Change in ecosystem dynamics							✓		✓							
	Changes to the functions, interests or activities of other users															✓	
MDO Release	Change in water quality	✓															
	Change in sediment quality		✓														
	Change in habitat / ecosystem dynamics							✓							✓		
	Change in fauna behaviour									✓	✓	✓	✓	✓			
	Injury/mortality to fauna								✓	✓	✓	✓	✓	✓			
	Changes to the functions, interests or activities of other users															✓	✓
	Change in aesthetic value																✓
Spill Response Activities	Change in water quality	✓															
	Change in habitat / ecosystem dynamics							✓							✓		
	Change in fauna behaviour									✓	✓	✓	✓	✓			
	Injury/mortality to fauna								✓	✓	✓	✓	✓	✓			
	Changes to the functions, interests or activities of other users															✓	✓
	Change in aesthetic value																✓

X Subject to impacts/risks that are predicted to have a consequence considered as less than Negligible (1) / or where no cause/effect pathway has been identified. See Appendix B for justification.

Receptor Identification/ Protection Tool

		Type of Presence - EMBA								Biologically important area/habitat critical to the survival of the species - EMBA								EPBC Status / Protection Level			EPBC Management Plan			
Scientific Name	Common Name	Operational Area	Sound - Vessel (+1)	Seismic Sound Fish (+2.55)	Seismic Sound - LF Marine Mammals (+56.9)	Seismic Sound - MF, HF Marine Mammals (+11)	Seismic Sound Marine reptiles (+5.43)	Light (+20)	Spill	Operational Area	Sound - Vessel	Seismic Sound - Fish	Seismic Sound - LF Marine Mammals	Seismic Sound - MF, HF Marine Mammals	Seismic Sound - Marine reptiles	Light	Spill	Threatened Species*	Migratory Species*	Listed Marine Species*	Recovery Plan / Conservation Advice	Relevant Objectives	Relevant Key Threats	Relevant Conservation Actions
Fish																								
Sharks and Rays																								
Carcharodon carcharias	White Shark	KO	KO	KO	FKO	KO	KO	KO	BKO	D	D	D	F, D	D	D	F, D	F, B (nursery area)	V	✓	-	Recovery Plan for the White Shark (Carcharodon carcharias) (DSEWPC, 2013)	No explicit relevant objectives	Climate Change Impacts	No explicit relevant management actions; threat identified as 'climate change ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents and acidification).'
Galeorhinus galeus	School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	MO	MO	MO	LO	MO	MO	MO	LO	-	-	-	-	-	-	-	-	CD	-	-				
Isurus oxyrinchus	Shortfin Mako, Mako Shark	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	✓	✓				
Zearaja maugeana	Maugean Skate, Port Davey Skate	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	E	-	-	Approved Conservation Advice for *Raja sp. L (Maugean Skate)*	No explicit relevant objectives	Trace metal pollution from historic mining operations in Macquarie Harbour, incidental capture in fishing activities, the introduction of non-native marine species, changes to the water nutrient levels through discharge from vessels and tourism	No explicit management actions, identifies research priorities and advises population monitoring and threat abatement be conducted.
Rhincodon typus	Whale Shark	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	V	✓	-	Conservation Advice *Rhincodon typus* whale shark.	No explicit relevant objectives	International fishing pressure	No explicit management actions, identifies research priorities and recommends threat management actions.
Carcharias taurus (east coast population)	Grey Nurse Shark (east coast population)	-	-	-	-	-	-	-	LO	-	-	-	-	-	-	-	M, F	CE	-	-	Recovery Plan for the Grey Nurse Shark *(Carcharias taurus)*	• Improving the population status • Ensuring that anthropogenic activities do not hinder the recovery of the grey nurse shark	Mortality resulting from incidental (accidental and/or illegal) capture by commercial and recreational fishers	An extensive list of actions is identified under objectives with the following priorities: • Taking prompt action is necessary in order to mitigate the key threats to the grey nurse shark and also provide valuable information to help identify long-term population trends. • Priority 2: Action would provide a more informed basis for the long-term management and recovery of the grey nurse shark. • Priority 3: Action is desirable, but not critical to the recovery of the grey nurse shark or assessment of trends in that recovery
Lamna nasus	Porbeagle, Mackerel Shark	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	✓	✓				
Manta birostris	Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	✓	-				
Fish																								
Prototroctes maraena	Australian Grayling	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	V	-	-	National Recovery Plan for the Australian Grayling (Prototroctes maraena)	The overall objective of recovery is to minimise the probability of extinction of the Australian Grayling in the wild, and to increase the probability of important populations becoming selfsustaining in the long term.	Barriers to movement	Maintenance or restoration of flow regimes (especially winter flows) in coastal rivers to meet the habitat and spawning requirements of Australian Grayling.
										-	-	-	-	-	-	-	-						River Regulation	Removal of artificial barriers or provision of fish passage (of a type suitable for negotiation by Australian Grayling) past barriers on coastal rivers and streams. Maintenance and restoration of river channel structure and instream habitat quality.
										-	-	-	-	-	-	-	-						Water Quality	Maintenance or restoration of quality and width of riparian vegetation at levels necessary to maintain stream temperature and light regimes, maintain input of organic materials, and filter surface runoff under heavy rainfall conditions. Management of catchment vegetation clearing and planting (eg. of pine or eucalypt plantations) to avoid negative effects on catchment water yields and flow patterns, in catchments where Australian Grayling occur. Manage water quality where Australian Grayling occurs to maintain waters free of significant levels of nutrient, sediment, pesticide and other pollutants, consistent with the ANZECC guidelines for water quality (ANZECC 2000).
										-	-	-	-	-	-	-	-						IMS	No explicit relevant management actions; Invasive Marine Species - introdueced fish and disease identified as threats.
										-	-	-	-	-	-	-	-						Climate Change Impacts	No explicit relevant management actions; climate change identified as a threat.
										-	-	-	-	-	-	-	-						Fishing	Continuing to prohibit fishing for the species, through education, regulation and enforcement, at least until there is recovery to sustainable levels. Management of fish stockings to avoid any potential impacts on Australian Grayling. Continue to limit the Tasmanian recreational whitebaiting season to selected rivers for a short open season.
Seriolella brama	Blue Warehou	KO	KO	KO	KO	KO	KO	KO	KO	-	-	-	-	-	-	-	-	CD	-	-	Blue Warehou (Seriolella brama) Stock Rebuilding Strategy 2014	Rebuild the stocks to their biomass limit reference point within a biologically reasonable timeframe of 16 years.	Fishing	• prevents targeted fishing for blue warehou by setting low TACs to cover incidental catches only • ensures that incidental catch of the species is kept to a minimum • aims to improve knowledge of stock status, including improved data collection and monitoring that will inform future management responses.
Thunnus maccoyii	Southern Bluefin Tuna	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	CD	-	-				
Centrophorus zeehaani	Southern Dogfish, Endeavour Dogfish, Little Gulper Shark	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	CD	-	-				
Galaxiella pusilla	Eastern Dwarf Galaxias, Dwarf Galaxias	-	-	-	-	-	-	-	LO	-	-	-	-	-	-	-	-	V	-	-	National Recovery Plan for the Dwarf Galaxias *(Galaxiella pusilla)* .	•Determine the distribution and abundance of the Dwarf Galaxias. •Determine the genetic and taxonomic status of Dwarf Galaxias populations. •Determine Dwarf Galaxias habitat characteristics and requirements. •Identify and manage potentially threatening processes impacting on Dwarf Galaxias conservation. •Protect key populations across the range of the Dwarf Galaxias. •Determine population trends at key sites. •Investigate key aspects of biology and ecology of the Dwarf Galaxias. •Establish a captive breeding population of Dwarf Galaxias. •Undertake translocations to establish new populations of Dwarf Galaxias. •Undertake community education and communication to increase awareness and involvement.	Degradation and loss of habitat, climate change, alteration to flow regime, introduced aquatic species, illegal collection.	Several actions are associated with each objective in the plan. The plan outlines that a Dwarf Galaxias Recovery Team will be formed consisting of scientists, land/water managers and community organisations with relevant technical, scientific and habitat management skills, to coordinate recovery actions, circulate information and facilitate a review and evaluation of this Recovery Plan at its termination.
Epinephelus daemelii	Black Rockcod, Black Cod, Saddled Rockcod	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	V	-	-	Approved Conservation Advice for *Epinephelus daemelii* (black cod)		Historical overfishing, incidental by-catch by recreational and commercial fishers and illegal fishing activities.	No specific actions, advises research priorities and threat abatement such as regulation of fisheries.
Hoplostethus atlanticus	Orange Roughy, Deep-sea Perch, Red Roughy	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	CD	-	-	Orange Roughy (Hoplostethus atlanticus) Stock Rebuilding Strategy 2014	Maintain low fishing mortality to support rebuilding while continuing to monitor and assess the stocks and ensure they are harvested in an ecologically sustainable manner consistent with the Commonwealth Fisheries Harvest Strategy Policy 2007.	Fishing	•deep water closures within the Southern and Eastern Scalefish and Shark Fishery (SESSF) •restricting effort by limiting entry to existing fisheries •research and monitoring to support stock assessments and to ensure the Strategy meets its objectives •allowing targeted fishing for Orange Roughy stocks above limit reference point
Syngnathids																								
Heraldia nocturna	Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	-				

Legend

Type of Presence:

MO - Species of species habitat may occur within area
LO - Species or species habitat likely to occur within area
KO - Species or species habitat known to occur within area
FMO - Foraging, feeding or related behaviour may 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
MLO - Migration likely to occur within area
BLO - Breeding Likely to Occur
RKO - Roosting known to occur within area
RLO - Roosting likely to occur within area

BIA
FKO - Foraging (known foraging area)
F+ - Foraging (annual high use area)
F - Foraging
MR - Migration and Resting on migration
CH - Connecting Habitat

Not BIA listed
D - Distribution

Threatened Species:
V - Vulnerable
E - Endangered
CE - Critically Endangered
CD - Conservation Dependant

Hippocampus abdominalis	Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Hippocampus breviceps	Short-head Seahorse, Short-snouted Seahorse	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Hippocampus minotaur	Bullneck Seahorse	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Histiogamphelus briggsii	Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Histiogamphelus cristatus	Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Hypselognathus rostratus	Knifesnout Pipefish, Knife-snouted Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Lissocampus caudalis	Australian Smooth Pipefish, Smooth Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Kaupus costatus	Deepbody Pipefish, Deep-bodied Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Kimblaeus bassensis	Trawl Pipefish, Bass Strait Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Leptoichthys fistularius	Brushtail Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Lissocampus runa	Javelin Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Maroubra perserrata	Sawtooth Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Mitotichthys semistriatus	Halfbanded Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Mitotichthys tuckeri	Tucker's Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Notiocampus ruber	Red Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Phycodurus eques	Leafy Seadragon	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Phyllopteryx taeniolatus	Common Seadragon, Weedy -Seadragon	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Mitotichthys mollisoni	Mollison's Pipefish	-	-	-	MO	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Syngnathoides biaculeatus	Double-end Pipehorse, Double-ended Pipehorse,	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Pugnaso curtirostris	Pugnose Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Solegnathus robustus	Robust Pipehorse, Robust Spiny Pipehorse	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Solegnathus spinosissimus	Spiny Pipehorse, Australian Spiny Pipehorse	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Stigmatopora argus	Spotted Pipefish, Gulf Pipefish, Peacock Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Stigmatopora nigra	Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Stipecampus cristatus	Ringback Pipefish, Ring-backed Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Urocampus carinirostris	Hairy Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Vanacampus margaritifer	Mother-of-pearl Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	-				
Vanacampus phillipi	Port Phillip Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	-				
Vanacampus poecilolaemus	Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓				
Birds																								
Migratory seabirds																								
Apus pacificus	Fork-tailed Swift	-	-	-	LO	-	-	-	LO	-	-	-	-	-	-	-	-	-	✓	✓				
Anous stolidus	Common Noddy	-	-	-	-	-	-	-	LO	-	-	-	-	-	-	-	-	-	✓	✓				
Hydroprogne caspia	Caspian Tern	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	✓	✓				
Sternula albifrons	Little Tern	-	-	-	MO	-	-	-	BKO	-	-	-	-	-	-	-	-	-	✓	-				
Ardenna carneipes	Flesh-footed Shearwater, Fleshy-footed Shearwater	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	F	-	✓	✓ (Listed as Puffinus carneipes)				
Ardenna grisea	Sooty Shearwater	MO	MO	MO	MO	MO	MO	MO	LO	-	-	-	-	-	-	-	F	-	✓	✓ (Listed as Puffinus griseus)				
Diomedea gibso	Gibson's Albatross	-	-	-	-	-	-	-	FLO	-	-	-	-	-	-	-	-	V	-	✓	National Recovery Plan for Threatened Albatrosses and Giant Petrels	Overall objective: To ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land. Specific objectives: 2. Land-based threats to the survival and breeding success of albatrosses and giant petrels breeding within areas under Australian jurisdiction are quantified and reduced. 3. Marine-based threats to the survival and breeding success of albatrosses and giant petrels foraging in waters under Australian jurisdiction are quantified and reduced.	Marine Pollution	No explicit management actions; marine pollution recognised as a threat.
Thalassarche eremita	Chatham Albatross	-	-	-	-	-	-	-	FLO	-	-	-	-	-	-	-	-	E	✓	✓				
Diomedea antipodensis	Antipodean Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	F	F	F	F	F	F	F	F	V	✓	✓				
Diomedea epomophora	Southern Royal Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	-	V	✓	✓				
Diomedea exulans	Wandering Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	F	F	F	F	F	F	F	F	V	✓	✓				
Diomedea sanfordi	Northern Royal Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	-	E	✓	✓				
Macronectes giganteus	Southern Giant-Petrel, Southern Giant Petrel	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	-	E	✓	✓				
Macronectes halli	Northern Giant Petrel	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	F	V	✓	✓				
Phoebetria fusca	Sooty Albatross	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	V	✓	✓				
Thalassarche bulleri	Buller's Albatross Pacific Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	F	F	F	F	F	F	F	F	V	✓	✓			Climate Change Impacts	A3.1: Where climate change is identified as having the potential for significant negative impacts on Australian populations of seabirds: • Appropriate monitoring strategies are implemented to fill information gaps • Mitigation actions are identified and adopted where feasible and appropriate.
Thalassarche cauta	Shy Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	BKO	F	F	F	F	F	F	F	B, FL	E	✓	✓				
Thalassarche chrysostoma	Grey-headed Albatross	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	E	✓	✓				
Thalassarche impavida	Campbell Albatross, Campbell Black-browed Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	F	F	F	F	F	F	F	F	V	✓	✓				
Thalassarche melanophris	Black-browed Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	F	F	F	F	F	F	F	F	V	✓	✓				
Thalassarche salvini	Salvin's Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	-	V	✓	✓				
Thalassarche steadi	White-capped Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	F	V	✓	✓				
Resident seabirds																								
Pachyptila turtur subantarctica	Fairy Prion (southern)	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	V	-	✓	Conservation Advice Pachyptila turtur subantarctica Fairy Prion (southern)	No explicit relevant objectives	Predation	Continue strict quarantine management practices for Macquarie Island and surrounding rock stacks to reduce the risk of any invasive species (re)establishing on the island.
										-	-	-	-	-	-	-	-						Habitat degradation/modification	Continue to manage Macquarie Island and its surrounds in such a way that human disturbance is minimised.

Pterodroma leucoptera leucoptera	Gould's Petrel, Australian Gould's Petrel	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	E	-	-	Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan	The overall objective of the Gould's Petrel recovery effort is for Gould's Petrel to be downlisted from endangered to vulnerable by 2011. The specific recovery objectives are: 1. To identify and manage the threats operating at sites where the subspecies occurs; 2. To establish and maintain a translocated second colony at Boondelbah Island, 3. To raise awareness of the subspecies with the local community and involve volunteers in the recovery program; 4. To promote research and continue monitoring that will assist with the management of the subspecies; and 5. To co-ordinate recovery actions through a recovery team and annual reporting on Recovery Plan	Entanglement with Bird-lime tree Predation Habitat degradation/modification	1.3 All mature Pisonia plants have been removed from within the nesting habitat of the Gould's Petrel. Annual removal of seedlings is required. Regeneration of ground cover and the lower shrub layer as a result of the rabbit eradication program will eventually render this action unnecessary as the sticky fruits of the Pisonia plant will be caught by the understorey vegetation and no longer pose a risk to the ground-dwelling Petrel. 2.3 Weed control (prickly pear, bitou bush etc.) and native vegetation control will be undertaken as necessary in the nest box gully to allow birds to have clear access to nest box entrances. 1.1 Pied Currawongs and Australian Ravens will be controlled by shooting. Culling is to be undertaken in October when Currawongs are brooding nestlings and are most easy to locate and shoot. Currawong nests and nestlings will also be destroyed. Annual culling will need to be ongoing or continued until the understorey has recovered sufficiently to provide nesting Petrels with adequate concealment from avian predators. 1.2 Other avian predators such as Goshawks and Owls will be assessed on a case by case basis. Action will only be taken to control these species where predation of adult Petrels exceeds 20 birds. The removal of these avian predators may involve translocation to the mainland. 1.4 The DEC will restrict access to Cabbage Tree and Boondelbah Islands and access will only be permitted for scientific and conservation purposes. 1.5 The DEC will discourage unsupervised public access by way of installation of advisory signs on Cabbage Tree and Boondelbah Island and at other appropriate locations in Port Stephens. The status of Cabbage Tree Island as critical habitat, its significance to the Gould's Petrel and the penalties associated with harming Gould's Petrel and damaging its habitat will be included in the signage. 1.6 The Australian Department of Defence will instruct personnel to observe the no fly zone over Cabbage Tree and Boondelbah Islands
Pterodroma mollis	Soft-plumaged Petrel	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	F	V	-	✓	Conservation Advice *Pterodroma Mollis* Soft-plumaged Petrel	No explicit relevant objectives	Predation Habitat degradation/modification	Continue strict quarantine management practices for Maatsuyker and Macquarie Island to reduce the risk of any invasive species (re)establishing on the islands. Continue to manage Maatsuyker and Macquarie Island in such a way that human disturbance is minimised.
Sternula nereis nereis	Australian Fairy Tern	FLO	FLO	FLO	KO	FLO	FLO	FLO	KO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice for *Sternula nereis nereis* (Fairy Tern)	No explicit relevant objectives	Habitat degradation/modification (oil pollution)	Ensure appropriate oil spill contingency plans are in place for the subspecies' breeding sites that are vulnerable to oil spills.
Sterna nereis	Fairy Tern	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Thalassarche chlororhynchos bassi	Indian Yellow-nosed Albatross	-	-	-	-	-	-	-	X	FKO	-	-	-	-	-	FKO	F	-	-	-	National Recovery Plan for Threatened Albatrosses and Giant Petrels	Overall objective: To ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by	Marine Debris Climate Change Impacts	No explicit management actions; marine pollution recognised as a threat. A3.1: Where climate change is identified as having the potential for significant negative impacts on Australian populations of seabirds: • Appropriate monitoring strategies are implemented to fill information gaps • Mitigation actions are identified and adopted where feasible and appropriate.
Fregetta grallaria grallaria	White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian)	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	V	-	-				
Halobaena caerulea	Blue Petrel	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	V	-	✓				
Ardenna pacifica	Wedge-tailed Shearwater	-	-	-	-	-	-	-	-	F	F	F	F, B	F	F	F	F, B	-	-	-				
Ardenna tenuirostris	Short-tailed Shearwater	-	-	-	BKO	-	-	-	BKO	F	F	F	F, B	F	F	F	B, F	-	-	-				
Pelagodroma marina	White-faced Storm-petrel	-	-	-	-	-	-	-	BKO	F	F	F	F	F	F	F	B, F	-	-	✓				
Pelecanoides urinatrix	Common Diving-petrel	-	-	-	-	-	-	-	BKO	F	F	F	F, B	F	F	F	B	-	-	✓				
Stercorarius skua	Great Skua	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓ (Listed as Catharacta skua)				
Thalassarche bulleri platei	Northern Buller's Albatross, Pacific Albatross	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FLO	-	-	-	-	-	-	-	-	V	-	✓ (Listed as Thalassarche sp. nov.)				
Migratory Shorebirds																								
Calidris canutus	Red Knot	MO	MO	MO	MO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	E	✓	✓ (Overfly marine area)	Conservation Advice *Calidris canutus* Red Knot	No explicit relevant objectives	Habitat degradation/modification Climate Change Impacts	No explicit relevant management actions; oil pollution recognised as a threat. No explicit relevant management actions; climate change recognised as a threat.
Calidris ferruginea	Curlew Sandpiper	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	CE	✓	✓ (Overfly marine area)	Conservation Advice *Calidris ferruginea* Curlew Sandpiper	Australian Objective: 3. Reduce disturbance at key roosting and feeding sites	Habitat degradation/ modification (oil pollution)	No explicit relevant management actions; oil pollution recognised as a threat.
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	MO	MO	MO	LO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	CE	✓	✓	Conservation Advice *Numenius madagascariensis* Eastern Curlew	Australian Objectives: 3. Reduce disturbance at key roosting and feeding sites	Habitat degradation/ modification	7. Manage disturbance at important sites when the species is present.
Thinornis cucullatus cucullatus	Hooded Plover (eastern), Eastern Hooded Plover	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	V	✓	✓ (Overfly marine area - Listed as Thinornis rubricollis rubricollis)	Conservation Advice Thinornis rubricollis rubricollis Hooded Plover (Eastern)	1. Achieve stable numbers of adults in the population, and maintain a stable number of occupied and active breeding territories. 2. Improve breeding success, namely increase fledgling rates (which is a combination of improving egg and chick survival rates), via: a. reducing the destruction of nests and chicks, and the disturbance of breeding pairs, by human and human-related activities. b. reducing predation by feral animals and overabundant native predators. 3. Maintain, enhance and restore habitat, and integrate the subspecies' needs into coastal planning.	Predation Anthropogenic Disturbance (i.e. crushing/disturbance of eggs, chicks and nesting birds) Habitat degradation/modification Marine Debris Climate Change Impacts	Implement predator control programs for invasive species where necessary. Investigate control options for native predators such as ravens, magpies, currawongs and silver gulls, if their impacts are threatening a population and human activities cannot be sufficiently reduced to mitigate their impacts. Manage the use of (and access to) key beaches for recreation when plovers are breeding – e.g. discourage or prohibit vehicle access, horse riding and dogs from beaches; implement temporary beach closures; erect fencing to prevent people entering. Adequately police beaches to ensure compliance with regulations, especially those relating to dog walking, and undertake a review of existing regulations to assess whether there is room for improvement. Evaluate the efficacy of management techniques such as the use of chick shelters, predator controls, mechanisms to alter human behaviour on beaches, habitat restoration and maintenance, and identify areas for improvement. Educate the public in research, monitoring, management and advocacy efforts. Incorporate requirements for the hooded plover into coastal planning and management, and erosion control activities, including: a) limiting levels of urban development within the coastal zone b) adopting evidence-based best practice c) consulting with relevant state and local government departments, research organisations, and community organisations. Construct fencing to prevent livestock entering beaches. Prepare oil spill response plans to ensure effective rehabilitation of oiled birds. Reduce in-shore marine debris, including educating fishers and the public to properly dispose of fishing lines. No explicit relevant management actions; climate change impacts recognised as a threat.
Actitis hypoleucos	Common Sandpiper	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	-	✓	✓	x			
Calidris acuminata	Sharp-tailed Sandpiper	MO	MO	MO	KO	MO	MO	MO	RKO	-	-	-	-	-	-	-	-	-	✓	✓	x			
Calidris melanotos	Pectoral Sandpiper	MO	MO	MO	KO	MO	MO	MO	KO	-	-	-	-	-	-	-	-	-	✓	✓ (Overfly marine area)	x			
Other marine listed birds																								
Neophema chrysogaster	Orange-bellied Parrot	MLO	MLO	MLO	MKO	MLO	MLO	MLO	MKO	-	-	-	-	-	-	-	-	CE	X	✓	National Recovery Plan for the Orange-bellied Parrot, *Neophema chrysogaster*	Objective 1. To achieve a stable or increasing population in the wild within five years. Objective 2. To increase the capacity of the captive population, both to support future releases of captive-bred birds to the wild and to provide a secure longterm insurance population. Objective 3. To protect and enhance habitat to maintain, and support growth of, the wild population. Objective 4. To ensure effective adaptive implementation of the	Habitat degradation/modification Barriers to movement Loss of genetic diversity Disease Climate Change Impacts Predation Consumption of toxic food plants Negative effects of management activities	Retain habitat Manage thhreats to habitat quality Monitor the wild population and habitat Manage breeding in the wild Manage direct threats to birds in the wild Manage captive population Manage the wild/captive metapopulation No explicit relevant management actions; disease recognised as a threat. No explicit relevant management actions; climate change impacts recognised as a threat. No explicit relevant management actions; predation recognised as a threat. No explicit relevant management actions; consumption of toxic food plants recognised as a threat. Conduct research essential for future management Coordinate implementation Secure resources for implementation Communicate effectively with partners, stakeholders and the community
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	-	-	BKO	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Merops ornatus	Rainbow Bee-eater	-	-	-	MO	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Monarcha trivirgatus	Spectacled Monarch	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Gallinago stenura	Pin-tailed Snipe	-	-	-	-	-	-	-	RLO	-	-	-	-	-	-	-	-	-	-	✓				
Larus pacificus	Pacific Gull	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Larus novaehollandiae	Silver Gull	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Larus dominicanus	Kelp Gull	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Gallinago megala	Swinhoe's Snipe	-	-	-	-	-	-	-	RLO	-	-	-	-	-	-	-	-	-	-	✓				
Chrysococcyx osculans	Black-eared Cuckoo	-	-	-	LO	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				

Gallinago hardwickii	Latham's Snipe, Japanese Snipe	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	E	-	✓	Conservation Advice for the Lesser Sand Plover *(Charadrius mongolus)*	No explicit relevant objectives.	Identifies habitat loss and habitat degradation (through environmental pollution), pollution/contamination and direct death as a consequence of oil spill as a threat.	Outlines research and survey priorities and recommends habitat restoration/ maintenance.
Charadrius ruficapillus	Red-capped Plover	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Himantopus himantopus	Pied Stilt, Black-winged Stilt	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Heteroscelus incanus	Wandering Tattler	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Heteroscelus brevipes	Grey-tailed Tattler	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Calidris alba	Sanderling	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Charadrius bicinctus	Double-banded Plover	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	V	-	✓	Conservation Advice *Charadrius leschenaultii* Greater sand plover	No explicit relevant objectives.	Identifies habitat loss and habitat degradation (through environmental pollution), pollution/contamination and direct death as a consequence of oil spill as a threat.	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites
Limicola falcinellus	Broad-billed Sandpiper	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Calidris tenuirostris	Great Knot	-	-	-		-	-	-	RKO	-	-	-	-	-	-	-	-	CE	-	✓	Conservation Advice *Calidris tenuirostriss* Great knot	No explicit relevant objectives.	Identifies habitat loss and habitat degradation (through environmental pollution), pollution/contamination and direct death as a consequence of oil spill as a threat.	Identifies research priorities and the need for actions to prevent destruction of key breeding and migratory staging sites
Calidris ruficollis	Red-necked Stint	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Arenaria interpres	Ruddy Turnstone	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Limosa lapponica	Bar-tailed Godwit	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Limosa limosa	Black-tailed Godwit	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Ardea ibis	Cattle Egret	-	-	-	MO	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Lathamus discolor	Swift Parrot	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	CE	-	✓	Conservation Advice *Lathamus discolor* swift parrot	No explicit relevant objectives.	Habitat loss and degradation and predation.	
Acanthiza pusilla archibaldi	King Island Brown Thornbill, Brown Thornbill (King Island)	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	E	-	-	No specific recovery plan or conservation advice however the King Island Biodiversity Management Plan is adopted.	• To promote the recovery of priority species, ensuring that each species persists in the long term on King Island. • To stop the decline and retain presence of the King Island Brown Thornbill, and King Island	Habitat degradation and fragmentation.	The King Island Biodiversity management plans identifies actions around protecting habitat.
Acanthornis magna greeniana	King Island Scrubtit, Scrubtit (King Island)	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	CE	-	-				
Sterna fuscata	Sooty Tern	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Tringa nebularia	Common Greenshank, Greenshank	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Recurvirostra novaehollandiae	Red-necked Avocet	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Xenus cinereus	Terek Sandpiper	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Sterna bergii	Crested Tern	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	-	-	✓				
Tringa glareola	Wood Sandpiper	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Thinornis rubricollis	Hooded Plover (eastern), Eastern Hooded Plover	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Rostratula benghalensis (sensu lato)	Painted Snipe	-	-	-	-	-	-	-	LO	-	-	-	-	-	-	-	-	E	-	✓	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe).	No explicit relevant objectives.	Loss and degradation of wetlands.	Habitat recovery actions are a priority.
Pluvialis squatarola	Grey Plover	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Pluvialis fulva	Pacific Golden Plover	-	-	-	KO	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Philomachus pugnax	Ruff (Reeve)	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Phalacrocorax fuscescens	Black-faced Cormorant	-	-	-	BKO	-	-	-	BKO	-	-	-	B, F	F	-	F	B, F	-	-	✓				
Numenius phaeopus	Whimbrel	-	-	-	-	-	-	-	RKO	-	-	-	-	-	-	-	-	-	-	✓				
Pandion haliaetus	Osprey	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	-	-	✓				
Numenius minutus	Little Curlew, Little Whimbrel	-	-	-	-	-	-	-	RLO	-	-	-	-	-	-	-	-	-	-	✓				
Tyto novaehollandiae castanops (Tasmanian population)	Masked Owl (Tasmanian) [67051]	-	-	-	-	-	-	-	BKO	-	-	-	-	-	-	-	-	V	-	-	Approved Conservation Advice for *Tyto novaehollandiae castanops* (Tasmanian Masked Owl)	No explicit relevant objectives.	Habitat clearing and fragmentation (mainly terrestrial).	Habitat recovery actions and research are a priority.
Strepera fuliginosa colei	Black Currawong (King Island)	-	-	-	BLO	-	-	-	BLO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice *Strepera fuliginosa colei* black currawong (King Island)	No explicit relevant objectives.	No ongoing threats identified.	Expand habitat through replanting and weed management (terrestrial).
Rostratula australis	Australian Painted Snipe	-	-	-	LO	-	-	-	LO	-	-	-	-	-	-	-	-	E	-	-	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe)	No explicit relevant objectives.	Loss and degradation of wetlands (terrestrial).	Habitat recovery actions and research are a priority.
Platycercus caledonicus brownii	Green Rosella (King Island)	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice *Platycercus caledonicus brownii* green rosella (King Island)	No explicit relevant objectives.	Habitat clearing.	Habitat recovery actions and research are a priority.
Limosa lapponica baueri	Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice *Limosa lapponica baueri* Bar-tailed godwit (western Alaskan)	No explicit relevant objectives.	Ongoing human disturbance as well as habitat loss and degradation from pollution, changes to the water regime and invasive plants,	Habitat recovery actions and research are a priority.
Grantiella picta	Painted Honeyeater	-	-	-	MO	-	-	-	LO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice *Grantiella picta* painted honeyeater	1. Stable population at key sites. 2. No further clearance of suitable habitat. 3. Adequate numbers of mature trees and mistletoe populations across its distribution.	Habitat loss.	Habitat recovery and management are priority (terrestrial).
Falco hypoleucos	Grey Falcon	-	-	-	MO	-	-	-	LO	-	-	-	-	-	-	-	-	V	-	-	Conservation Advice *Falco hypoleucos* Grey Falcon.	To improve habitat management, cat and camel control in arid and semi-arid Australia.	Climate change, predation, nest shortage, grazing from invasive species.	Habitat recovery and invasive species management are priority (terrestrial).
Dasyornis brachypterus	Eastern Bristlebird	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	E	-	-	National Recovery Plan for Eastern Bristlebird *Dasyornis brachypterus*	The recovery of all populations of the Eastern Bristlebird to a position where all four populations are stable.	Loss or fragmentation of suitable habitat.	Habitat recovery and management are priority (terrestrial).
Botaurus poiciloptilus	Australasian Bittern	-	-	-	KO	-	-	-	KO	-	-	-	-	-	-	-	-	E	-	-	Conservation Advice *Botaurus poiciloptilus* Australasian Bittern	Provide guidance for actions that will expand the range and the number of Australasian Bitterns in Australia.	Habitat degradation.	Habitat recovery and management are priority (terrestrial).

Ceyx azureus diemenensis	Tasmanian Azure Kingfisher	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	E	-	-	Approved Conservation Advice for *Ceyx azureus diemenensis* (Tasmanian Azure Kingfisher)	No explicit relevant objectives.	Loss of habitat, the flooding of nesting burrows from boat wash, competition with Brown Trout and the illegal removal of whitebait by recreational fishers	Research and habitat recovery and management are priority (terrestrial).
Aquila audax fleayi	Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian)	-	-	-	BLO	-	-	-	FLO	-	-	-	-	-	-	-	-	E	-	-	Threatened Tasmanian Eagles Recovery Plan 2006-2010.	Objective 11: Reduce the occurrence of eagle mortalities and injuries (in number and proportion), particularly those attributable to human activities.	Loss of nesting habitat, nest disturbance from land clearance and other inappropriate land management practices and from unnatural mortality, including persecution	Actions are categorised as strategic planning, habitat protection, monitoring, mitigation, education and research.
Anthochaera phrygia	Regent Honeyeater	-	-	-	MO	-	-	-	BLO	-	-	-	-	-	-	-	-	CE	-	-	National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*)	Reverse the long term population trend of decline and increase numbers.	Clearing and fragmentation of woodland and forest, mining,	Habitat recovery and management are priority (terrestrial).
Eudyptula minor	Little Penguin	-	-	-	BKO	-	-	-	BKO	-	-	-	F,B	-	-	F	B, F	-	X	✓	X			
Marine Mammals																								
Low-Frequency (LF) Cetaceans																								
Balaenoptera edeni	Bryde's Whale	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	✓	✓				
Hyperoodon planifrons	Southern Bottlenose Whale	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Tasmacetus shepherdi	Shepherd's Beaked Whale, Tasman Beaked Whale	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	✓				
Balaenoptera musculus	Blue Whale (including Pygmy Blue Whale subspecies)	FKO	FKO	FKO	FKO	FKO	FKO	FKO	FKO	F	F	F	F	F	F	F	F	E	✓	✓	Conservation Management Plan for the Blue Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act	The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the Blue Whale to improve so that it can be removed from the threatened species list under the EPBC Act.	Noise Interference Vessel Disturbance Climate Change Impacts	A2: Assess and address anthropogenic noise: shipping, industrial and seismic noise. A4: Minimise vessel collisions Develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Ship Strike Database. Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented. Understanding impacts of climate variability and change: Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica
Eubalaena australis	Southern Right Whale	KO	KO	KO	KO	KO	KO	KO	KO	KCR	KCR	KCR	MR, CH (May- Nov)	KCR	KCR	KCR	A, KCR, CH, M & RM (resting on migration)	E	✓	✓	Conservation Management Plan for the Southern Right Whale. A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999	Long term recovery objective: To minimise anthropogenic threats to allow the conservation status of the southern right whale to improve so that it can be removed from the threatened species list under the EPBC Act Interim Recovery Objective 5:	Noise Interference Vessel Disturbance Climate Change Impacts Entanglement in debris	A2: Assess and address anthropogenic noise: shipping, industrial and seismic noise. A5: Address vessel collisions: Develop a national ship strike strategy that quantifies vessel movements within the distribution ranges of southern right whales and outlines appropriate mitigation measures that reduce impacts from vessel collisions A4: Assess impacts of climate variability and change. Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica.
Balaenoptera borealis	Sei Whale	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FKO	-	-	-	-	-	-	-	-	V	✓	✓	Conservation Advice Balaenoptera borealis sei whale (DoE 2015b)	No explicit relevant objectives	Noise Interference Vessel Disturbance Climate Change Impacts Pollution (persistent toxic pollutants)	Assess and manage acoustic disturbance. Minimising vessel collisions: Develop a national vessel strike strategy that investigates the risk of vessel strikes on Sei Whales and also identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database Understanding impacts of climate variability and change: Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica No explicit relevant management actions; pollution identified as a threat
Balaenoptera physalus	Fin Whale	FLO	FLO	FLO	FLO	FLO	FLO	FLO	FKO	-	-	-	-	-	-	-	-	V	✓	✓	Conservation Advice Balaenoptera physalus fin whale (DoE 2015c)	No explicit relevant objectives	Noise Interference Vessel Disturbance Climate Change Impacts	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development). Develop a national vessel strike strategy that investigates the risk of vessel strikes on Fin Whales and identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database. Understanding impacts of climate variability and change: Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica.
Megaptera novaeangliae	Humpback Whale	KO	KO	KO	KO	KO	KO	KO	FKO	-	-	-	-	-	-	-	F	V	✓	✓	Conservation Advice Megaptera novaeangliae humpback whale (DOE 2015d)	No explicit relevant objectives	Noise Interference Vessel Disturbance Climate Change Impacts Marine Debris	For actions involving acoustic impacts (example pile driving, explosives) on Humpback Whale calving, resting, feeding areas, or confined migratory pathways, undertake site specific acoustic modelling (including cumulative noise impacts). 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. 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 Enhance education programs to inform vessel operators of best practice behaviours and regulations for interacting with humpback whales. A4: Impacts of climate variability and change: Continue to meet Australia's international commitments to reduce greenhouse gas emissions and regulate the krill fishery in Antarctica. Reducing commercial fishing entanglements. No explicit management measures for marine debris.
Caperea marginata	Pygmy-Right Whale	FMO	FMO	FMO	FMO	FMO	FMO	FMO	FLO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Balaenoptera acutorostrata	Minke Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Balaenoptera bonaerensis	Antarctic Minke Whale	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Mid-Frequency (MF) Cetaceans																								
Berardius arnuxii	Arnoux's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Delphinus delphis	Common Dolphin	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Globicephala macrorhynchus	Short-finned Pilot Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Globicephala melas	Long-finned Pilot Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Grampus griseus	Risso's Dolphin	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Lagenorhynchus obscurus	Dusky Dolphin	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Lissodelphis peronii	Southern Right Whale Dolphin	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon bowdoini	Andrew's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon densirostris	Blainville's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon grayi	Gray's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon hectori	Hector's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon layardii	Strap-toothed Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Mesoplodon mirus	True's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Orcinus orca	Killer Whale	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Pseudorca crassidens	False Killer Whale	LO	LO	LO	LO	LO	LO	LO	LO	-	-	-	-	-	-	-	-	-	-	✓	-			
Physete macrocephalus	Sperm Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	✓	✓	-			
Torsiops truncates s. str.	Bottlenose Dolphin	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Tursiops aduncus	Indian Ocean Bottlenose Dolphin	-	-	-	LO	-	-	-	LO	-	-	-	-	-	-	-	B	-	-	✓	-			
Ziphius cavirostris	Cuvier's Beaked Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
High-Frequency (HF) Cetaceans																								
Kogia breviceps	Pygmy Sperm Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Kogia simus	Dwarf Sperm Whale	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	-	✓	-			
Pinnipeds																								
Arctocephalus forsteri	New Zealand Fur-seal	MO	MO	MO	MO	MO	MO	MO	MO	-	-	-	-	-	-	-	-	-	X	✓	X			
Neophoca cinerea	Australian Sea-lion, Australian Sea Lion	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	E	X	✓				
Arctocephalus pusillus	Australian Fur-seal	MO	MO	MO	MO	MO	MO	MO	BKO	-	-	-	-	-	-	-	-	-	X	✓	X			
Marine Reptiles																								

Caretta caretta	Loggerhead Turtle	LO	LO	LO	BLO	LO	LO	LO	FKO	-	-	-	-	-	-	-	-	E	✓	✓	Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised		A1: Maintain and improve efficacy of legal and management protection •Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival as per section 3.3 Table 6. •Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Vessel disturbance	Vessel interactions identified as a threat; no specific management actions in relation to vessels prescribed in the plan.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Light pollution	A8. Minimise 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. •Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. •Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Pollution (persistent toxic pollutants)	A4. Minimise chemical and terrestrial discharge.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Climate Change Impacts	A2: Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability: •Continue to meet Australia's international commitments to address the causes of climate change. •Identify, test and implement climate-based adaptation measures.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Marine Debris	A3. Reduce the impacts from marine debris. •Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.
																					Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised	Noise Interference	B3. Assess and address anthropogenic noise. •Understand the impacts of anthropogenic noise on marine turtle behaviour and biology.
Chelonia mydas	Green Turtle	KO	KO	KO	FKO	KO	KO	KO	FKO	-	-	-	-	-	-	-	-	V	✓	✓	Recovery plan for Marine Turtles in Australia (CoA 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.		
Natator depressus	Flatback Turtle	-	-	-	-	-	-	-	KO	-	-	-	-	-	-	-	-	V	✓					
Eretmochelys imbricata	Hawksbill Turtle	-	-	-	-	-	-	-	FKO	-	-	-	-	-	-	-	-	V	✓					
Dermochelys coriacea	Leatherback Turtle	KO	KO	KO	FKO	KO	KO	KO	FKO	-	-	-	-	-	-	-	-	E	✓	✓	Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017a)	Long-term recovery objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised.		*A1: Maintain and improve efficacy of legal and management protection* *•Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival as per section 3.3 Table 6.* *•Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue.*
																							Vessel disturbance	Vessel interactions identified as a threat; no specific management actions in relation to vessels prescribed in the plan.
																							Light pollution	A8. Minimise 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. •Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. •Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
																							Pollution (persistent toxic pollutants)	A4. Minimise chemical and terrestrial discharge.
																							Climate Change Impacts	A2: Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability: •Continue to meet Australia's international commitments to address the causes of climate change. •Identify, test and implement climate-based adaptation measures.
																							Marine Debris	A3. Reduce the impacts from marine debris. •Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.
																							Noise Interference	B3. Assess and address anthropogenic noise. •Understand the impacts of anthropogenic noise on marine turtle behaviour and biology.
																					Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) (TSSC 2009a)	No explicit relevant objectives	Vessel Disturbance	No explicit relevant management actions; vessel strikes identified as a threat.
																							Marine Debris	No explicit relevant management actions; marine debris identified as a threat.
																							Climate Change Impacts	No explicit relevant management actions; climate change identified as a threat.
Crustaceans																								
Astacopsis gouldi	Giant Freshwater Crayfish, Tasmanian Giant Freshwater Lobster	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	V			Conservation Advice *Astacopsis gouldi* (giant freshwater crayfish, Tasmanian giant freshwater lobster)	No explicit relevant objectives	Habitat loss and disturbance and sedimentation of waterways, modifications to water flow, illegal fishing and climate change.	Actions directly address the key threats identified, particularly habitat loss and disturbance.
Species in BIA list not identified in PMST:																								
Morus serrator	Australasian Gannet	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	F, A							
Procellaria parkinsoni	Black Petrel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F							
Pterodroma macroptera	Great-winged Petrel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F							
Sterna striata	White-fronted Tern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F							
Oceanites oceanites	Wilsons Storm Petrel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M							

Appendix A - Presence and Absence Tool

Colour Key
▨ Non-peak period - activity known to occur in lower densities/concentrations, or sporadically, or may occur
■ Peak period - activity known to occur

	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Reference
Marine Mammals		
Whales		
Threatened Species		
Blue Whale		http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=36
Southern Right Whale	Nearest coastal aggregation areas are in southwest Victoria (Warnambool)	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=40
Humpback Whale	rthern Migrat Southern Migration	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=38
Fin Whale	General migration window for movement out of sub polar water	
Sei Whale	General migration window for movement out of sub polar water	SPRAT profile states - There is insufficient data on sei whale migration, however, they have been sighted inshore in the proximity of the Bonney Upwelling, Victoria, along the continental shelf during the summer and autumn months (Gill 2002).
Non-Threatened Species		
Minke Whale	Based off known migration movements	http://minkewhaleproject.org/biology/distribution/
Antarctic Minke Whale	*** half of March	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67812
Pygmy Right Whale		DoEE 2015. Biologically Important Areas of Regionally Significant Marine
Short-finned Pilot Whale	Prefers open ocean waters, no migratory patterns known	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=62
Long-finned Pilot Whale	Based off records of strandings	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59282
Pygmy Sperm Whale	Prefers offshore waters with 2 sightings in Australian waters, insufficient to assess potential presence	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=57
Dwarf Sperm Whale	Prefers deep water and no sightings in Victoria	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85043
Andrew's Beaked Whale	Based off known records in Victoria	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=73
Blainville's Beaked Whale	One stranding recorded in Victoria, insufficient to assess potential presence	
Strap-toothed Beaked Whale	Based on strandings occurring during Summer-Autumn	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25556
Gray's Beaked Whale	Most strandings occur during December-April	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=75
Hector's Beaked Whale	No records from Victoria	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=76
True's Beaked Whale	Prefers open ocean waters, no migratory patterns known	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=54
Sperm Whale	Window of northward movement. More likely in WA	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59
Cuvier's Beaked Whale	Most strandings occur from January-July	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=56
Arnoux's Beaked Whale	Prefers slope and escarpment environments	
Dolphins		
Common Dolphin	Assumed present year round	
Risso's Dolphin	Assumed present year round	
Dusky Dolphin	Based off inshore seasonal movements during cooler months	
Southern Right Whale Dolphin	Prefers deep water and the outer edge of continental shelf	
Killer Whale	More likely during winter months, summer months spent further south	
False Killer Whale	ggested period of migration to coastal/continental shelf wat	
Indian Ocean Bottlenose Dolphin	Assumed present year round	
Bottlenose Dolphin		
Seals		
Australian Fur-seal	Females feeding pups Northern Migration Weanin Weaning/ Breeding	Shaughnessy P (1999) The Action Plan for Australian Seals, https://www.environment.gov.au/system/files/resources/bb9edd6b-8e63-
New Zealand Fur-seal		
Invertebrates of Commercial Importance		
Southern Rock Lobster	Mating Spawning	
Giant Crab	Breeding Season Spawning	
Gould's Squid		
Fish - EPBC Listed		
Blue Grenadier	Assumed year round presence Spawning winter and early spring	AFMA (2021e) Blue grenadier, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/blue-grenadier
Australian Grayling	Spawning however occurs in freshwater Assumed presence	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26179
Blue Warehou	Assumed year round presence Spawning winter and early spring	https://www.frdc.com.au/Archived-Reports/FRDC%20Projects/1996-142-DLD.pdf, https://www.afma.gov.au/fisheries-management/species/blue-warehou
Eastern School Whiting	Spawning- (Tasmania: late Summer) Year round presence with largest catches March- July	AFMA (2021a) Eastern school whiting, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/eastern-school-whiting.
Elephantfish	Spawning Assumed year round presence	AFMA (2021c) Elephantfish, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/elephant-fish
Ocean Perch	Assumed year round presence Spawning Winter to early Summer	https://www.afma.gov.au/fisheries-management/species/ocean-perch
Orange Roughy	Assumed year round presence Spawning (not every year)	DAWE (2020b) Hoplostethus atlanticus — Orange Roughy, Deep-sea Perch, Red Roughy- SPRAT Profile, Species Profile and Threats Database (SPRAT), http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68455, accessed 16/05/2021.
Pink Ling	Assumed year round presence Spawning - late winter and spring	AFMA (2021d) Pink Ling, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/pink-ling
Tiger Flathead	Spawning	AFMA (2021b) Tiger flathead, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/tiger-flathead.
White Shark- migration	Moving north along the east coast South	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64470
White Shark- congregation of juvenlies		http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64470
Sawshark	Assumed presence year round Breeding/ Pups are born (12 mth gestation)	AFMA, 2021g) Saw Shark, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/sawsharks.
Schoolshark	Assumed presence year round (transitory) Breeding/ Pups are born (mainly December and Jan	DAWE, (2020c) Galeorhinus galeus — School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark- SPRAT Profile, Species Profile and Threats Database (SPRAT), https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68453.
Gummy Shark	Breeding/ pups born (11-12 mth gestation) Assumed presence year round	AFMA (2021) Gummy Shark, Australian Fisheries Management Authority, https://www.afma.gov.au/fisheries-management/species/gummy-shark.
Turtles - EPBC Listed		
Loggerhead Turtle		
Green Turtle	Low likelihood of presence of turtles in Victoria. No known turtle breeding or nesting sites in Victoria	
Leatherback Turtle		
Commercial Fisheries		
See commercial fisheries section 4.7		
Victorian Fisheries		Mills et al., 2006; VFA (2020); SETFIA and Fishwell Consulting (2018, 2020)
Giant Crab - Fishery open (males)		
Giant Crab - Fishery open (females)		
Giant Crab - Highest catch rates (CPUE)		*unreported due to low number (<5) operators, however Tasmanian fishery catch is highest December to February and lowest from June to October (Mills et al., 2006).
Southern Rock Lobster - Fishery open (males)		
Southern Rock Lobster - Fishery open (females)		
Southern Rock Lobster - Highest catch rates (CPUE)		
Tasmanian Fisheries		DPIPWE 2020; SETFIA and Fishwell Consulting (2020)
Giant Crab - Fishery open (males)		
Giant Crab - Fishery open (females)		
Giant Crab - Highest catch rates (CPUE)		
Southern Rock Lobster - Fishery open (males)		
Southern Rock Lobster - Fishery open (females)		
Southern Rock Lobster - Highest catch rates (CPUE)		
Plankton (General)		
The Bonney Upwelling	Sustained Quiescent Downwelling Onset of upwelling	Nieblas A, Sloyan B, Hobday A, Coleman R, Richardsone A (2009) Variability of Biological Production in Low Wind-Forced Regional Upwelling Systems: A Case Study off southeastern Australia, WACO: American Society of Limnology and Oceanography, 54 (5), 1548-1558.
Western Tasmania Upwelling System	ate austral summer bloom (larger bloom Spring bloo	Kampf, 2015
Birds (migratory seabirds)		
Antipodean Albatross	Fledging May be foraging Egg laying austral summe	
Black-browed Albatross	Fledging Presence Breeding	
Buller's Albatross Pacific Albatross	Possible presence Breeding Dec-Oct (New zealand)	(Stahl et al., 1998), DAWE: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64460
Campbell Albatross	Breeding Winter presence	ACAP, 2011
Flesh-footed Shearwater	Breeding & possible presence	DotEE, 2014
Grey-headed Albatross	Breeds on Macquarie Island, feeds in Southern Ocean	EP
Northern Giant Petrel	Breeds on subantarctic islands Most likely presence	EP
Northern Royal Albatross		
Salvin's Albatross	No breeding colonies in Aus	EP
Shy Albatross	Presence Fledging Eggs laid (breeding Albatross island NW Tas)	Gales, 1998, EP
Sooty Albatross	Observed presence	EP
Sooty Shearwater	No breeding colonies in Aus	EP
Southern Giant-Petrel, Southern Giant Petrel	Breeds on subantarctic islands	EP
Southern Royal Albatross	No breeding colonies in Aus	EP
Wandering Albatross	Fledging Possible presence. Feeds in Southern Ocean Eggs laid- B	ACAP, 2011, EP
White-capped Albatross	No breeding colonies in Aus	EP
Birds (Resident seabirds)		
Australian Fairy Tern	Breeding Possible presence Less frequent during Winter	DoEE, 2019, https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82950
Blue Petrel	Breeds on subantarctic islands	EP
Common Diving-petrel		
Fairy Prion		
Fairy Prion (southern)		
Gould's Petrel	Breeds on N Breeds on NSW islands	EP
Great Skua		
Indian Yellow-nosed Albatross	Fledging Most likely presence in Aus Eggs laid	(ACAP 2009).
Northern Buller's Albatross	No breeding colonies in Aus	EP
Short-tailed Shearwater	Foraging (BIA's) + breeding Migrate Northern hemisphere	DoE, 2015a
Soft-plumaged Petrel		
Wedge-tailed Shearwater	Foraging (BIA) + breeding season Sep- May	
White-bellied Storm-Petrel (Tasman Sea)		
White-faced Storm-petrel	Fledging Return to colonies Presence Eggs laid	
Migratory Shorebirds		
Common Sandpiper		
Curlew Sandpiper	Presence	
Eastern Curlew, Far Eastern Curlew	Possible presence	DotE, 2015
Hooded Plover (eastern), Eastern Hooded Plover		
Pectoral Sandpiper		
Red Knot	Presence Breeds in North hemisphere	Birdlife Australia, 2020).
Sharp-tailed Sandpiper		
Birds **- Other**		
Orange-bellied Parrot	Breeding Depart Tas Arrive in Tas for breeding	TSS,2021
Little Penguin	Year round presence Breeding season (Sep-Feb)	

Appendix A - Legislation & Other Requirements Tool

		Receptors												Aspects										Activity		*List all Legislative requirements and identify relevance and justify. If yes – go into more detail – which part.*
Type	**Title**	**Water quality**	**Air Quality**	**Benthic Assemblages**	**Plankton**	**Invertebrates**	**Birds**	**Fish**	**Marine mammals**	**Marine reptiles**	**Commercial Fisheries**	**Other Marine Users**	**Coastal habitats and communities**	**Emissions – Underwater Sound**	**Emissions – Light**	**Emissions – Atmospheric**	**Planned Discharge – Vessels**	**Interference with Other Marine Users**	**Loss of Materials or Waste Overboard**	**Vessel Collision / Entanglement**	**Introduction of IMS**	**MDO Release**	**Spill Response Activities**	**Seismic Survey**	**Vessel / Support activities**	**Scope / Relevance to EP activities**
Cwth Legislation	Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	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; and • water trigger for coal seam gas and coal mining developments.
Regulations	EPBC Act Regulations 2000	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans. The interaction requirements are applicable to the activity in the event that a cetacean is sighted.
EPBC Policy	EPBC Act Policy Statement 2.1 - Interaction between offshore seismic activities and whales (2008)								Y				Y	Y										Y	Y	Provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations and provides 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.
EPBC Policy	EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y													This Significant impact guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a matter protected under national environment law
EPBC Policy	EPBC Act Policy Statement 3.21 - Industry Guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE, 2017)						Y																			This policy statement is intended to provide a guide for stakeholders in assessing the likelihood of a proposed action having a significant impact on one or more migratory shorebird species in Australia.
Cwth Legislation	Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	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)R 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). • so that environmental impacts and risks of the activity are of an acceptable level.
Cwth Legislation	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The object of these Regulations is to ensure that any petroleum activity or greenhouse gas activity carried out in an offshore area is: carried out in a manner consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level.
Cwth Legislation	Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009	Y	Y										Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	A safety case is a document produced by the operator of a facility, and assessed by NOPSEMA, which: •Identifies the hazards and risks •Describes how the risks are controlled •Describes the safety management system in place to ensure the controls are effectively and consistently applied.
Cwth Legislation	Environment Protection (Sea Dumping Act) 1981	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y		Y					Y	Y	Regulates the loading and dumping of waste at sea. This Act also fulfils Australia's international obligations under the London Protocol to prevent marine pollution by controlling dumping of wastes and other matter
Cwth Legislation	Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y				Y	Y	Y		Y	Regulates ship-related operational activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc. It requires that ships >400 gross tonnes have pollution emergency plans. Several MO 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 • MO 97: Marine Pollution Prevention – Air Pollution • MO 98: Marine Pollution Prevention – Anti- fouling Systems. Relevance to this activity: The survey vessel (and support vessels if >400 gross tonnes) will adhere to the relevant MOs by having a SMPEP, Oil Record Book and Garbage Management Plan in place and implemented, along with international pollution prevention certificates verifying compliance with oil, air pollution and sewage measures.
Cwth Legislation	Protection of the Sea (Harmful Antifouling Systems) Act2006	Y			Y	Y		Y	Y	Y	Y						Y								Y	It is an offence under this Act 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.
Cwth Legislation	Australian Maritime Safety Authority Act 1990	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y										Y	Y		Y	The Act applies to offshore petroleum activities that have the potential to affect maritime safety and/or result in environmental damage including pollution associated with the operation of vessels. The EP complies with the Relevant requirements of the Act, including SMPEP and safe navigation lighting.
Cwth Legislation	Navigation Act 2012	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	This Act the primary legislative means for the Australian Government to regulate international ship and seafarer safety, shipping aspects of protecting the marine environment and the actions of seafarers in Australian waters. It also gives effect to the relevant international conventions to which Australia is a signatory. Although the Act does not apply to the operation of petroleum facilities, it may apply to some support vessels.
Cwth Legislation	Biosecurity Act 2015			Y	Y	Y		Y			Y										Y				Y	This Act replaced the Quarantine Act 1908 and is the primary legislation for the management of the risk of diseases that may cause harm to human, animal or plant health, the environment and the economy. The Biosecurity Act regulations apply to Australian territory which is the airspace over and the coastal seas to 12 nm from the coastline. Regulates vessels entering Australian territory regarding ballast water and hull fouling.
Cwth Legislation	Biosecurity Regulations 2016			Y	Y	Y		Y			Y										Y				Y	
Cwth Legislation	Hazardous Waste (Regulation of Exports and Imports) Act 1989	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y						Y	implements Australia's obligations under the Basel Convention on the Control or Transboundary Movements of Hazardous Wastes and their Disposal
Cwth Legislation	National Environmental Protection Measures (Implementation) Act 1998	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y			Y	Y	Y	Y	An Act to provide for the implementation of national environment protection measures in respect of certain activities carried on by or on behalf of the Commonwealth and Commonwealth authorities, and for related purposes
Cwth Legislation	National Greenhouse and Energy Reporting Act (NGER Act)			Y												Y								Y	Y	(1) The first object of this Act is to introduce a single national reporting framework for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production of corporations to:
Cwth Legislation	Underwater Cultural Heritage Act 2019											Y						Y						Y	Y	Protects the heritage values of shipwrecks, sunken aircraft and relics (older than 75 years) in Australian Territorial waters from the low water mark to the outer edge of the continental shelf (excluding the State's internal waterways). The Act allows for protection through the designation of protection zones. Activities / conduct prohibited within each zone will be specified.
Cwth Legislation	South-east Commonwealth Marine Reserves Network management plan 2013-23				Y	Y			Y																	The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
Legislation	Facility Safety Cases required by OPGGS Act 2006						Y			Y																A safety case is a document produced by the operator of a facility, and assessed by NOPSEMA, which: •Identifies the hazards and risks •Describes how the risks are controlled •Describes the safety management system in place to ensure the controls are effectively and consistently applied.
Convention	Marine Order 21 (Safety and Emergency arrangements)	Y	Y	Y	Y																					Marine order 21 sets out the requirements for safety and emergency arrangements including: •safety measures for manning, bridge visibility, pilot transfer arrangements and operation of steering gear •emergency procedures such signals, drills, passenger lists •management plans and duties of seafarers •atmosphere sampling and measuring.
Convention	Marine Orders Part 27 (Safety of Navigation and Radio Equipment).																									Marine order 27 sets out the requirements for: safe navigation radio equipment and communications danger, urgency and distress signals and messages.
Convention	Marine Order 30 (Prevention of Collisions, as appropriate to vessel class)	Y																								Marine order 30 sets out the requirements for: •prevention of collisions •internationally agreed measures for navigation •lights and signals to be used by a vessel.
Convention	Marine Order 70 (Seafarer certification)																									Marine order 70 sets out the requirements for: •application and eligibility requirements for seafarer qualifications •recognition of international qualifications •revalidation and endorsement of qualifications •training courses •audits of training courses.
Convention	Marine Order 71 (Masters and Deck Officers)																									Marine order 71 sets out the requirements for: •eligibility, training and experience requirements to become a master or deck officer under the Navigation Act
Convention	Marine Order 72 (Engineer Officers)																									Marine order 72 sets out the requirements for: •eligibility, training and experience requirements to become an engineer under the Navigation Act 2012.
Convention	Marine Order 91 (Marine Pollution Prevention - Oil)	Y		Y	Y																					Marine order 91 sets out the requirements of the prevention of pollution of the environment by oil for regulated Australian vessels, domestic commercial vessels and Australian recreation vessels including: •certificates required to be held by vessels •reporting requirements •operational requirements for transfer of oil between vessels •when a vessel is not permitted to enter a port
Convention	Marine Orders Part 94 (Marine pollution prevention – packaged harmful substances) 2014																									Marine order 94 sets out the requirements for preventing harmful substances carried by regulated Australian vessels, domestic commercial vessels and Australian recreation vessels from entering the marine environment, including: •management of harmful substances in packaged •form washing substances overboard •notifying and reporting an incident.
Convention	Marine Order 95 (Marine Pollution Prevention - Garbage)	Y		Y	Y																					Marine order 95 sets out the requirements for: •management of cargo residues •discharge of animal carcasses •garbage management plans •garbage record books.
Convention	Marine Order 96 (Marine Pollution Prevention - Sewage)	Y		Y	Y																					Marine order 96 sets out the requirements for the prevention of marine pollution by sewage from ships including: •certification requirements •reporting of incidents •discharge of untreated sewage •discharge in special areas.
Convention	Marine Order 97 (Marine Pollution - Air Pollution)		Y																							Marine order 97 sets out the requirements for the prevention of air pollution by vessels including: •certification requirements •reporting requirements •incineration on board a vessel •energy efficiency •servicing and record keeping.

Convention	Marine Order 98 (Marine Pollution Prevention - Antifouling Systems)	Y		Y	Y																					Marine order 98 sets out the requirements for: •survey, inspection and certification of anti-fouling systems installed on vessels •certification requirements •forms to be used to report incidents.
National Standards	National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009			Y																	Y					Voluntary biofouling management guidance documents for risk of marine pest translocation and introduction via biofouling. All vessels and installations to implement effective biofouling controls as best practice.
National Standards	AS/NZS ISO 31000:2018 Risk Management																									This document provides guidelines on managing risk faced by organizations. The application of these guidelines can be customized to any organization and its context. This document provides a common approach to managing any type of risk and is not industry or sector specific. This document can be used throughout the life of the organization and can be applied to any activity, including decision-making at all levels.
National Standards	AS/NZS ISO HB 203:2012 Managing Environment Related Risk																									This document discusses how the Standard can be used to help an organization manage environment-related risks, which include risks to the environment and from the environment.
National Standards	AS/NZS 4360:2004 Risk Management																									This standard provides a generic guide for managing risk. It may be applied to a very wide range of activities, decisions or operations of any public, private or community enterprise, group or individual and at all stages in the life of an activity, function, project, product or asset. The objective of this standard is to provide guidance to enable public, private or community enterprises, groups and individuals to achieve: (i) a more confident and rigorous basis for decision-making and planning; (ii) better identification of opportunities and threats; and (iii) gaining value from uncertainty and variability.
National Standards	Australian Ballast Water Management Requirements 2020			Y																	Y					The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas. These requirements include legislative obligations under the: • Biosecurity Act 2015 (Biosecurity Act), and • International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention). The requirements provide guidance for vessel operators on best practice policies and apply to all vessels operating internationally and domestically in Australia.
Guidelines	Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (NOAA 2018)								Y					Y												The Technical Guidance provides thresholds for onset of permanent threshold shift (PTS) and temporary threshold shifts (TTS) in marine mammal hearing for all underwater sound sources. It is intended to be used by NOAA analysts and managers, other federal agencies, and other relevant user groups/stakeholders to better predict how a marine mammal's hearing will respond to sound exposure.
Guidelines	National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DAWE 2017)								Y											Y						Provides guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna. Guidance to determine risks of vessel strike, and identify mitigation measures. The audience is government agencies.
Guidelines	National Light Pollution Guidelines for Wildlife						Y			Y					Y											The aim of the Guidelines is that artificial light will be managed so wildlife is: •Not disrupted within, nor displaced from, important habitat •Able to undertake critical behaviours such as foraging, reproduction and dispersal. The Guidelines recommend: •Always using best practice lighting design to reduce light pollution and minimise the effect on wildlife. •Undertaking an environmental impact assessment for effects of artificial light on listed species for which artificial light has been demonstrated to affect behaviour, survivorship or reproduction.
Guidelines	EPBC Policy Statement 2.1 Interaction between offshore seismic exploration and whales							Y	Y	Y																Provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations and provides 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. Although these guidelines are specifically designed for interactions with cetaceans, the soft start provision may also afford protection to other species.
Guidelines	Australian National Guidelines for Whale and Dolphin Watching 2017							Y	Y	Y			Y									Y	Y		Y	Principally applies to commercial marine tourism operations involves in whale and dolphin watching, outlining measures to comply with the EPBC Act and minimise disturbance to these cetaceans. These guidelines are used by ConocoPhillips to the support vessels so that approach distances to cetaceans are adhered to. The EP complies with the relevant components of the guidelines, including using MMOs, soft start procedures, low-power and shut-down zones..
EPBC Management Plans	National Recovery Plan for the Orange-bellied Parrot, *Neophema chrysogaster* (DELWP, 2016)						Y								Y											This recovery plan outlines the long-term strategy, and short-term objectives and actions, for the recovery of the Orange-bellied Parrot (Neophema chrysogaster).
EPBC Management Plans	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPC, 2011)						Y								Y											Covered in this recovery plan are 21 species, including 19 albatross species and two giant petrel species, categorised as Breeding species and Foraging species. It sets out relevant information on the biology and ecology of Australia's albatrosses and giant petrels, identifies issues and threats to these species, and also appropriate management strategies. With overall objective being to ensure the long-term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land.
EPBC Management Plans	Wildlife Conservation Plan for Migratory Shorebirds (DoE, 2015)						Y								Y											This Wildlife Conservation Plan for Migratory Shorebirds outlines national activities to support migratory shorebird conservation initiatives and provides a strategic framework to ensure these activities plus future research and management actions are integrated and remain focused on the long-term survival of migratory shorebird populations and their habitats. The Plan outlines the statutory elements as legislated by the EPBC Act by addressing topics relevant to the conservation of migratory shorebirds, including a summary of Australia's commitments under international conventions and agreements, and identification of important habitat.
EPBC Management Plans	South-east Commonwealth Marine Reserves Network Management Plan 2013-23 (DNP, 2013)				Y		Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Pachyptila turtur subantarctica Fairy Prion (southern)						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Gould's Petrel (Pterodroma leucoptera leucoptera) Recovery Plan						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Pterodroma Mollis Soft-plumaged Petrel						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice for Sternula nereis nereis (Fairy Tern)						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Calidris canutus Red Knot						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Calidris ferruginea Curlew Sandpiper						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice *Numenius madagascariensis* Eastern Curlew						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Thinornis rubricollis rubricollis Hooded Plover (Eastern)						Y																			The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Recovery plan for Marine Turtles in Australia (CoA 2017a)									Y																Identifies light pollution as a threat. Action Area A8 (minimise light pollution) relevant management actions: •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 •Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches •Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution. Identifies noise interference as a threat. Relevant information to noise: •Given that the impacts of noise are unknown, a precautionary approach should be applied to seismic work, such that surveys planned to occur inside important internesting habitat should be scheduled outside the nesting season. •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.
EPBC Management Plans	Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 (DOE 2015a)								Y																	The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Management Plan for the Southern Right Whale. A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011-2021 (DSEWPC 2012)								Y																	Recovery plans set out the research and management actions necessary to stop the decline of and support the recovery of SRW. The aim of a recovery plan is to maximise the long term survival. Relevant to Sequoia MSS the Plan identifies noise interference (and specifically seismic surveys, vessel noise and aircraft operating at low altitude) as a key threat, with potential for add physical (TTS and PTS) and behavioural (distribution and avoidance) impacts specified. Specific to the South-east population, seismic surveys are identified to have moderate population consequence, while vessel noise and aircraft noise is a minor population consequence ranking.
EPBC Management Plans	Conservation Advice Balaenoptera borealis sei whale (DoE 2015b)								Y																	The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Balaenoptera physalus fin whale (DoE 2015c)								Y																	The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
EPBC Management Plans	Conservation Advice Megaptera novaeangliae humpback whale (DOE 2015d)								Y																	The Plan outlines the management strategies for research and monitoring, assessment and permitting, compliance, community participation, Indigenous involvement and environmental management.
Guidelines	Australian Government National biofouling management guidance for the petroleum industry			Y																						Voluntary biofouling management guidance document has been developed to assist industry manage biofouling risk. Guidance for evaluation of biofouling risk of types of structures/facilities; and on biofouling management and decommissioning.
Guidelines	Australian Quarantine and Inspection Service - Australian Ballast Water Management Requirements			Y																	Y					Mariners undertaking ballast water management are to comply with Australian requirements must pay primary attention to the safety of their ships and crews. This applies particularly for vessels using the Sequential Exchange (Empty / Refill) method. Vessel stability, stresses and sloshing at every stage of a planned operation (including the 'half full tank' situation) must be pre-calculated before execution of the planned operation. The requirements are intended to reduce the threat of introducing non-indigenous species to Australia's marine environment through ballast water imported from overseas.
Guidelines	National Plan for Maritime Environmental Emergencies																					Y	Y			The National Plan applies to potential and actual pollution of the sea or harm to the marine environment by oil or hazardous and noxious substance, originating from: • maritime casualties requiring salvage and intervention, emergency towage and requests for a place of refuge • oil pollution or hazardous and noxious substance pollution incidents from vessels • oil or hazardous and noxious substance pollution incidents from oil or chemical terminals (addressed by state and port plans) • oil or hazardous and noxious substance pollution incidents from offshore petroleum activities • marine pollution from unknown sources • marine pollution from floating or sunken containers of hazardous materials • debris originating from a maritime casualty, or
Guidelines	EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance						Y																			This Significant impact guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a matter protected under national environment law.
Guidelines	EPBC Act Policy Statement 3.21 - Industry Guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species						Y																			This policy statement is intended to provide a guide for stakeholders in assessing the likelihood of a proposed action having a significant impact on one or more migratory shorebird species in Australia.
Guidelines	Environmental Management in the upstream oil and gas industry											Y														•Develop exclusion zones in consultation with key stakeholders, including local fishing communities; raise awareness of exclusion zones with all stakeholders. •Issue a 'Notice to Mariners' through the relevant government agencies, detailing the area of operations. •Ensure all vessels adhere to International Regulations for Preventing Collisions at Sea (COLREGS), which set out the navigation rules to be followed to prevent collisions between two or more vessels. •Optimise vessel use to ensure the number of vessels required and length of time that vessels are on site is as low as practicable.

Guidelines	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development											Y														•The EPS listed in this table meet these guidelines with regard to: •Ship Collision (item 120) – to avoid collisions with third-party and support-vessels, offshore facilities [interpreted to include the survey vessel] should be equipped with navigational aids that meet national and international requirements.
Guidelines	Environmental Manual for Worldwide Geophysical Operations											Y														The EPS listed in this table meet these guidelines with regard to: •Section 8.4 (Travel – water travel) – maintain a lookout for, and establish communications with local fishing boats, tourist diving vessels, etc, where possible to minimise interruption with their operations and equipment.
Guidelines	APPEA											Y														The EPS listed in this table meet the following offshore geophysical survey objectives: •Reduce the impact on other marine resource users to ALARP and to an acceptable level. •To reduce risks to public safety to ALARP and an acceptable level.
EPBC Management Plan	Recovery Plan (generic) *Refer to Receptor Screening Tool*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long term survival in the wild of a threatened species or ecological community.
EPBC Management Plan	Conservation Advice (generic) *Refer to Receptor Screening Tool*																									Conservation advice provides guidance on immediate recovery and threat abatement activities that can be undertaken to ensure the conservation of a newly listed species or ecological community.
Fisheries Stock Rebuilding Plan	Stock Rebuilding Strategy 2014 *Refer to Receptor Screening Tool*							Y																		Stock rebuilding strategies aim to rebuild stocks to a defined level consistent with the Commonwealth Fisheries Harvest Strategy Policy 2007.
Tasmania State Legislation	Living Marine Resources Management Act 1995					Y																				The purpose of this Act is to achieve sustainable development of living marine resources having regard to the need to: -increase the community's understanding of the integrity of the ecosystem upon which fisheries depend; and -provide and maintain sustainability of living marine resources; and -take account of a corresponding law; and -take account of the community's needs in respect of living marine resources; and -take account of the community's interests in living marine resources.

Appendix A - Environmental Performance

Control Measures(System, Item of Equipment, Person, Procedure)			Planned Events						Unplanned Events				Environmental Performance			Consultation	ALARP Assessment		
ID	Title	Detail	Emissions – Underwater Sound (Continuous)	Emissions – Underwater Sound (Impulsive)	Emissions – Light	Emissions – Atmospheric	Planned Discharges – Vessels	Interference with Other Marine Users	Loss of Materials or Waste Overboard	Vessel Collision or Entanglement with Marine Fauna	Introduction of IMS	Loss of diesel containment	Ref	Environmental Performance Standards (EPS) Grey text indicates that this performance standard has not been adopted and will not be applied for this activity.	Measurement Criteria (MC)	Measure adopted because of the consultations?	Adopted	Rejected	Reasons for rejection <u>or</u> consideration of improved performance of control measures that have been adopted.
1	Fisheries and community liaison program	The purpose of this control measure is to ensure that relevant persons and local communities are informed about the progress of the activity at the frequency requested during preparation of the EP. There are various people involved in ensuring that the communications procedure is followed with the overall responsibility for ensuring the performance residing with the Environment Advisor. Further detail on the objectives and preferred methods of ongoing consultation is provided in Section 6 - Implementation Strategy.	✓					✓		✓			1.1	All relevant persons will receive notification of commencement of the survey upon acceptance of the EP or a minimum of 2 weeks prior to the survey unless they requested not to receive this information.	Communications records	✓	✓		Updates on a more regular basis are considered burdensome on relevant persons and could dilute the important messages that do need to be received and understood.
													1.2	Relevant persons who requested a 72-hour look ahead for acquisition will be provided this notification daily for the duration of the survey.	Communications records	✓	✓		
													1.3	All correspondence with relevant persons will be recorded in the COPA stakeholder management system.	Entries in the system		✓		
													1.4	Notification to AMSA JRCC 48 hours prior to the commencement of the activity.	Communications records	✓	✓		
													1.5	'Notice to Mariners' issued via RAN Australian Hydrographic Service (AHS) prior to the commencement of the survey.	Log of transmission of Notice To Marines broadcast	✓	✓		
													1.6	AMSA will be notified in the event of equipment loss to provide a warning to shipping vessels in the area, if necessary.	Communications records		✓		
													1.7	A 'on-water' cooperation and interaction protocol will be in place for commercial fishers prior to the commencement of the activity.	Communications records	✓	✓		
													1.8	Undertake post-acceptance, pre-survey visits to Portland, King Island, and Northern Tasmania to meet with local fishers and communities to communicate the outcomes of the NOPSEMA assessment, hear additional feedback from relevant persons, and liaise with local government bodies. If Covid-19 restricts travel to carry out these engagement they will be replaced by online methods of engagement.	Communication records	✓	✓		
													1.9	Undertake one visit to Portland, King Island, and Northern Tasmania during the survey to meet with local fishers and communities to update on progress of the survey and any changes that may have occurred to the conduct of the activity. If Covid-19 restricts travel to carry out these engagement they will be replaced by online methods of engagement.	Communication records		✓		Additional or more frequent visits are likely to increase concern and add more burden to relevant persons who have day jobs and other interests.
													1.10	There will be best endeavours made to develop a SIMOPS plan (consistent with the DMAC guidelines) with abalone divers on King Island and if this isn't possible notices will be put in to local papers and radio on the King Island.	Communication records		✓		
													1.11	Communicate information about the survey including .kmz files, 5 minutes updates, a 48hr look-ahead, to relevant persons who identified a need for this information.	Communication records	✓	✓		
													1.12	Appoint a Fisheries Liaison Officer (FLO) to carry out specific consultation with commercial and recreational fishers.	Communication records			×	Not requested by fishers during consultation. The on-water communication protocol is known to be effective at reducing interference to other marine users so this option is not expected to reduce impact and risks further than already lowered to. Impractical to have a single FLO because the relevant fishers could be from Victoria, Tasmania, and King Island.
													1.13	Notification to all relevant persons with close out letter at conclusion of activity.	Communication records				
													1.14	If following a management of change new research has been considered in the context of the Sequoia EP, summaries of the research and consideration of changes to the activity or control measures will be provided to relevant persons who may be affected by the change.	Communication records				
													1.15	Updates placed on ConocoPhillips's website at key activity stages (a minimum of pre-survey and survey completion).	The website		✓		
2	SRW surveillance program	The purpose of this control measure is to detect presence of SRWs, confirm the classification status (single whale or female and calf pair) and confirm the location, behavioural state and direction of travel by aerial surveillance and land based observer network so that the Sequoia MSS acquisition plans are adapted to minimise impact of sound to SRWs. These controls will also and will be applied to observed BW.	✓										2.1	Coordinate an observer network to collate all available sightings and photographic evidence on the presence, classification, location, behavioural state and direction of travel of SRWs along the Victorian and King Island coasts, commencing 4 weeks prior to and continuing throughout the Sequoia MSS. Undertake aerial surveillance of BIAs off the Victorian and King Island coasts and through the operational area once a week for 4 weeks prior to the commencement of the Sequoia MSS to identify the presence, classification, location, behavioural state and direction of travel of SRWs to inform the adaptive management plan.	SRW Surveillance Reports Weekly Peer Review Panel Meeting reports		✓		Adherence to EPBC Policy Statement 2.1 Part B Part B: Additional Management Procedures, which are designed to further minimise any possible impacts on individual animals or populations. B.3 spotter vessel and aircraft are used to assist in detecting the presence of whales and information will be used to re-design the survey tracks to be run to avoid whales that are in the vicinity. Spotter aircraft will maintain contact with the seismic survey and trained and qualified MMOs will be on board the aerial surveillance aircraft and the seismic vessel. Undertaking surveys more frequently and or earlier in the SRW breading season are not expected to result in additional information on the presence of cow/calf pairs unless cow/calf pairs cannot be found (Adaptive Management Procedure for Marine Mammals outlines actions and triggers).
													2.2	Undertake aerial surveillance of BIAs off the Victorian and King Island coasts and through the operational area weekly during the Sequoia MSS to identify the presence, classification, location, behavioural state and direction of travel of SRWs to inform the adaptive management plan. A second aerial surveillance survey per week may be triggered depending on detection of SRWs during observer program, aerial surveillance and MMO on board vessel.	SRW Surveillance Reports MMO Daily Report Daily Cetacean meeting minutes		✓		Adherence to EPBC Policy Statement 2.1 Part B Part B: Additional Management Procedures, which are designed to further minimise any possible impacts on individual animals or populations. B.3 spotter vessel and aircraft are used to assist in detecting the presence of whales and information will be used to re-design the survey tracks to be run to avoid whales that are in the vicinity. Spotter aircraft will maintain contact with the seismic survey and trained and qualified MMOs will be on board the aerial surveillance aircraft and the seismic vessel.
													2.3	Liaise with the Curtin University SRW Study to understand the presence of SRW in the Otway and Tasmanian waters in the 2021 winter season.	Communication records		✓		The SRW surveillance program includes an observe network program that collates all available sightings records of SRW from citizen scientists, systematic surveys, social media and government databases. Expertise was provided from Curtin University researcher to inform project team of potential impacts to sensitive life stages of SRW in South Eastern Australia. A gaps assessment of available literature was undertaken and incorporated into the evaluation of impacts to cetaceans from project activities,
													2.4	Carry out night flights to detect SRW during MMO unavailability with aircraft fitted with Forward Looking Infra-Red (FLIR) capability.	MMO daily reports, bridge log			×	Cost of such a program is prohibitive and method is unproven for detection of whales.
													2.5	Undertake drone monitoring off King Island to locate and monitor behaviour of SRW for the duration of the survey.	MMO daily reports, bridge log			×	A drone monitoring program has a limited area coverage and line of sight to marine mammal in comparison to the already adopted aerial monitoring adopted as part of this program. Currently available drones (e.g. Mariner Drone - not infrared) will detect cetaceans during daylight hours only, but work in 'all' weather conditions, although visibility and range may be impacted. They also require real-time oversight by MMOs to ensure relevant actions are implemented when detection occurs and don't address night-time.
													2.6	Undertake vessel based monitoring of the East coast of King Island searching for SRW cow/calf pairs within the critical habitat once a week during the survey.	MMO daily reports, bridge log			×	A vessel based monitoring program has a limited area coverage and line of sight to marine mammal in comparison to the already adopted aerial monitoring adopted as part of this program.
													2.7	Undertake night time observations using Infrared cameras	MMO daily reports, bridge log			×	A review of publicly available information on infrared cameras confirms that they detect both small and large cetaceans, but are considered only a "bellringer" for MMOs, instead of a stand-alone detection and classification system. Challenges include: large number of false-positives resulting in multiple alerts in a short time frame that overwhelm the MMO; stabilisation limitations in sea states > Beauford 4; poor performance in rain, fog and drizzle - will not greatly improve detection in areas where this is common. The Generation 1 cameras have image stabilising software which has limited capabilities – it's one of the biggest improvements for the Generation2 cameras that will be undergoing final testing in August. The cost to install and operate the Gen1 camera is estimated at $100,000-$150,000. The University of Sydney is developing vessel-based thermal detection systems but these will not be ready for proof of concept until 2022. They concurred that current technologies are influenced by pitch roll/sea state and that developing technologies using tethered infrared drones would be better in rough seas, but commercialisation with relevant technology is still a year out.
3	Marine mammal adaptive management procedure	The Marine Mammal Adaptive Management Procedure will facilitate communication and planning between the aerial survey and land based observer network teams, the expert											3.1	Daily Cetacean Meetings with MMOs, reviewing input from onshore and aerial surveillance program, to adapt the sail line plan to ensure sound exposure to marine mammals is minimised.	MMO daily report Cetacean meeting minutes		✓		Information and direction will be provided from the peer review panel and informed by the SRW surveillance program. Pre- MSS workshops and training will be undertaken to ensure adoption of the Adaptive Management Procedure.

Control Measures(System, Item of Equipment, Person, Procedure)			Planned Events						Unplanned Events				Environmental Performance			Consultation	ALARP Assessment		
ID	Title	Detail	Emissions – Underwater Sound (Continuous)	Emissions – Underwater Sound (Impulsive)	Emissions – Light	Emissions – Atmospheric	Planned Discharges – Vessels	Interference with Other Marine Users	Loss of Materials or Waste Overboard	Vessel Collision or Entanglement with Marine Fauna	Introduction of IMS	Loss of diesel containment	Ref	**Environmental Performance Standards (EPS)** Grey text indicates that this performance standard has not been adopted and will not be applied for this activity.	Measurement Criteria (MC)	Measure adopted because of the consultations?	Adopted	Rejected	Reasons for rejection <u>or</u> consideration of improved performance of control measures that have been adopted.
		peer review panel, Sequoia MSS project team, MMOs and the vessel contractor to adaptively mitigate impacts to SRWs and BW from sound associated with seismic acquisition.	✓	✓						✓			3.2	Establishment of a peer review panel to review the adaptive management procedure prior to commencement of the MSS and input on the implementation of the plan.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report		✓		The purpose of this review is to ensure that procedure is appropriate to the species and specific risks of interaction during critical life stages and throughout northern and southern migrations, is supported by an appropriate validation process and can be effectively implemented to manage impacts to an acceptable level. Adaptive Management Procedure has been peer reviewed by SRW Expert and ongoing consultation with peer review panel will continue through weekly surveys and as new information becomes available before and during the survey. See also EPS 3. Peer review panel includes expert SRW scientist, ConocoPhillips project team and SRW surveillance program contractors - Fathom Pacific. Review new information that becomes available and provide advice to ConocoPhillips Australia on Adaptive Management procedure methodology, triggers, actions, reporting and monitoring to minimise risk to whales. Information from SRW surveillance program will be delivered to the peer review panel and information will be used to re-design the survey tracks to be run to avoid whales that are in the vicinity. The peer review panel will meet weekly (or more often if adaptive management actions are triggered and new information becomes available) to review SRW surveillance program weekly reports and advise on adaptive management actions.
													3.3	In the event that a SRW or BW (~~A~~dult(s) or cow-calf pair) enters the 3km shut down zone, shutdown and move >TTS effect distance for adults, or TTS or Behavioural Disturbance distance for cow-calf-pairs (which ever is the greatest ~~(~~based on noise modelling results), then commence start-up procedure; or Shutdown for required 'shutdown duration' of 19 hours to ensure whale(s) have~~s~~ time to move >worst-case TTS effect distance, then commence start-up procedure in daylight. This provides for no night time acquisition if there is a sighting of BW or SRW within the preceding 24 hours within the increased shut-down zone to 3 km, with start-up procedure commencing at daylight (PS 2.1 Part B). The 'effect distance' is the distance to TTS for adults, or TTS or behavioural disturbance (which ever is greater) for cow-calf pairs. The specified 'shutdown duration' is based on the average swim speed of 3km/hr (Mackay et al. 2020), and the worst-case assumption that whales travel away from the vessel in the offshore direction (for a maximum TTS effect distance of 56.6km) taking 19 hours. Therefore a shutdown duration of 19 hours is considered acceptable for encounters within the 3km shutdown zone.	MMO daily report		✓		
													3.4	If an adult SRW or BW (confirmed not with calf) is detected by spotter vessel or aerial surveillance within the zone of potential exposure to TTS, shutdown and move >TTS effect distance, then commence start-up procedure; or Shutdown for specified 'shutdown duration' then commence start-up procedure in daylight. Spotter vessel or aerial surveillance detection of SRW adults located further away from the source but within the TSS effect distance will result in the activity shutting down. The 'effect distance' is the distance to TTS for adults and the specified 'shutdown duration' is based on the location of the whale in relation to the vessel as specified in the Marine Mammal Adaptive Management Procedure.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report		✓		Respiration rates for calves are 1.8/minute (Nielson et al. 2019) therefore aerial observations and photography for ≥10 minutes would reliably detect presence of calf. The aircraft with circle whale sighting for 10 minutes and record observations and photography. Therefore, a calf with be detected with confidence. If there is any doubt abut whether there is a calf present, it will be assumed that a there is a calf present, and extra precautionary measures taken. Aerial observations and photographs validated by 2 MMOs with ≥10 minute observation time to confirm no calf. Single whale may experience temporary behavioural disturbance and move away from the area. Energetic costs are low, survey is in small proportion of overall migration route, no impact to biologically critical behaviours are likely and impact to migration pathway is small relative to overall migration area in the offshore waters of southern Australia. TTS occurs over 24hours of exposure and whales are expected to move away before being at risk of TTS. Based on average swim speeds of 3km/hr (Mackay et al. 2020), the adult would be expected to move out side the maximum TTS effect distance (56.6km) within 19 hours.
													3.5	In the event of >2 shutdowns from SRW or BWs in preceding 24 hours, shutdown for 'maximum shutdown duration', then commence start-up procedure in daylight; or Shutdown until aerial surveillance can confirm no SRW/BW present in or migrating towards TTS or behavioural disturbance effect distances, then commence start-up procedure in daylight. The maximum shutdown duration is 38 hours - the time takes a whale to move double the maximum TTS effect distance as specified in the Marine Mammal Adaptive Management Procedure.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report		✓		
													3.6	If a SRW Cow-Calf~~–~~Pair is detected by spotter vessel or aerial surveillance within the zone of potential exposure to TTS and/or behavioural disturbance zone (as defined by noise modelling), ~~-~~shutdown and move >TTS or behavioural disturbance effect distance, whichever is greater, then commence start-up procedure; or Shutdown for specified 'shutdown duration' then commence start-up procedure in daylight. Spotter vessel or aerial surveillance detections of SRW cow-calf pairs located further away from the source but within the TSS/Behavioural disturbance effect distances will result in the activity shutting down. The 'effect distance' is the distance to TTS or behavioural disturbance (whichever is greater) for cow-calf pairs and the specified 'shutdown duration' is based on the location of the whales in relation to the vessel as specified in the Marine Mammal Adaptive Management Procedure.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report		✓		Shutdown to occur to prevent energetic impacts from disturbance affecting biologically important behaviour such as migrating and nursing calf. Peak abundance of SRW in coastal aggregation areas occurs mid-July to end-August (Charlton et al. 2019). The majority of female and calf pairs are expected to have reached the coastline before acquisition starts in August. The mean residency period is 65 days (Charlton 2017) so it can be assumed that pairs will be residing in coastal aggregation areas until end-August, start-September (Charlton et al. 2019). SRW are thought to have a counter-clockwise migration pattern where animals arrive in the east of Australia in May-July, peak in coastal aggregation areas during July/August and then migrate west along the coast before migrating back to southern feeding grounds in Sept/Oct (Burnell 2001).
													3.7	If a resident migration-ready SRW cow-calf pair is not detected by land based observer network program for 48 hours, undertake second weekly aerial surveillance flight as soon as is safe to do so, to confirm no SRW cow-calf pairs present in, or migrating towards TTS/behavioural disturbance effect zones.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report				Onshore observations and photographs validated by suitably qualified specialist. Aerial observations and photographs validated by 2 MMOs. A resident SRW CC-pair is defined as a pair that has selected a breeding aggregation habitat to reside for the season (>1 week) to nurse and rear their young. Mean residency periods for CC-pairs are 65 days (Charlton 2017). Resident CC-pairs occupy typically shallow water <10m deep within 1km of the coast. The Victorian and Tasmania coastal waters are known to include migrating habitat and SRW are known to arrive at the south eastern Australian coastline and travel west to established aggregation areas in South Australia such as the Head of the Great Australian Bight (Watson et al. 2021). There is one established calving ground for female and calf pairs in south eastern Australian at Logans Beach, Warrnambool, Victoria (Watson et al. 2021). SRW are known to have a east to west migration pattern and mothers often travel with their calves west along the coast to prepare for migration. The SRW surveillance program includes a land based observer network and collates all citizen scientist information available on whale presence in the area. There is a strong whale watching citizen scientist community in Victoria so there is a high probability of regular sightings of whales inside established aggregation areas.
													3.8	Where possible, acquisition of eastern seismic lines will occur within 12-24 hours following aerial surveillance that confirms no SRW/BW are present along or moving into AREA 1 (west coast of King Island). The eastern acquisition lines will not be acquired until no SRW or BW are detected inside King Island coastal BIA, a second aerial surveillance flight may be triggered to confirm no SRW or BW inside BIA.	SRW Surveillance Report Weekly peer review panel meeting Daily Cetacean meeting minutes MMO Daily report		✓		No injury to SRW/BW adults. No injury or behavioural disturbance to SRW cow-calf pairs. Seismic acquisition of eastern most lines will not occur if there are SRW or BW detected within the connecting habitat BIA along the west coast of King Island, to ensure that whales inside the BIA are not exposed to sound levels above effect criteria for TTS or behavioural disturbance during biologically critical behaviours (breeding, feeding, resting).
4	Marine Mammal Observers (MMOs) and PAM operators.	The purpose of the MMOs and PAM operators is to provide environmental expertise to the vessel crew to ensure that COPA's Environmental Performance Outcomes are achieved. They do this by implementing EBPC Act Policy Statement 2.1, the Australian National Guidelines for Whale and Dolphin Watching 2017, WA Fisheries Publication No 112 (2013), and the adaptive management procedure for protected species. COPA will review the CV's of the MMOs to determine competence as part of the subcontractor selection.											4.1	Two trained and qualified MMOs with previous survey experience will be resident on the seismic vessel at all times covering all day-time operations. The MMOs will undertake cetacean awareness sessions for key vessel crew. Two PAM operators are also trained MMOs are can provide additional coverage for marine mammal observations.	MMO CVs, MMO daily reports, bridge log		✓		Consideration will be given to the MMOs previous experience including items such as compliance/knowledge and application of relevant controls within EPBC policy statement 2.1, whale and general marine fauna identification relevant for the activity. MMOs will apply the procedure outlined in the adaptive management plan to ensure sound exposure to marine mammals is minimised. Daily cetacean meetings will be held between MMO, PAM operator and on-shift ConocoPhillips offshore representative on shift changes and adaptive management actions triggered or considered are to be documented and discussed.
													4.2	Ensure implementation of all EPBC Act Policy 2.1 Statement Part A measures as required; observation zone (3km), low-power zone (2km) and shut-down zone (500m), and use of softs starts.	MMO daily reports, bridge log confirms MMO attendance		✓		Given additional performance standard to increase distances for more sensitive marine mammals it is unreasonable to extend Policy Statement 2.1 distances for all other whales.
													4.3	Ensure the implementation of increased shut-down zones for blue whales and southern right whales to 3km.	MMO daily reports, bridge log confirms MMO attendance		✓		Increase shut-down zones for SRW beyond 3km are not possible due to MMO visual field limits.
													4.4	Ensure no night time acquisition if there are three of more whale instigated shut-downs or power downs within the preceding 24 hours and commence start-up procedure at daylight.	MMO daily reports, bridge log		✓		COPA could shut-down for a specified period (i.e. 24 hours) but at daylight the MMOs will return to the bridge and therefore the shut-down provides no additional protection to these species.
													4.5	Ensure no night time acquisition if there is a sighting of BW or SRW within the preceding 24 hours within the increased shut-down zone and recommence at daylight (PS 2.1 Part B).	MMO daily reports, bridge log			✓	EPS 3.3 more effectively provides for mitigation of potential impacts of TTS and behavioural disturbance if there is a sighting of BW or SRW within the preceding 24 hours within the increased shut-down zone to 3 km, with start-up procedure commencing at daylight (PS 2.1 Part B). For example, a shutdown 'overnight' may not be adequate where sightings occur on dusk with EPS 3.3 providing for a longer shutdown duration (19 hours) to ensure whales are afforded adequate time to migrate the greatest TTS effect distance away from the vessel.
													4.6	Cease all night time surveying if there are three consecutive days on which there are three or more whale-instigated shut down situations (PS 2.1 Part B)	MMO daily report			×	This performance standard has the potential to undermine the financial viability of the survey. Would extend the duration of the survey and potentially increase the quantum of impact on the population.
													4.7	Work with the vessel master to implement the observation, low-power, and shut-down zones.	Copies of induction records for MMOs and the vessel master		✓		
													4.8	Document all marine fauna interactions in the prescribed format and report cetacean sightings online to the DAWE within 2 months of survey completion using the online Cetacean Sightings Application: http://www.marinemammals.gov.au/sorp/sightings	MMO daily report		✓		
													4.9	Report all marine fauna interactions to the Department of Environment with two months of survey completion	Copies of the reports		✓		

Control Measures(System, Item of Equipment, Person, Procedure)			Planned Events						Unplanned Events				Environmental Performance			Consultation	ALARP Assessment		
ID	**Title**	**Detail**	**Emissions – Underwater Sound (Continuous)**	**Emissions – Underwater Sound (Impulsive)**	**Emissions – Light**	**Emissions – Atmospheric**	**Planned Discharges – Vessels**	**Interference with Other Marine Users**	**Loss of Materials or Waste Overboard**	**Vessel Collision or Entanglement with Marine Fauna**	**Introduction of IMS**	**Loss of diesel containment**	**Ref**	**Environmental Performance Standards (EPS)** Grey text indicates that this performance standard has not been adopted and will not be applied for this activity.	**Measurement Criteria (MC)**	**Measure adopted because of the consultations?**	**Adopted**	**Rejected**	**Reasons for rejection or consideration of improved performance of control measures that have been adopted.**
			✓	✓						✓			4.10	Report marine fauna collisions via the online National Ship Strike Database as per the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna. Entanglement of megafauna is reported to the Whale and Dolphin Emergency Hotline on 1300 136 017 as soon as possible. No attempts to disentangle megafauna should be made by vessel crew.	Copies of the reports		✓		
													4.11	Use of PAM for whale detection and associated notification procedures for 24hrs a day including night and low-vis conditions. Additional detection methods reduce the risks to marine fauna in the vicinity by influencing the seismic survey operations (EPBC Policy Statement 2.1 – Part B.5).	MMO daily reports		✓		The Quiet Sea system includes inbuilt streamer and auxiliary modules to detect vocalisations from 10Hz up to 180kHz and provides automated detection and localisation algorithms in support of MMO observations and decision-making on board the seismic survey vessel. Although the use of PAM from the source vessel can make it difficult to detect low frequencies, this detection method, in conjunction with information on whale movements into and out of the area from the aerial surveillance program, and observations from the supply vessel, will provide an additional layer of detection.
													4.12	Two PAM operators with previous survey experience will be resident on the seismic vessel covering 24 hr operations to detect for whales. PAM operators will work with the MMOs to correlate the identification and localisation of vocalising marine mammals to assess the confidence in PAM to detect present species and distance/bearing to position in low-visibility and at night.	MMO daily reports		✓		Correlation of PAM observations with MMO observations during daylight will improve confidence in the effectiveness of this control measure to detect present species and distance/bearing to position in low visibility and at night. The use of MMOs and PAM during pre-start observations will improve detectability of cetaceans prior to start-up. The combination of MMOs and PAMs is expected to be the most effective combination during high seas and precipitation (Smith et al., 2020).
													4.13	Part B. Additional Management Procedures (see EPBC Policy Act Statement 2.1) - increased pre-watch period of 45 minutes.	MMO daily reports		✓		Typically surface intervals for cetaceans are less than 20 minutes and they typically surface at least five times over 5-10 minutes before submerging, Therefore, extending the pre-start observation period from 30 minutes to 45 minutes improves the probability of sighting marine fauna within the observation zone.
													4.14	Part B. Additional Management Procedures increased pre-watch period of 60 minutes in waters greater than 300 m depth.	MMO daily report			×	Spatially, there is a low probability of overlap given Sperm Whales preference for water depths >300m (Bannister et al (1996). The use of PAM during pre-start observations will also provide for detection of vocalising sperm whales.
													4.15	Delay start-up, power down and/or Implement a shut-down to manage potential interactions with pinnipeds	MMO daily report			×	Soft start procedure will provide warning on start-up, PTS thresholds are not reached, TTS within 80m (assumes they stay within 80m of vessel for 24 hours) is unlikely, hearing is poor in low frequencies and they are expected to practice avoidance behaviours
													4.16	At the discretion of the MMOs', i.e. in response to aerial observations of potential SRWs in the near vicinity, and in accordance with HSE requirements, an MMO may be seconded from the Seismic vessel to undertake scouting to confirm the species present. Support vessel operators will be provisioned with information and equipment to support them in the detection and reporting of marine mammal observations to the MMOs on the seismic vessel.	MMO daily report		✓		Additional MMO permanently stationed on the supply vessel or a dedicated vessel to scout areas where SRWs were observed during aerial surveys incurs significant additional cost and due to observation ranges/small area of coverage this measure is ineffective. The use of additional vessels increases complexity in simultaneous operations which increases risk and has a high adoption cost. MMOs on the escort vessels is not practical because the bridge height is too low to detect whales at distance.
													4.17	At night, the seismic vessel will shutdown in the event of 2 or more acoustic detections for an individual low frequency cetacean (and PAM operator is confident in species ID and distance estimation) and commence start-up procedure in daylight.	MMO/PAMO daily report		✓		
													4.18	The seismic array will operate at low power during line turns to minimise the risk of SRW or BW entering the zone of potential TTS or behavioural disturbance during shut down.	Bridge log		✓		The seismic array will shut down for 2-4 hours every ~12 hours during line turns. Instead of powering down during line turns, the array will stay on low power in order to minimise the risk of a whale entering a zone of potential TTS or behavioural disturbance during a shut down and then increasing probability of exposure to TTS. If the guns are left on lower power, the sound may cause animals to be temporality displaced, however this will reduce the risk of injury to the animals.
5	Project vessels	The activity includes one support vessel (for equipment and crew transfers), one chase vessel (for safe navigation) and the acquisition vessel. As per the requirements of the implementation strategy the vessels will be staffed with qualified and experience crew at all times and will be required to complete an environment induction. All project vessels have various piece of equipment that minimise environmental impacts and risks, mostly specified by maritime law. All project vessels will have means of communication with each other and other marine users.			✓	✓	✓	✓	✓	✓	✓	✓	5.1	Vessels will not travel at speeds greater than 6 knots within a 300m of a marine mammals/birds and will maintain 100m separation from these species. Vessels will not approach closer than 50m of a dolphin (with the exception of animals bow riding).	Bridge log		✓		
													5.2	Project vessels will be equipped with suitable and functioning navigation aids, automatic identification system (AIS) and competent crew maintaining 24-hour visual, and radio and electronic surveillance	Pre-mobilisation inspection report		✓		
													5.3	At least one of the chase or support vessel will be present at all times during the seismic survey. The support vessel will undertake equipment and crew transfers and assist, if it is safe to do so, recovery of lost equipment or unplanned lost garbage.	Bridge logs, support vessel logs		✓		COPA has considered transferring equipment by helicopter however this is expected to increase survey timing which increases environmental risk. Increased emissions and threats to birds also result in no benefit from this improved control measure.
													5.4	Additional chase and/or support vessels will be utilised to provide further protection for other marine users at time of high vessel traffic.	Bridge logs, support vessel logs			×	Increases complexity in simultaneous operations which increases risks. More vessels on the water means greater disturbance to fishers and marine fauna. High adoption cost.
													5.5	COPA will implement the use of the support / chase vessel to manage the proximity of the seismic vessel to any traditional fishing vessels that may be transiting the OA.	Bridge logs, support vessel logs		✓		
													5.6	Support and/or chase vessels will accompany the seismic vessel during surveying to patrol and maintain a clear zone ahead of the vessel including scouting for and communication with commercial, recreational, shipping, and other marine users.	Bridge logs, support vessel logs		✓		
													5.7	All project vessels will all have a Ballast Water and Sediment Management Plan, a Ballast Water Record Book, a Shipboard Oil Pollution Emergency Plan (SOPEP), an Ozone-Depleting Substances Record Book, a Garbage Management Plan, appropriate to the Class of the vessel.	Relevant record book or management plan		✓		
													5.8	Ballast water exchanges will be done in open waters and not within an AMP.	Ballast water record book		✓		
													5.9	Contracted vessels will have water separation systems such that bilge discharges overboard will not exceed 15 ppm and an oily water record book to record discharges.	Oily water record book		✓		
													5.10	Vessels fitted with shrouded lights to prevent light spill or directional lighting.	Pre-mobilisation inspection report		✓		
													5.11	There will be no discharges from contracted vessels within the Zeehan Marine Park	Relevant record books		✓		
6	IMS Risk Assessment Process	This process mandates an IMS risk assessment be conducted on vessels and immersible equipment by a qualified IMS inspector, prior to mobilisation to the operational area. Vessels/immersible equipment must be assessed as 'low-risk' prior to mobilisation to the operational area. This procedure assures COPA's adherence to the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and the Australian Ballast Water Management Requirements (DAWE, 2020.									✓		6.1	As per the IMS Risk Assessment Process, vessels and in-water equipment will be assessed by a qualified IMS inspector as having a low risk of invasive marine species prior to deployment to the operational area. Where the vessel/immersible equipment have been deemed low-risk by the IMS inspector, no further management measures are required, and the vessel/immersible equipment may be deployed into the operational area. Where the vessel/immersible equipment have been deemed high, moderate or uncertain risk by the IMS inspector, a vessel inspection will be undertaken by the IMS inspector. If IMS are identified or it is uncertain if IMS are present, cleaning will be undertaken and the vessel/immersible equipment deemed low-risk by the IMS inspector prior to deployment to the operational area.	Completed IMS risk assessment report		✓		
													6.2	The IMS risk assessment will be conducted by a qualified IMS inspector who is listed by the WA Department of Primary Industries and Regional Development (Fisheries) to be suitably qualified to undertake vessel biofouling inspections (https://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biosecurity/Vessels-And-Ports/Pages/Biofouling-Inspectors.aspx).	WA Department of Primary Industries and Regional Development (Fisheries) biofouling inspector listing		✓		
													6.3	Before entering a port, check NIMBI'S database for invasive marine species and assess changes in known to occur species (https://nimpis.marinepests.gov.au/species)	Completed risk assessment		✓		
													6.4	During the Sequoia MSS immersible equipment will be cleaned of any biofouling whenever it is bought onboard the vessel.	Vessel maintenance logs		✓		
													6.5	The COPA IMS Risk Assessment Process is consistent with the national standards.	Annual review of the procedure to confirm consistency with the tool		✓		
7	Marine Assurance System	The marine assurance system is administered by COPA's Marine team and, amongst other requirements, ensures compliance of contract vessels with MARPOL, COLREGS, and Marine Orders 21, 30, 59 70,71,72, 91, 95, 96, 97, 98. COPA undertakes a vessel contractor pre-qualification assessment in accordance with its Marine Risk Management Standard (GM-STD- MA-003) to ensure vessel biofouling controls meet these EP requirements. The system also requires the contractor to have aHSE management plan and to provide a bridging document that needs to be approved by COPA prior to execution.	✓		✓	✓	✓	✓	✓	✓	✓	✓	7.1	Ensure that contracted vessels have anti-foulant systems that are maintained and in compliance with the International Convention on the Control of Harmful Anti-Fouling Systems on Ships	Copy of the antifoulant certificate/declaration		✓		
													7.2	OVID-style inspections will be undertaken of project vessels, including a check for valid and in date certificates as required by the various Marine Orders, as part of the contracting process.	Pre-mobilisation inspection report, including sighting of the relevant certificates.		✓		
													7.3	Ensures that the sulphur content of fuel used by project vessels will comply with Regulation 14 of MARPOL Annex VI (as appropriate to vessel class) in order to control SOx and particulate matter emissions.	Bunkering records/receipts, vessel contract		✓		
													7.4	If any project vessels, including the seismic vessel and any spill response vessels, has an overseas 'last port of call', a Pre-Arrival Report will confirm that the vessel meets ballast and quarantine requirements.	Completed pre-arrival report, vessel track logs, Ballast Water Record Book		✓		
													7.5	Ensures that spill kits will be available on project vessels.	Pre-mobilisation inspection report		✓		
													7.6	Ensures that vessels will use approved navigation systems and depth sounders.	Pre-mobilisation inspection report		✓		
													7.7	Preventative maintenance of anchoring equipment completed as scheduled.	Pre-mobilisation inspection report		✓		
													7.8	Checks that project vessels have a preventative maintenance system and that maintenance is regularly completed as scheduled.	Pre-mobilisation inspection report		✓		
													7.9	Ensures that lifting equipment that contains hydraulic fluid will be maintained in accordance with a functioning maintenance management system	Vessel maintenance logs		✓		
													7.10	Communicate the requirements imposed on the vessel contractor that are additional to maritime law through an environmental induction which includes a requirement for no waste discharges within Australian Marine Parks.	Induction and AIS logs		✓		
													7.11	Requires pre-mobilisation audits of all contracted vessels.	Pre-mobilisation inspection report		✓		
8	Oil Pollution Emergency Plan (including OSMP)	The purpose of the OPEP is to guide COPA in how to respond to a hydrocarbon spill in a manner consistent with the national system for oil pollution preparedness and response.											8.1	The OPEP and OSMP will be part of the EP submission and assessed and accepted by NOPSEMA	Letter of acceptance from NOPSEMA		✓		
													8.2	COPA will implement a monitor and evaluate strategy to determine the fate and ecological consequences of a spill in accordance with the OPEP and OSMP.	Daily logs from monitoring personnel, monitoring records from flights and vessels		✓		

Control Measures(System, Item of Equipment, Person, Procedure)			Planned Events						Unplanned Events				Environmental Performance			Consultation	ALARP Assessment		
ID	Title	Detail	Emissions – Underwater Sound (Continuous)	Emissions – Underwater Sound (Impulsive)	Emissions – Light	Emissions – Atmospheric	Planned Discharges – Vessels	Interference with Other Marine Users	Loss of Materials or Waste Overboard	Vessel Collision or Entanglement with Marine Fauna	Introduction of IMS	Loss of diesel containment	Ref	Environmental Performance Standards (EPS) Grey text indicates that this performance standard has not been adopted and will not be applied for this activity.	Measurement Criteria (MC)	Measure adopted because of the consultations?	Adopted	Rejected	Reasons for rejection **or** consideration of improved performance of control measures that have been adopted.
												✓	8.3	COPA will implement a shoreline cleanup strategy to remove bulk and stranded oil from shorelines identified as suitable for cleanup as an outcome of SCAT assessments and in accordance with the OPEP Shoreline Response Guide	SCAT assessment records, shoreline cleanup records		✓		
													8.4	COPA will implement a protection and deflection strategy at identified sensitive areas to prevent hydrocarbons entering sensitive or pristine habitats in accordance with plans recommended as an outcome of SCAT assessments.	SCAT assessment records		✓		
													8.5	COPA will implement a contain and recover strategy to contain, collect, separate and reprocess liquid hydrocarbon through suitable vessel configurations.	Daily logs from vessels			×	Only diesel will be used for this activity which spreads too thin in the open ocean to be able to be collected. The fate of diesel in the marine environment is likely to be <7 days on the surface and <6 weeks before natural microbial breakdown removes any trace of spilt hydrocarbons.
													8.6	COPA will implement a chemical dispersant strategy to enhance the natural processes of water column microbial breakdown by increasing the surface area of hydrocarbon available to be degraded.	Daily logs from vessels			×	High evaporation of diesel and rapid spreading mean that adding chemical dispersants would be ineffective and increase environmental harm.
													8.7	COPA will implement an oiled wildlife response strategy to protect listed and migratory species in consultation with the Tasmania government.	Wildlife response records		✓		
9	Oil spill response equipment and personnel and associated emergency management procedure	COPA maintains access to large stockpiles of equipment and a local, national and international pool of dedicated oil spill response personnel. COPA is a member of AMOSC, OSRL, and the GRSN. COPA also has MOU's in place with other titleholders should support be required.										✓	9.1	Oil spill response equipment is located in Fremantle, Geelong (AMOSC), Singapore, and Southampton (OSRL), is maintained and ready for deployment on a 24/7 availability basis in accordance with an agreed Service Level Agreement (or equivalent).	Master services contracts, service level agreements		✓		Keep on-water spill response equipment available on the survey vessel along with trained crews is considered unreasonable given the predicted fate of diesel in this environment.
													9.2	AMOSC and OSRL will be audited annually by one of their members to ensure that the Service Level Agreement can be met	Annual audit report		✓		
													9.3	Memoranda of Understanding are in place with other titleholders through the AMOSPLAN	AMOSPLAN		✓		
													9.4	COPA has access to trained oil spill responders in Australia and will staff an Incident management team in the event of an incident.	Staff emergency roster		✓		It is not feasible or of any benefit to locate responders closer to site given the remoteness offshore and the fate of diesel in the marine environment.
													9.5	COPA will maintain the minimum personnel numbers to respond to a spill.	Training records		✓		These numbers of personnel are considered the minimum requirement for all COPA's offshore activities. This capability well exceeds the need in relation to this activity.
10	Vessel bunkering procedure	The purpose of this procedure is to ensure that good practice and industry standards are applied to bunkering operations.										✓	10.1	Should the contracted vessel be of sufficient tank capacity be available then there will be no offshore refuelling/bunkering as part of the petroleum activity.	Bunkering records/receipts, vessel contract		✓		COPA's preference will be for a vessel of sufficient capacity to avoid refuelling at sea.
													10.2	Should the contracted vessel have insufficient fuel capacity and need to refuel the contracted vessel will have a vessel bunkering procedure.	Bunkering procedure		✓		
													10.3	Contracted vessels will have dry-break couplings, inspected and certified bunkering hoses, and this equipment will be maintained.	Pre-mobilisation inspection report, maintenance records		✓		
													10.4	Bunkering operations will commence during daylight hours with continual monitoring of hoses and tank levels from both vessels.	Bunkering record book, completed checklist		✓		
													10.5	Bunkering operations will occur outside 50 km of marine parks.	Bunkering records/AIS track		✓		
													10.6	Bunkering operations will only commence in port	Bunkering record book			×	Recovering streamers and return to port increases survey duration, increases life safety risk, and increases impacts to other marine users. High adoption cost.
11	Sail line plan	The sail line plan is the key control measure for ensuring that activity is carried out by the contractor to the specifications of COPA. It includes spatial and technical data consistent with the description of activity including the limits and boundaries of the operational area and acquisition area for operation of the seismic source and excised zones. The sail line plan includes all the specifications of the acoustic source and streamer configuration.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11.1	The sail plan will contain information for the seismic contractor on the operational area, the acquisition area, depth contours, and distances related to environment management control measures. These areas will be the minimum extent that the survey needs to cover to be financially and geophysically viable.	Sail line plan		✓		If COPA were to decrease the extent of the survey any further the geophysical objectives of the survey could not be met as we need to tie into existing data points and cover the title work commitments.
													11.2	Implement a 'low-power' excise area over the known GC fishing area/habitat.	Sail line plan	✓	✓		
													11.2a	Excise of the south west area of the survey that overlaps with GC habitat from the 140m depth contour (plus 750m on water buffer) to the border of the acquisition area.	Sail line plan	✓	✓		
													11.3	The sail plan will contain sail line pre-plots for acquisition and instruction on how and when these sail lines will be optimised and updated throughout the survey due to operational and environmental constraints and considerations. The optimisation process will ensure the minimum duration possible for the survey to minimise costs and environmental harm. Therefore this includes night-time operations (subject to MMO reports).	Sail line plan		✓		Any increase to survey duration financially impacts COPA and increases environmental exposure so our interests are aligned to minimise the survey duration.
													11.4	Proprietary CSI technology is used so that the survey time is reduced as much as possible (60 days on water rather than up to 98 days)	Vessel contract		✓		Marine vibrosize could reduce seismic sound impacts however the technology has not a proven to result in the necessary quality of imaging and is not currently commercial viable.
													11.5	**Vessel activity is limited in the Multiple Use Zone of the Zeehan AMP, which allows for petroleum exploration (no ingress into the Special Use Zone is permitted). No activities in the Apollo marine park.**	Sail line plan		✓		
													11.6	Alternative acquisition timing to minimise impact from acoustic emissions.	Sail line plan			×	The Aug-Oct period was identified as the least environmentally sensitive timing for the range of environmental values and sensitivities. Key amongst this was the effectiveness of management measures in being able to avoid peak fishing seasons (Nov - May), sensitive life-cycle stages for female lobsters (April - June), moulting and buried female lobsters (April - June), and the increased biodiversity associated with the Bonney upwelling (Nov - May). Southern Right Whales breading and migration times are overlapped and with the control measures adopted these impacts can be minimised to below an acceptable level of impact. Moulting male lobsters peak in August and this timing is avoided as much as possible whilst meeting survey objectives.
													11.7	The sail plan will be split across multiple time windows to allow for environmental recovery.	Sail line plan			×	No permanent or irreversible environmental harm is predicted from the impact assessment meaning there is no environmental benefit from this control measure performing in this way. Extreme adoption costs.
													11.8	The sail line plan will be provided to the seismic contractor for agreement prior to the survey and all variations to the plan will be agreed and recorded in writing between COPA and the seismic contractor.	Sail line plan and variation instructions		✓		
													11.9	Acoustic source size will not exceed 3,480 in3 and will utilise three independent source arrays to generate acoustic pulses by alternatively discharging compressed air into the water column at ~6–7 seconds intervals, ('flip-flop' or 'flip-flop-flap').	Sail line plan		✓		`
													11.10	Streamer will be solid, rather and fluid filled streamers equipped with pressure-activated self-inflating buoys, streamer recovery units, and turtle guards. Control devices will be positioned along the streamers to maintain the position of the streamers at the required depth and cables will be towed at a depth that will not allow them to be closer than 10 m from the seabed.	Sail line plan		✓		
													11.11	Data acquisition will be undertaken in a north to south and south to north line orientation as modelled.	Vessel track from AIS		✓		
													11.12	There will be no operation of the acoustic source outside of the Operational Area	Vessel track from AIS		✓		
													11.13	Operation of the acoustic source array will only occur in water depths >70 m.	Vessel track and bathymetry overlays	✓	✓		
													11.14	40 km separation between the survey and other operating seismic vessels of concurrent / simultaneous surveys in the region of the OA during data acquisition.	Vessel track from AIS		✓		In the event that the timing of any proposed seismic survey coincides with another survey in the area, the survey vessel will ensure a minimum distance of 40 km is maintained between them during full seismic acquisition to: •minimise cumulative impacts on marine fauna; and •minimise noise interference that may affect seismic data quality.
													11.15	Conduct the MSS only in waters deeper than 150 m to avoid areas of importance for the southern rock lobster fishery.				×	SIV has requested that COPA Australia excludes undertaking the survey in water depths less than 150 m deep to avoid important southern rock lobster fishing grounds. COPA Australia has considered this request, but 91% of the survey occurs in waters <150 m deep and all four prospects are located in water depths <150 m. This means the survey objectives and the permit requirements could not be met, making this request unviable.
													11.16	Maintenance airgun tests in water will be minimised and will not exceed 50% source power.	Daily reports		✓		This control will minimise airgun discharge within the OA to ALARP.
													11.17	If COPA becomes aware of another MSS to take place in the same area at the same time as this survey, at least a 40 km (21 nm) separation will be maintained between active sources to ensure sound from one source doesn't interfere with sound from the other and to reduce the possibility of cumulative sound impacts.	Daily reports		✓		
													11.17	Excise of the largest and eastern most polygon identifying rock lobsters as a key natural value as per Figure 4-6 of the EP plus a 750 buffer on the western edge of the polygon.	Sail line plan & EP		✓		
													11.18	Sail line turns will not occur within 200m of the Big Reef seabed feature.	Sail line plan		✓		
12	Company Site Representatives	COPA will have a Quality Control Representative (QCR), a Navigation Specialist, and a Seismic Specialist onboard the vessel at all times. Their responsibilities include ensuring the activity is conducted in accordance with the EP and contract.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	12.1	Oversight of the project and implementation of EPO's and EPS's within the EP.	Bridge logs, POB record		✓		
													12.2	Verify that the project vessels are performing as per the agreed contract and executing the seismic in accordance with the agreed (and varied) sail line plan.	Daily reports		✓		
													12.3	Conduct daily informal HSE checks of vessel operations to ensure that the EP commitments are implemented.	Daily reports		✓		
													12.4	Attend the daily operational meeting and tool box talks recording any environment matters discussed.	Daily reports		✓		
													12.5	Record details of any environmental incidents that have occurred in the previous 24 hours.	Daily reports		✓		
13	Adjustment protocol	The objective of the protocol is to ensure that no fisher is worse off as a result of the Sequoia seismic survey. The scope of the protocol is for direct losses: 1) Accidental damage or loss of deployed fishing equipment causes by the presence of the seismic vessel (either repair or replace); 2) Displacement for increased transit times which result in increased fuel and crewing costs from moving fishing locations, 3) Reduced catch per unit effort if survey acquisition timing directly overlaps a previously fished area, within the fishing season, demonstrated by the reported data in previous 5 years.						✓					13.1	Claimants will be provided with an assessment outcome report including the catch data and methodology committed to in the Protocol.	Ongoing consultation records	✓	✓		
													13.2	Claims will be assessed by a third-party on behalf of ConocoPhillips Australia with at least 20 years experience in Australian fisheries management.	Ongoing consultation records	✓	✓		
													13.3	ConocoPhillips Australia will provide the claimant with an assessment report within 30 days.	Assessment report(s)		✓		
													13.4	There will be an independent expert review panel in place to resolve any disputes or disagreements on claims assessments.			✓		
													13.5	The compensation process will require a fisher to provide evidence for claimed losses that enables a calculation of how much compensation may be due.	Compensation process (or equivalent)	✓	✓		
													13.6	The 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 ConocoPhillips Australia. An independent expert review decision may differ from the initial assessment outcome.	Independent expert report	✓	✓		
													13.7	ConocoPhillips Australia commits to abiding by an independent expert review decision and paying any adjustment amount determined by the independent expert panel.	Independent expert report	✓	✓		

Control Measures(System, Item of Equipment, Person, Procedure)			Planned Events						Unplanned Events				Environmental Performance			Consultation	ALARP Assessment		
ID	**Title**	**Detail**	**Emissions – Underwater Sound (Continuous)**	**Emissions – Underwater Sound (Impulsive)**	**Emissions – Light**	**Emissions – Atmospheric**	**Planned Discharges – Vessels**	**Interference with Other Marine Users**	**Loss of Materials or Waste Overboard**	**Vessel Collision or Entanglement with Marine Fauna**	**Introduction of IMS**	**Loss of diesel containment**	**Ref**	**Environmental Performance Standards (EPS)** Grey text indicates that this performance standard has not been adopted and will not be applied for this activity.	**Measurement Criteria (MC)**	**Measure adopted because of the consultations?**	**Adopted**	**Rejected**	**Reasons for rejection <u>or</u> consideration of improved performance of control measures that have been adopted.**
													13.8	The Adjustment Protocol will be drafted with engagement and due consideration to the ongoing feedback of the fishing associations who will be encouraged to communicate the details of the protocols with their members prior to the commencement of the survey.	Consultation records	✓	✓		
													13.9	The Adjustment Protocol will be drafted based on the following principles: - ConocoPhillips will amend the Adjustment Protocol based on objections/claims raised by the fishing associations where those claims are within the scope of the Adjustment Protocol. - ConocoPhillips will provide its assessment of merit of objections/claims to objections/claims raised by fishing associations in writing and provide a written response about how they can be resolved. - ConocoPhillips will ensure records of engagement with fishing associations are kept and there is as little burden on the associations as possible.	Consultation records				
													13.10	There will be a simplified summary of the Adjustment Protocol provided to fishing associations for distribution to members. The simplified summary will include details of how to make claims and the process for assessment/payment.	Consultation records	✓	✓		Indirect losses are not predicted from this activity and thus are not reasonable to consider within this compensation process.
14	Acquire Seismic On Paper (ASOP)	This exercise is designed to bring all stakeholders, technical staff and decision makers together, from all companies working on the project to share knowledge, identify any project risks, and map out possible improvements before the operations phase.		✓	✓	✓		✓	✓	✓	✓	✓	14.1	The ASOP will occur prior to the commencement of the survey.	Written report		✓		
													14.2	There will be a terms of reference, attendee list, and ASOP report written up and adjustments to the EP or operational procedures will be recorded in a report.	Written report, MOC		✓		
													14.3	The ASOP will involve all operational stakeholders including relevant environmental experts.	Attendee list		✓		
													14.4	The ASOP will involve a marine mammal expert when discussing control measures and monitoring programmes.	Attendee list		✓		
													14.5	The ASOP will involve an invertebrate expert when discussing control measures and monitoring programmes.	Attendee list			×	There are no specific control measures relevant for the ASOP process (i.e. activity adjustments only)
15	DNP requirements	Following consultation with the DNP the key natural values of the Zeehan marine park had to be excised or monitored. This control has been adopted to address their claims.		✓	✓	✓		✓	✓	✓	✓	✓	15.1	Provide the bathymetry data available from the survey once processed.	Consultation records	✓	✓		
													15.2	Provide all geotechnical and geophysical data gathered from any future surveys in the title, if they are carried out.	Consultation records	✓	✓		
													15.3	Carry out a desktop study of SRL population characteristics within the marine park. The objectives and design of this study will be decided in consultation with the DNP. Also see Note 1	Consultation records	✓	✓		
													15.4	Carry out an in-field characterisation survey of the five un-excised areas of natural value after completion of the survey. The objectives and design of this study will be decided in consultation with the DNP. Also see Note 2	Consultation records	✓	✓		
													15.5	Contribute to a field-based impact study to further understanding about the ecological sustainability of rock lobster populations in the Zeehan Marine Park. Also see Note 3	Consultation records	✓	✓		

Sequoia 3D MSS Environment Plan

Appendix B

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Rev 4 19 July 2021

1. Receptors-impacts-aspects Scoping of Relationships and Justifications

Based upon an understanding of environmental interactions, relevant impacts or risks resulting from the interaction of an operational aspect with each receptor were defined. Environmental receptors identified as particular values and sensitivities (described within the EP) with the potential to be exposed to an aspect and subsequent impacts or risks were then summarised, enabling a systematic evaluation to be undertaken. For each receptor, planned impacts and unplanned risks are shown in The Aspect-Impact-Receptor section of Appendix A.

Each interaction is identified as:

- 'X', Impact or risk analysis (described in Section 1 of the EP) indicated that interaction is either not predicted to occur i.e. there is no significant cause/effect pathway, or the interaction is predicted to have less than Negligible (1) consequence. An explanation is provided in the appropriate assessment in Sections 1.1 and Section 1.2.
- '✓', Impact or risk analysis indicated that an impact is predicted to occur. A detailed evaluation of the impact or risk is provided in the appropriate assessment in Section 4 and 5 of the EP.

The following sections provides a summary and justification for those aspect-receptor relationships not evaluated further.

1.1. Planned Impacts - Ecological Receptors Screening

1.1.1. Emissions – Underwater Sound (Continuous)

Table 1-1 Justification for Planned Impacts Not Evaluated Further for Emissions – Underwater Sound (Continuous)

Plankton	**X**
Injury/mortality to fauna; Change in fauna behaviour Underwater sound (continuous) emissions have the potential to result in: • a change in ambient sound. As a result of a change in ambient sound, further impacts may occur to plankton, including: • change in fauna behaviour • injury/mortality to fauna. The Sound Exposure Guidelines for Fishes and Sea Turtles Guidelines (Popper et al., 2014) details that no data exists in relation to vessels noise impacts for eggs and larvae. Popper et al. (2014) provides quantitative thresholds for effects to fish eggs and larvae from continuous noise sources in the near, intermediate and far field. As there are no thresholds for plankton the thresholds for eggs and larvae are typically applied as a proxy. Where insufficient data exists to make recommendations Popper et.al., (2014) describe three distances from a sound source of near, intermediate and far and rate the relative risk to receptors as high, moderate or low. Distances are described as: • Near - tens of metres from the source • Intermediate - hundreds of metres from the source • Far - thousands of metres from the source Popper et.al. (2014) describe the risk of mortality and potential mortal injury, recoverable injury, and TTS to eggs and larvae as 'low' at all three zones. They also state behavioural changes for moderate at distances near and intermediate from the source and low at distances far from the source. Masking is rated as high, moderate and low of distances of near, intermediate and far, respectively. Any potential impacts to plankton have to be assessed in the context of natural mortality rates which have been reported to be 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. Mortality or mortal injury impacts to plankton (including fish eggs and larvae) resulting from vessel continuous sound are likely to be inconsequential compared to natural mortality rates.

Plankton have a patchy distribution linked to localised and seasonal productivity that produces sporadic bursts in populations (CoA, 2015c). Plankton distribution in the operational area is expected to be highly variable both spatially and temporally and are likely to comprise characteristics of tropical, southern Australian, central Bass Strait and Tasman Sea distributions.

Blue and other whales feed on the zooplankton *Nyctiphanes australis*, typically called krill, that are linked to seasonal upwellings along the Great Southern Australian Upwelling System which extends along the shelf from the eastern Great Australian Bight to western Tasmania (Gill, 2020). the Sequoia MSS is temporally positioned (August and October) to avoid the upwelling season when Blue and other whales are feeding the area.

Noise emissions on plankton populations, including krill, are unlikely to cause a significant change in behaviour or injury/mortality at a measurable level. Therefore, continuous noise emissions on plankton have not been evaluated further.

The survey is taking place in waters 90 – 1,250 m deep, and vessels will be operating constantly at low speeds. Continuous sound from the Sequoia MSS is not expected to cause Injury/mortality to fauna or a change in fauna behaviour and no functional cause-effect relationship has been established. Therefore, impacts to plankton, benthic assemblages and invertebrates from continuous underwater sound are not expected, and have not been evaluated further.

Invertebrates **X**

Injury/mortality to fauna; Change in fauna behaviour

Underwater sound (continuous) emissions have the potential to result in:

- a change in ambient sound.

As a result of a change in ambient sound, further impacts may occur to invertebrates, including:

- change in fauna behaviour
- injury/mortality to fauna.

No functional cause-effect relationship has been established for injury or potential mortal injury to invertebrates from continuous underwater sound thus impacts are not predicted and have not been evaluated further.

There have been some studies that have identified behavioural and physiological effects on marine invertebrates from shipping noise (Murchy et al., 2019). There are no effect criteria to assess potential impacts and given that underwater sound from the acoustic source is the dominant source of sound, any impacts from vessel sound would not be distinguishable and therefore have not been evaluated further.

Fish, Marine reptiles **X**

Injury/mortality to fauna

Underwater sound (continuous) emissions have the potential to result in:

- a change in ambient sound.

As a result of a change in ambient sound, further impacts may occur to fish and marine reptiles, including:

- injury/mortality to fauna.

The Sound Exposure Guidelines for Fishes and Sea Turtles Guidelines (Popper et al., 2014) details that there is no direct evidence of mortality or potential mortal injury to fish or marine turtles from shipping and continuous sounds.

As no functional cause-effect relationship has been established, injury/mortality to fish from continuous underwater sound is not predicted and has not been evaluated further.

Marine Mammals **X**

Injury/mortality to fauna

Underwater sound (continuous) emissions have the potential to result in:

- a change in ambient sound.

As a result of a change in ambient sound, further impacts may occur to marine mammals, including:

- injury/mortality to fauna.

Erbe et al. (2019) in a review of the effects of ship noise on marine mammals did not identify injury or mortality as a potential effect from continuous vessel noise. This is supported by other studies looking a sound impacts to marine mammals (McCauley 1998, 2003; McCauley and Jenner 2001; Richardson et al., 1995).

As no functional cause-effect relationship has been established, injury/mortality to marine mammals from continuous underwater sound is not predicted and has not been evaluated further.

1.1.2. Emissions – Underwater Sound (Impulsive)

Table 1-2 Justification for planned impacts Not Evaluated Further for Emissions – Underwater Sound (Impulsive)

Invertebrates	**X**
Change in hearing via permanent and temporary threshold shift Underwater sound (impulsive) emissions have the potential to result in: • a change in ambient sound. As a result of a change in ambient sound, further impacts may occur to invertebrates, including: • change in hearing via permanent and temporary threshold shift. Invertebrates detect sound by sensing either the 'particle motion' (Przeslawski et al., 2016a;b; Carroll et al., 2017), through other external and internal physiological structures such as hairs, statocysts and muscles; or 'pressure' component (or both) of a sound field in the marine environment. Invertebrate statocysts are the mechanosensory organ equivalent to the inner ear of humans and are responsible for the detection of gravity, position and movement (Day et al., 2020). Because they lack gas-filled bladders, marine invertebrates are unable to detect the pressure changes associated with sound waves (Carroll et al., 2017; Parry & Gason, 2006). As no functional cause-effect relationship has been established for a change in hearing, permanent and/or temporary threshold shifts in invertebrates are not predicted and have not been evaluated further. Impacts to statocysts are evaluated under 'Fauna injury/mortality'.	
Birds	**X**
Change in fauna behaviour Underwater sound (impulsive) emissions have the potential to result in: • a change in ambient sound. As a result of a change in ambient sound, further impacts may occur to birds, including: • change fauna behaviour. There are no thresholds for underwater sound impacts to seabirds. As such, no modelling can be conducted and there is no threshold distance by which to set an EMBA. The threshold for physiological damage on the auditory system for marine birds is unknown, however most seabirds are generally shallow divers and utilise surface waters where the acoustic signals 'destructively interfere' resulting in much lower sound exposure compared with deeper waters (Marine Technology Directorate, 1996: cited in SCAR, 2002) and the time of exposure underwater is short. In the event that individual birds or flocks are present in the Operational Area during acquisition, vessel movement is expected to temporarily deter them from foraging in the immediate vicinity of the vessel. The risk of underwater sound impacting individuals or a population of any given species during plunge/dive feeding is extremely low. While resting/rafting on the water surface, there is limited potential for seabirds to be affected by the seismic sound due to the limited transmission of sound between the air- water interface. If there is an affect, it is likely to be a startle response, resulting in the bird flying away. Seabirds feed on multiple prey species and have widespread foraging areas. While cephalopod displacement may result in the displacement of these birds, this impact is localised, temporary and recoverable in any one location. Given their widespread foraging areas (ACAP, 2018) and the small area possibly affected by prey displacement, seabirds are not expected to be impacted by reduced net foraging opportunities. Impacts to shorebird species are not predicted from the Sequoia MSS, given their prey is concentrated within the intertidal zone along the coastline and the Operational Area is ~22 km from the nearest coastline (New Year Island, north-west of King Island). The Little Penguin is capable of diving to 72 m but typically dives to 10-20m. The species is known to generally forage within 20 km of their nesting site during non-breeding season and 15 km of their nest during the breeding season (October to December) (Australian Wildlife, 2014). The Little Penguin has a foraging BIA (10 km buffer) around Christmas Island, which is a breeding colony (~22 km from the Operational Area). On this basis, encounter rates with the penguin in the acquisition area is considered unlikely. It is inferred that penguins have relatively poor hearing thresholds in the lower frequencies, which is where MSS have the most energy (10-250 Hz) (McCauley, 1994). However, Pichegru et al (2017) identified that African penguins switched foraging direction and distance in response to seismic activity but that the response was short-term. As seabirds spend very little time underwater, and shorebirds and the Little Penguin are located > 15 km from the Operational Area, impacts to birds from underwater sound emissions are not predicted and have not been evaluated further.	

Marine Reptiles X

Injury/mortality to fauna

Underwater sound (impulsive) emissions have the potential to result in:

- a change in ambient sound.

As a result of a change in ambient sound, further impacts may occur to marine reptiles, including:

- injury/mortality to fauna.

Studies to date on marine turtles have not identified injury or mortality as an impact from seismic sound (Nelms 2016, McCauley et al., 2000, Popper et al., 2014).

As no functional cause-effect relationship has been established, injury/mortality to turtles from seismic sound is not predicted and has not been evaluated further.

Marine Mammals X

Injury/mortality to fauna

Underwater sound (impulsive) emissions have the potential to result in:

- a change in ambient sound.

As a result of a change in ambient sound, further impacts may occur to marine mammals, including:

- injury/mortality to fauna.

Studies to date on marine mammals have not identified injury or mortality as an impact from seismic sound and no threshold criteria have been developed for injury or mortality (Finneran, 2016, DEWHA, 2008, Southall et al., 2019, NFMS 2018).

As no functional cause-effect relationship has been established, injury/mortality to marine mammals from seismic sound is not predicted and has not been evaluated further.

1.1.3. Emissions – Light

Table 1-3 Justification for planned impacts Not Evaluated Further for Emissions – Light

Plankton, Invertebrates X

Change in fauna behaviour

Light emissions have the potential to result in:

- a change in ambient light.

As a result of a change in ambient light, further impacts may occur to ecological receptors, including:

- change in fauna behaviour.

The National Light Pollution Guidelines (DoEE, 2020) do not identify plankton or invertebrates as being sensitive to light, or have any studies, guidance, or control measures relevant for these receptors.

The photic zone in the South-east Marine Region is generally between 0 – 100 m (NOO, 2002). Artificial light from vessels would not reach benthic habitat within the Operational Area which is 90 – 1250 m deep where many invertebrates live. Light emissions from the Sequoia MSS are temporary, mobile and are not expected to cause a change in fauna behaviour and have not been evaluated further.

Fish X

Change in fauna behaviour

While fish may be attracted to lights, thie area of influence is small, and this small change in aggregation and predation is not expected to result in a change in the viability of a population.

The only information relevant to fish in the National Light Pollution Guidelines (DoEE, 2020) is on studies suggesting light impacts hatching of clownfish eggs; and that changes in food availability due to artificial light can cause changes in fish assemblages (Bolton et al., 2017). DoEE (2020) does not include any guidance, or control measures relevant for fish. Light emissions from the Sequoia MSS are not expected to cause a change in fauna behaviour and no functional cause-effect relationship has been established. Therefore, impacts to fish from light emissions are not expected, and have not been evaluated further.

Marine Mammals X

Change in fauna behaviour

Artificial light has not been reported to cause a significant behavioural disturbance to marine mammals, despite their often-higher activity levels at night.

Results from a previous independent review and risk assessment of the sensitivity of marine mammals to mining and exploration activities in the Great Australian Bight Marine Park indicate that the consequence of light pollution impacts to marine mammals were insignificant (defined as occasional short-term attraction and/or disruption to marine mammals) (Pidcock, Burton and Lunney, 2003).

Therefore, impacts to marine mammals from light emissions are not expected, and have not been evaluated further.

1.1.4. Emissions – Atmospheric

Table 1-4 Justification for planned impacts Not Evaluated Further for Emissions – Atmospheric

Birds, Marine mammals	**X**

Injury/mortality to fauna;

Atmospheric emissions have the potential to result in:

- a change in air quality.

As a result of a change in ambient air quality, further impacts may occur to marine fauna, including:

- injury/mortality to fauna.

The use of fuel (specifically marine-grade diesel) to power engines, generators and mobile and fixed plant (e.g., ROV, back-deck crane, generator), will result in gaseous emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG such as sulphur oxides (SO_X) and nitrous oxides (NO_X).

A change in air quality has the potential to result in fauna injury/mortality.

The Sequoia MSS is of a short duration (up to 60 days), and will only involve up to three vessels. It is a once-off activity. Based on a 2018 3DMSS in Bass Strait, 18 tonnes of fuel was used per day by the survey vessel. This results in the daily emissions of approximately:

- 0.6 tonnes of nitrogen dioxide (NO^X);
- 0.02 tonnes of sulphur dioxide (SO_X); and
- 55 tonnes of carbon dioxide (CO_2).

Based on a 60-day MSS, this activity could be expected to use 1,080 tonnes of fuel, resulting in similar daily emissions of NO_X, SO_X and CO_2.

Potential receptors above the sea surface within the Operational Area that may be exposed to reduced air quality include seabirds and marine megafauna that surface for air (e.g. marine mammal and marine turtles).

Emissions will be small in quantity and will dissipate quickly into the surrounding atmosphere, therefore any localised reduction in air quality is not expected to result in any measurable effect. Therefore, impacts to marine fauna from atmospheric emissions are not expected, and have not been evaluated further.

ConocoPhillips Australia will implement legislative requirements identified as relevant to atmospheric emissions (Other Requirements section of Appendix A).

The relevant control measure is:

- Marine Assurance System (CM7) ensures that all maritime legislative requirements are met.

Benthic assemblages, Plankton, Invertebrates, Fish, Marine Mammals, Marine Reptiles, Coastal habitats and communities

Change in climate; Change in ecosystem dynamics

Atmospheric emissions have the potential to result in:

- a change in climate.

As a result of a change in climate, further impacts may occur to ecological receptors, including:

- change in ecosystem dynamics
- injury/mortality to fauna.

The use of fuel to power engines, generators and any mobile/fixed plant will result in gaseous emissions of GHG such as CO_2, methane (CH_4) and nitrous oxide (N_2O). While these emissions add to the GHG load in the atmosphere, which adds to global warming potential, they are relatively small on a state, national and global scale, representing an insignificant contribution to overall GHG emissions.

Emissions will be small in quantity and short-term. The emission from 60 days use by up to three vessels will not significantly contribute to climate change.

Therefore, impacts to climate from vessel atmospheric emissions are not expected, and have not been evaluated further.

1.1.5. Planned Discharges – Vessels

Table 1-5 Justification for planned impacts Not Evaluated Further for Planned Discharges – Vessels

Plankton, Invertebrates, Fish, Marine Mammals, Marine Reptiles	**X**
Change in fauna behaviour, Injury/mortality to fauna Vessel discharges have the potential to result in: • a change in water quality. As a result of a change in ambient water quality, further impacts may occur to marine fauna, including: • a change in fauna behaviour • injury/mortality to fauna. Discharges of organic matter, such as those present in sewage, greywater or food waste can lead to an increase in scavenging behaviour in fauna. Discharges will be localised and temporary as they will be quickly broken down by microbial action and dispersed by wave action and local ocean currents. Sewage solids will be broken down during treatment before being discharged, which will aid the decomposition process. Likewise, food scraps are required under MARPOL to be macerated to a size small enough to pass through a 25 mm mesh before being discharged. Plankton have a patchy distribution linked to localised and seasonal productivity that produces sporadic bursts in populations (DEWHA, 2008). A change in water quality as a result of sewage, greywater or food waste is unlikely to lead to a significant change in plankton distribution at a measurable level and will not result in a change in the viability of the population or ecosystem. Marine fauna likely to be present within the upper water column are expected to be highly mobility and therefore able to avoid any localised change in ambient water quality. Species with limited mobility (i.e. plankton, fish embryo and larvae) are extremely unlikely to be impacted by any effects of temporary and localised increases in turbidity and low toxicity due to rapid dilution. No significant impacts are expected to plankton species, or on higher trophic levels reliant on plankton abundance. Levels of containments within deck washdown, rainwater and deck drainage are likely to be insignificant. OSPAR (2014) indicates that the predicted no effect concentration (PNEC) for marine organisms exposed to dispersed oil is 70.5 ppb. Due to wave action and ocean currents any low-level contaminants will be quickly diluted and dispersed with no or negligible environmental impact. Shell (2009) conducted modelling that showed discharges of hydrocarbon and other chemical concentrations will be rapidly diluted and expected to be below PNEC within a relatively short time period, and will meet UNEP (1999) standards within 70 m of their discharge. Bilge water will be treated prior to discharge via an OWS with a maximum concentration of 15 ppm oil-in-water being achieved prior to discharge and therefore will have negligible injury/morality impacts on plankton. A change in water quality as a result of routine vessel discharges are unlikely to cause a change in behaviour or impact/mortality to plankton and marine fauna at a measurable level and will not result in a change in the viability of the population or ecosystem. Therefore, impacts from planned vessel discharges on marine fauna are not expected, and have not been evaluated further. ConocoPhillips Australia will implement legislative requirements identified as relevant to planned vessel discharges (Other Requirements section of Appendix A). The relevant control measure is: • Marine Assurance System (CM7) ensures that all maritime legislative requirements are met.	

1.2. Unplanned Risks - Aspects Screening

1.2.1. Vessel Collision with Marine Fauna

Table 1-6 Justification for unplanned risks Not Evaluated Further for Vessel Collision with Marine Fauna

Commercial Fisheries	**X**
Changes to the functions, interests or activities of other users The physical presence of vessels in the Operational Area has the potential to result in an unplanned collision with fish species. However, emission of underwater sound from both vessel operations and seismic activities are expected to result in avoidance	

behaviour within tens to hundreds of metres from the vessel. Any potential impacts on fish species (or their food sources) is considered to be Minor (as evaluated in Section 4.3).

This evaluation focused on the large species, such as White Sharks, which are not the commercial species targeted in the region.

Therefore, impacts from vessel collision on commercial fisheries are not expected, and have not been evaluated further.

Sequoia 3D MSS Environment Plan

Appendix C

ABU2-000-EN-V01-D-00001

Rev 4 19 July 2021

Appendix C – Consultation Report

1. INTRODUCTION

This appendix outlines some additional detail underpinning the Relevant Person engagement undertaken in support of this EP. This appendix has been redacted prior to publishing to preserve the privacy of those persons or organisations consulted with. This can include the removal of personal information (as defined by the Privacy Act 1988) and the removal of any information that was provided during consultation where that person has requested for that information not to be published as per OPGGS(E) Regulations sub-regulation 11(A). ConocoPhillips has made reasonable efforts to inform each relevant person consulted that they may request for particular information not to be published during all stages of the consultation.

The separate sensitive information report (Appendix D) containing a log of all communications and copies of communications with relevant persons has not been published due to privacy reasons.

2. IDENTIFICATION OF RELEVANT PERSONS

2.1 Value mapping

Regulation 11A (1) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 identifies five groups as relevant persons who must be consulted with in the course of preparing an environment plan. The Beneficial Use/Value Mapping process involves listing the potential receptors (with a focus on socio-economic receptors) that may be affected by the proposed activity, and identifying the appropriate area of potential impact (e.g. Operations Area vs Noise EMBA). Then using these spatial areas to determine relevant persons that may have functions, interests or activities in the area. This process was captured in a matrix (Table 1). The text below describes the scope of the search that was undertaken. In completing the value mapping process a number of parties (either self-identified or identified by COPA) were assessed against the relevant person criteria but were determined not to fulfill the requirements. For completeness these are listed below in Table 2.

Marine-based Tourism

Recreational and tourism activities are important components for the local and regional economy. Key activities include sight-seeing, surfing and fishing which are generally land-based or near-shore activities

Surfing and swimming

The survey will not affect surfing activity given surfing is not considered an activity that will be affected by sound propagation from the survey given the distance from the acquisition area to known surf breaks, the short periods of time surfers spend underwater and their proximity to the surface.

Recreational Fishing

Recreational fishing includes rock, beach, boat and estuary fishing, using rod and line. Fishing licences are required for inland and ocean fishing. Fishing charter operators provide deeper water recreational fishing opportunities, such as the water depths around the acquisition area. Charter operators that launch from locations that could feasibility access the operational area within a day trip included Port Campbell, King Island, Stanley and Apollo Bay. Charters at these locations have been identified and engaged, along with the peak recreational fishing association of Victoria and Tasmania.

Recreational Diving and Snorkelling

Scuba diving and snorkelling can take place around the inshore reefs along the coast of King Island. COPA has adopted a conservative approach to managing safe diving in the vicinity of its marine seismic surveys and has operational plans to manage diving activity.

Table 1: Beneficial use and value mapping process

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
Aboriginal Heritage	No potential impact pathways identified from routine activities	Operational Area	There are no known sites of Aboriginal Heritage significance within the Operational Area. No identified risks from routine activities.	None identified	None identified	None identified
	MDO release	MDO spill EMBA	Shoreline oiling of sites	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Native Title	No potential impact pathways identified from routine activities	Operational Area	There are no known registered native title claims in the Operational Area No identified risks from routine activities.	None identified	None identified	None identified
	MDO release	MDO spill EMBA	Shoreline oiling of registered claim areas and associated cultural and socio-economic values	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Maritime Archaeological Heritage	No potential impact pathways identified from routine activities	Operational Area	There are no recorded historic shipwrecks or shipwreck protection zones within the Operational Area. No identified risks from routine activities.	None identified	None identified	None identified
	MDO release	MDO spill EMBA	Shoreline, dissolved and entrained impact on maritime sites.	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Coastal Settlements (Refer to section 4.8 of EP)	No potential impact pathways identified from routine activities	Noise EMBA	King Island's western shoreline intersects the boundary of the Noise EMBA. No identified risks from routine activities.	None identified	None identified	• Colac Otway Shire • Corangamite Shire Council • King Island Shire Council • King Island Chamber of Commerce (KICC) • Colac and District Chamber of Commerce

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
	MDO release	MDO spill EMBA	Shoreline, dissolved and entrained impacting values associated with settlements, socio-economic values and reputation.	Stakeholders identified and flagged for triggered engagement in event of spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Offshore Energy Exploration and Production (Refer to section 4.8.4 of EP)	• Displacement of or Interference of Third-party Vessels	Operational Area	There is no oil and gas infrastructure within the Operational Area but immediately adjacent titleholders may note increased vessel traffic or need to consider cumulative impacts in their assessments.	• Mineral Resources Tasmania (MRT) • Department of Jobs, Precincts and Regions (DJPR) – Marine Pollution	• Beach Energy • TGS (formerly Spectrum)	
	• MDO release	MDO spill EMBA	Response assistance and safety considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Other Infrastructure	• Risk of damage to infrastructure	Operational Area	The Indigo telecommunications cable runs east-west across the northern part of the survey area.	• Department of Infrastructure, Transport, Regional Development and Communications (DITRC)	• Indigo Communications Cable (SULO)	
	• MDO release	MDO spill EMBA	Safety considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Tourism (including diving and marine based activities) (Refer to section 4.8.5 of EP)	• Underwater sound from survey • Accidental Discharges • Light impacts • Displacement	Noise EMBA[#]	King Island's western shoreline intersects the boundary of the Noise EMBA. No identified risks from routine activities.	None identified	• Dive charter operators that utilise the area • Fishing charters that utilise the area	• Tourism Industry Council of Tasmania
	• MDO release	MDO spill EMBA	The King Island tourism sector is estimated to contribute just over 0.2% of the Tasmanian tourism output. It has a strong reputational link to pristine natural environment so potential socio-economic (reputational, income, loss of	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
			visual amenity) and economic impact due to loss of environmental values.			
Commercial Fisheries (Commonwealth) (Refer to section 4.7 of EP)	• Underwater noise from survey • Routine discharges • Displacement of or interference with third-party vessels • Introduction and establishment of Invasive Marine Species*	Operational Area or Noise EMBA for dive-based fisheries	A number of Commonwealth Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for displacement during the time of the survey or risk impacts on stocks.	• Australian Fisheries Management Authority (AFMA) • Department of Agriculture, Water and the Environment – Biosecurity and Compliance • Department of Agriculture, Water and the Environment – Fisheries, Forestry and Engagement (Fisheries)	• Commonwealth Fisheries Association (CFA) • Tuna Australia – Eastern Tuna and Billfish Fisheries Industry Association • Australian Southern Bluefin Tuna Industry Alliance (ASBTIA) • Sustainable Shark Fishing Inc. • Southern Shark industry Alliance • Bass Strait Scallop Industry Association	None identified
	• Accidental discharge of hazardous and non-hazardous material and wastes • MDO release	MDO spill EMBA (largest of risk EMBAs)	A number of Commonwealth Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for toxicology or direct impact to stocks.	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Commercial Fisheries (Victoria) (Refer to section 4.7 of EP)	• Underwater noise from survey • Routine discharges • Displacement of or interference with third-party vessels • Introduction and establishment of Invasive Marine Species*	Operational Area or Noise EMBA for dive-based fisheries	A number of Victorian Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for displacement during the time of the survey or risk impacts on stocks.	• Victorian Fishing Authority (VFA) • Department of Environment, Land, Water and Planning (DELWP)	• Seafood Industry Victoria (SIV) • Victorian Rock Lobster Fishing Association (VRLA) • Warrnambool Professional Fishermen's Association • Port Campbell professional Fisherman's Association • Apollo Bay Fishing Cooperative	None identified

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
	• Accidental discharge of hazardous and non-hazardous material and wastes • MDO release	MDO spill EMBA (largest of risk EMBAs)	A number of Victorian Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for toxicology or direct impact to stocks.	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Commercial Fisheries (Tasmania) (Refer to section 4.7 of EP)	• Underwater noise from survey • Routine discharges • Displacement of or interference with third-party vessels • Introduction and establishment of Invasive Marine Species*	Operational Area or Noise EMBA for dive-based fisheries	A number of Tasmanian Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for displacement during the time of the survey or risk impacts on stocks.	Department of Primary Industries, Parks, Water and Environment (DPIPWE), including the following departments; • Marine Resources (Wild Fisheries Management Branch) • Tasmanian Parks and Wildlife Service (PWS) – King Island Office • Environment Protection Authority (EPA) Tasmania	• Tasmanian Seafood Industry Council (TSIC) • Tasmanian Abalone Council Limited • Tasmanian Rock Lobster Fisherman's Association (TRLFA) • Tasmanian Scallop Fisherman's Association	None identified
	• Accidental discharge of hazardous and non-hazardous material and wastes • MDO release	MDO spill EMBA (largest of risk EMBAs)	A number of Tasmanian Commercial Fishing licence holders have recorded catch and effort in the activity area. There is the potential for toxicology or direct impact to stocks.	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Commercial Shipping (Refer to section 4.8.2 of EP)	• Displacement of or Interference of Third-party Vessels	Operational Area	To the south of the main east/west shipping route but Operational Area expected to have in the vicinity of 206 ships (cargo, tanker, fishing) per month pass through.	• Australian Hydrographic Office (AHO) • AMSA • Port Authority of NSW • Transport of NSW	• Managed through AHO who issue notifications to individual companies and users	

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
	- MDO release	MDO spill EMBA	Safety considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Defence activities (Refer to section 4.8.3 of EP)	- No potential impact pathways identified from routine activities	Operational Area	There are 4 sites located close to the survey area with a likelihood of UXO within them, and ADF activities occur within the region.	- Department of Defence	None identified	None identified
	- MDO release	MDO spill EMBA	Safety considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Recreational Vessels (including yachts)	- Displacement of or Interference of Third-party Vessels	Operational Area	Recreational vessels utilising the activity area safety considerations	- Australian Hydrographic Office (AHO) - AMSA - Port Authority of NSW - Transport of NSW	- Ocean Racing Club of Victoria (ORCV) - Managed through AHO who issue notifications to individual users	
	- MDO release	MDO spill EMBA	Safety and amenity considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Recreational Fishing	- Displacement of or interference with third-party vessels	Operational Area	Limited numbers due to remoteness and no shoreline	- DPIPWE - VFA	- Tasmanian Association for Recreational fishing (TARFish) - VR Fish	None identified
	- MDO release	MDO spill EMBA	Safety and amenity considerations	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Marine Parks	- Underwater noise from survey - Routine discharges	Operational Area	None	Director of National Parks (Parks Australia - Australia Marine Parks)	None identified	None identified

Potential Receptors	Potential impact or risk pathways	Area used to identify stakeholders	Known and Potential Risks that may affect a Relevant Person or has been identified by a relevant person	Relevant Persons Category a (Commonwealth), b (State or Territory) and c (Adjacent State or Territory)	Relevant Persons Category d (function, activity or interests that may be affected)	Relevant Persons Category e (any other person)
	- Introduction and establishment of Invasive Marine Species*					
	MDO release	MDO spill EMBA	Impact on AMP values	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		
Biological Environment	All impact pathways	Operational Area	Impact on biological values	Department of Agriculture and Water Resources	- NGO's - Deakin University – School of Life and Environmental Sciences - University of Tasmania (UTAS) - Institute for Marine and Antarctic Studies (IMAS)	Blue Whale Study
	MDO release	MDO spill EMBA	Impact on biological values	Stakeholders identified for potential engagement should an unplanned spill event in accordance with NOPSEMA guidance. Refer to OPEP.		

* Although Introduction and Establishment of Invasive Marine Species is a risk pathway, due to the initial spatial impact area likely to be the operational area this has been grouped with the impact pathways.

[#] The noise EMBA for diving activities is based on a buffered, linear 45km distance from the Operational Area. The Noise EMBA is considered precautionary and due to the distance from the source and the attenuation of noise in shallow water, there would not be expected to see any impacts on dive based activities off mainland Victoria and as such stakeholders associated with this value have not been listed.

Table 2: Parties assessed and not considered a Relevant Person

Party	Assessment of Relevance	Reference to correspondence
Southern Coast Charters	Does not run fishing charters around King Island from August to October.	See Sensitive Information Report REF: SCFCFN1 and SCFC1

King Island Fishing Tours	Vessel not currently in survey and unlikely to be for 2021 season. As such will not be running fishing charters near King Island in identified acquisition window	See Sensitive Information Report REF: KIFTFN1 and KIFT1
Proline Fishing Charter	Does not run fishing or diving charters near King Island.	See Sensitive Information Report REF: PLFCFN1
Stanley Seal Cruises	Does not run tourism charters in the region.	See Sensitive Information Report REF: SSCFN1, SSC1

2.2 Assessment of Public Submissions for new relevant persons

Each public comment responded was assessed against the following criteria to determine if they fell into category A-E under the regulations.

Category A-C	• Provided an official submission for a recognised Commonwealth, State or Territory regulatory body
Category D	Based on the information in the submission or easily accessible in the public domain the person: • Identified that they undertake a business activity in the Noise EMBA • Identified they undertake research in the Noise EMBA • Identified they undertake recreational activities in the Noise EMBA • Representative of a group with an interest specific to the activities being undertaken • Identified that they have an interest in the biological values specific to the Noise EMBA that have been identified as potentially impacted by activities
Category E	• Conoco Phillips determine the party would be beneficial to involve in the EP process for longer term strategic stakeholder engagement objectives

Note: the Noise EMBA was chosen as the boundary for determining a person's relevance as this is the largest area of impact for non-spill based risks and impacts. Noting NOPSEMA guidance that hypothetical, remote or speculative consequence from an activity such as a major oil spill should not be used when identifying relevant persons.

All public submissions receive by NOPSEMA were assessed against this criteria. The outcome of applying this process is contained in the Sensitive Information Report.

3. CLASSIFICATION OF RELEVANT PERSONS

In undertaking an assessment of the relevant persons, and to inform what constitutes sufficient information under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*, each relevant person was classified according to the categories in Table 3 based on the combination of potential for impact and the level of interest of the person or group. A summary table of all relevant stakeholders and their classification is found in Section 3 of the EP.

Table 3: Classification and associated levels of engagement

	Goal	Strategies
Category 1: **Regulatory agencies who have legislated requirements or decision making powers**	**Consult** Aim is to work directly with relevant persons to ensure their concerns and needs are understood and considered.	**Targeted consultation material specific to relevant persons, legislation, regulations or guidance.** **Follow up to ensure receipt and seek feedback**
Category 2: **Relevant persons with response actions** **Or**	**Involve** Aim is to ensure information on the project is conveyed and to obtain feedback on alternatives or outcomes where possible with	**Targeted consultation material specific to relevant persons.** **Follow up to ensure receipt and seek feedback**

Relevant persons with high interest	follow-up to ensure any required actions are undertaken.	
Category 3: **Relevant persons with low interest** **Or** **Any other person identified with ongoing interest**	**Inform** The level of engagement is primarily aimed at conveying information, rather than seeking input.	**Generic consultation material meeting the minimum requirements** **No follow up to ensure receipt or seek feedback**

4. RECORD KEEPING

All activities pertaining to relevant person consultation, including actions and commitments, are recorded and tracked using ConocoPhillips Australia's stakeholder management tool. This online database is controlled and maintained by the General Manager Government and External Affairs (or delegate). The database is a live consultation log that is systematically updated as consultation activities for the Sequoia 3D MSS are undertaken. ConocoPhillips Australia's stakeholder engagement practice is to keep ongoing records of engagement with stakeholders, as such this practice will be continued post EP submission for the Sequoia 3D MSS.

5. FISHERIES STAKEHOLDER ASSESSMENT

5.1 Relevant person identification

A separate assessment of relevant fisheries was undertaken to identify which fisheries should be considered relevant parties (Table 4). The Operational Area overlapped by the jurisdiction of several Commonwealth and State-managed fisheries. In addition, the Offshore Constitutional Settlement arrangement (OCS) between the Commonwealth of Australia and the State of Victoria determines management of some fisheries outside of the geographic boundary of state and Commonwealth waters. For example, Southern Rock Lobster fishery occurs beyond the 3nm boundary but is managed under this arrangement by the State authority.

A summary of each of the fisheries is contained in Section 4.7 of the EP. To complete this summary in the EP the Commonwealth and State managed fisheries outlined above were researched further to identify actual fishing effort within the operational area over the last five years. Under the fee for service arrangement with SETFIA/Fishwell Consulting, data requests for actual fishing effort within the proposed survey and operational area over the last five years were made to DPIPWE, Fisheries Victoria and AFMA. Consistent with respective privacy policies, the data outputs did not include personal information of professional fishers, or any catch data.

Fisheries were deemed to be relevant persons if they:

- Have jurisdiction to fish within the Noise EMBA;
- Have recent catch history within the Noise EMBA (within last 5 years); and
- Fishing methods would mean it was feasible to operate in the water depth or Operational Area.

Any fisheries that met this criterion were considered relevant persons (Table 5).

Table 4: Fisheries Relevant Party Assessment

Fishery		Assessment
Commonwealth	Southern and Eastern Scalefish and Shark Fishery (SESSF) - Shark Gillnet and Shark Hook	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.
Commonwealth	Southern and Eastern Scalefish and Shark Fishery (SESSF) -Commonwealth Trawl Sector (CTS)	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. Recorded fishing in the last 5 years.
Commonwealth	Southern and Eastern Scalefish and Shark Fishery (SESSF) - Scalefish Hook Sector (CGS/CSHS)	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. Recorded fishing in the last 5 years.
Commonwealth	Southern Squid Jig Fishery (SSJF)	✗ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. No historical fishing in this area for last 10 years
Commonwealth	Bass Strait Central Zone Scallop Fishery (BSCZSF)	✗ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. No historical fishing in this area for last 5 years.
Commonwealth	Southern Bluefin Tuna (SBTF)	✓ Although no overlap between operational area and fishing effort, representative body considered a relevant person based on previous advice that they want to be involved in consultation processes due to upwellings and movement of target species.
Commonwealth	Eastern Skipjack Tuna Fishery (ESTF)	✗ No recorded historical catch in last 5 years
Commonwealth	Eastern Tuna and Billfish Fishery (ETBF)	✗ No recorded historical catch in last 5 years
Commonwealth	Small Pelagic Fishery (SPF)	✗ No recorded historical catch in last 5 years
VIC	Southern Rock Lobster	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.
VIC	Abalone Fishery	✘ Whilst the fishery overlaps the Operations area, given water depths and hand collection methods for this fishery it is not considered feasible that this fishery would access the Operational Area. Any noise impacts will have dissipated to an acceptable level on reaching the mainland due to the affects of shallow water on underwater noise.
VIC	Giant Crab (Western Zone)	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.
VIC	Wrasse Fishery	✘ Whilst the fishery overlaps the Operations area. The two species of wrasse caught, Purple Wrasse (*Notolabrus fucicola*) and Bluethroat Wrasse (*Notolabrus tetricus*), are typically associated with shallow reefs but can inhabit wasters down to 90 m and 160 m respectively. However, this fishery sells live fish, and to reduce the chance of death through barotrauma, the fishery mainly operates in shallower water then would be expected in the operational area.

Fishery		Assessment
VIC	Pipi Fishery (via authorisations on Ocean fishery access licence)	✘ Whilst the fishery overlaps the Operations area, this fishery is primarily a shoreline (intertidal sandy beaches) hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
VIC	Ocean Access (or Ocean General) Fishery/Ocean Purse Seine Fishery	✘ Whilst the fishery overlaps the Operations area, given only one licence is active in Victorian waters (based out of Lakes Entrance), with fishing focused close to shore and during the day it is not considered feasible that this fishery would access the Operational Area.
TAS	Giant Crab Fishery	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.
TAS	Rock Lobster Fishery	✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.
TAS	Abalone Fishery	✓ This dive based fishery overlaps the Noise EMBA. Commercial fishers will be potentially active in this region.
TAS	Scallop Fishery	✘ This fishery overlaps the Operational Area but fishery is closed
TAS	Shellfish Fishery	✘ Whilst the fishery overlaps the Operations area, this fishery is primarily a nearshore hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
TAS	Seaweed Fishery	✘ Whilst the fishery overlaps the Operations area, this fishery is a shoreline hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
TAS	Scalefish Fishery	✘ Whilst the fishery overlaps the Operations area, this fishery has no recent catch from the past 10 years. It is not considered feasible that this fishery would access the Operational Area during the survey time.
TAS	Commercial Dive Fishery	✓ This fishery overlaps the Noise EMBA. Commercial fishers will be potentially active in this region.
TAS	Octopus Fishery	✘ Whilst the fishery overlaps the Operations area, this fishery has no recent catch from the past 8 years. It is not considered feasible that this fishery would access the Operational Area during the survey time.

5.2 Engagement with Representative bodies

To manage stakeholder fatigue and in line with the published consultation policy for SIV and TSIC, SIV, SETFIA and TSIC were engaged on a fee for service arrangement to engage with their membership on behalf of COPA. This included representation of the sector bodies. CFA deferred engagement to state and sector representative bodies. These arrangements are summarised in Table 5.

COPA recognises there may be risk of an individual fishing licence holder being missed if they are solely a commonwealth fisher (with no state licence) due to the voluntary nature of the Commonwealth Representative Bodies. The changing nature of licencing also means operators may have moved in or out of fisheries during the engagement period. COPA are confident however that the engagement through the representative bodies has identified all objections and claims. COPA will manage ongoing engagement with known stakeholders before, during and at the completion of the survey. Should any new stakeholders appear in the operational area, operational arrangements such as notice to mariners via AMSA, use of support boats, communications with known fishers who will be in the area and typically share this information, will be employed during the survey.

Table 5 Representative body engagement

Tasmania		
Fishery	Direct engagement vs Representative body?	Stakeholder Category
Individual Giant Crab Fishery Licence Holders	TSIC	Consulted through Representative bodies
Individual Rock Lobster Fishery Licence Holders	Represented by the Tasmanian Rock Lobster Fishermen's Association (TRLFA)	Consulted through Representative bodies
Individual Abalone Fishery Licence Holders	TSIC	Consulted through Representative bodies
Individual Commercial Dive Fishery Licence Holders	TSIC	Consulted through Representative bodies
DPIPWE	Direct	1
Tasmanian Seafood Industry Council (TSIC)	Direct	1
Tasmanian Abalone Council Limited	Direct initially then engaged through TSIC as per agreement	Consulted through Representative bodies
Tasmanian Rock Lobster Fisherman's Association (TRLFA)	Direct initially then engaged through TSIC as per agreement	Consulted through Representative bodies
Tasmanian Scallop Fisherman's Association	Direct initially then engaged through TSIC as per agreement	Consulted through Representative bodies
Victoria		
Fishery	Direct engagement vs Representative body?	Stakeholder Category
Seafood Industry Victoria (SIV)	Direct	1
Individual Southern Rock Lobster Licence Holders	Represented by SIV through Victorian Rock Lobster Fishing Association (VRLA) (as noted in their engagement report)	Consulted through Representative bodies
Individual Bass Straight Scallop Fishery (Victorian Zone) Licence Holders	Represented by SIV (as noted in their engagement report)	Consulted through Representative bodies
Individual Giant Crab (Western Zone) Licence Holders	Represented by SIV (as noted in their engagement report)	Consulted through Representative bodies
Individual Ocean Access (or Ocean General) Fishery Licence Holders	Represented by SIV (as noted in their engagement report)	Consulted through Representative bodies
Victorian Fisheries Authority (VFA)	Direct	1
Victorian Rock Lobster Fishing Association (VRLA)	Direct initially then engaged through SIV as per agreement	Consulted through Representative bodies

Warnambool Professional Fishermen's Association	Direct initially then engaged through SIV as per agreement	Consulted through Representative bodies
Port Campbell professional Fisherman's Association	Direct initially then engaged through SIV as per agreement	Consulted through Representative bodies
Apollo Bay Fishing Cooperative	Direct initially then engaged through SIV as per agreement	Consulted through Representative bodies
VRFish	Direct initially then engaged through SIV as per agreement	Consulted through Representative bodies
Commonwealth		
Fishery	Direct engagement vs Representative body?	Stakeholder Category
Individual Bass Strait Central Zone Scallop Fishery (BSCZSF) Licence Holders	• The representative bodies are: • CFA (and Scallop Fisherman's Association) • TSIC • SIV	Consulted through Representative bodies
Individual Southern Bluefin Tuna Fishery Licence Holders	• The representative body for this fishery is Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Consulted through Representative bodies
Individual Southern Squid Jig Fishery (SSJF) Licence Holders	• The representative body is CFA	Consulted through Representative bodies
Individual Southern and Eastern Scalefish and Shark Fishery (SESSF) licence holders, incorporating • Gillnet and Shark Hook sector. • Commonwealth Trawl sector. • Scalefish Hook sector.	• The Representative bodies are: • SETFIA • Sustainable Shark Fishing Inc • Southern Shark Industry Alliance Inc • Lakes Entrance Fishermen's Co-operative Society Ltd (LEFCOL)	Consulted through Representative bodies
Commonwealth Fishing Association (CFA)	• CFA delegates to other relevant industry bodies as per email 7 Sept 2020 from Andrew Sullivan	3
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Direct	2
Southern East Trawl Fishing Industry Association (SETFIA)	Direct	1
Southern Shark Industry Alliance	Advised COPA to consult via SETFIA	Consulted through Representative bodies
Sustainable Shark Fishing Inc.	Direct	1
AFMA	Policy advice is to consult directly with fisheries or representative bodies	3

5.3 Engagement Methods

Fishers were engaged through a number of different methods, tailored to the type of feedback sought and the relationship (Table 6).

Table 6: Engagement methods for consultation with fishers

Fishing activity survey	ConocoPhillips Australia issued a survey, via SIV and TSIC to relevant fishers in September 2020 in order to determine the relative fishing intensity in the survey area. 34 responses were received.
Fact sheets	Eight fact sheets (refer to Attachment A) were used to support this EP were developed with sub-regulation 11A(2) and associated guidance in mind to ensure it adequately described the activity – including the risks associated with the activities. The following fact sheets (see Attachment A) were issued to relevant persons and made available for stakeholders. 1. Project Summary fact sheet (ABU2-000-EX-R01-D-00001) and personalised letter of introduction – issued to all relevant persons between 7 and 17 August 2020. This fact sheet provided a high-level overview of ConocoPhillips Australia's intention to undertake the Sequoia 3DMSS and outlined the proposed survey design, location and timing. It also

	included some question and answers and contact details that stakeholders could use to provide feedback. This fact sheet was also posted on the ConocoPhillips Australia website 2. Proposed Survey Area Summary fact sheet (ABU2-000-EX-R01-D-00002) – issued to peak fishing industry associations and identified Commonwealth fishers on 17 September 2020. This fact sheet provided geographic coordinates of the proposed Sequoia 3DMSS operational area and seismic acquisition area. A simplified version of this fact sheet was posted on the ConocoPhillips Australia website. 3. How we will undertake a 3D seismic survey fact sheet (ABU2-000-EX-R01-D-00003) – issued to peak fishing industry associations and identified Commonwealth fishers between 15 and 17 September 2020. This fact sheet provided information on MSS and ConocoPhillips Australia's proprietary CSI technology. This fact sheet was also posted on the ConocoPhillips Australia website. 4. Vessel-based MDO spill modelling and controls fact sheet (ABU2-000-EX-R01-D-00004) – issued to various stakeholders between 23 and 27 October 2020. This fact sheet presented the results of the vessel MDO modelling undertaken and identified controls to support the survey. This fact sheet was also posted on the ConocoPhillips Australia website. 5. Underwater sound modelling and controls fact sheet (ABU2-000-EX-R01-D-00005) – issued to various stakeholders on 27 October 2020. This fact sheet presented the results of the underwater sound modelling undertaken and identified controls to support the survey. This fact sheet was also posted on the ConocoPhillips Australia website. 6. Project Update (ABU2-000-EX-RO1-D-00006) – issued to various stakeholders on 27 October 2020. This fact sheet presented changes made to the acquisition area reducing impact on fishing grids and complete avoidance of the Apollo Marine Park. This fact sheet was also posted on the ConocoPhillips Australia website. 7. Proposed Survey Area Summary (ABU2-000-EX-RO1-D-00006) – updated map of proposed acquisition area posted to the ConocoPhillips Australia website. Removed on 9 February 2021 when acquisition area changed (see below). 8. Project Update (ABU2-000-EX-R01-D-00008) – issued to various stakeholders on 9 February 2021. This fact sheet presented changes made to the acquisition area excising the giant crab habitat from the south west acquisition area. This fact sheet was also posted on the ConocoPhillips Australia website.
Online meetings and project briefings	Project briefings were provided to relevant persons. Briefings were facilitated/attended by the project team, technical experts and senior management. The purpose of these briefings was for ConocoPhillips Australia to provide activity information and updates, listen to issues and concerns, gain feedback on the project and to identify further opportunities for engagement. Information was tailored to accommodate the different levels of stakeholder understanding. Appendix D contains all individual responses provided to stakeholders as part of this process, including records of formal project briefings undertaken.
Individual Responses	ConocoPhillips Australia provided written responses to all written enquires received from stakeholders to address their specific concerns throughout the duration of EP development. Appendix D contains all individual responses provided to stakeholders as part of this process.
Email and Telephone	Email and telephone was used to consult with fishers and organisations as part of the development of the Sequoia 3D MSS. Appendix D contains all individual email records captured as part of relevant person consultation.
ConocoPhillips Australia website	All project updates and factsheets outlined above are also exhibited on ConocoPhillips Australia external website.
Media	A media release was made regarding the purchase, ongoing responses were provided to media enquiries, , and media advertisements were used to promote community sessions.
Consultation and fee for service arrangements with peak fishing bodies	A fee for service arrangement was entered into with peak fishing bodies (SIV and TSIC) to undertake engagement with their members on behalf of ConocoPhillips Australia. In line with their consultation guidance this approach was supported by the fishing industry to reduce stakeholder fatigue.

	A fee for service arrangement with Fishwell Consulting was entered into to compile a Fisheries Data Report. Consultation was undertaken by the same representative on behalf of SETFIA.
King Island visit/community drop in session	Representatives travelled to King Island for community meetings (which had been pre-advertised) to meet with any members of the public that may be interested in the project.

5.4 Responding to merits of objections or claims

In assessing the consultative feedback a number of considerations need to be made, often depending on the response received. ConocoPhillips implemented the following approach when determining if further follow-up was required regarding correspondence with relevant persons:

No response: Where no response has been received from the relevant person, ConocoPhillips needs to have strong grounds for accepting the relevant person had no response or feedback. The lack of a response can be a function of insufficient time, not understanding the material, not having received the material, etc. A follow up call or contact was undertaken to confirm that the relevant person had no response.

No issues: Where a relevant person has responded to consultative information and has no concerns or questions regarding the proposed activity, often this allows Conoco Phillips to consider the consultative process for that relevant person and activity to have been satisfactorily closed out and no further follow up for a response required.

Clarification: Where a relevant person sought further information or clarification of information received, this was an opportunity to confirm acceptance of proposed activity and arrangements or if there are any issues that can be identified or may arise.

Objection: Where a relevant person raised an objection regarding the proposed activity, Conoco Phillips representatives sought to understand the issue(s) held by the relevant person and undertake to negotiate arrangements that satisfy both parties. Negotiation processes in the instance an objection was raised were achieved through discussion with the direct parties involved. In some key issues flagged in section 4.5 below, a common solution satisfying both Conoco Phillips and the relevant person could not be found.

5.5 Key objections, claims and comments

For all responses received by ConocoPhillips Australia during the Sequoia engagement, the merit of each of these responses was assessed. Assessment of merit for all other responses is found in **Error! Reference source not found.**. Two key issues where COPA recognises that there have been challenges in reaching agreement with the commercial fishing sector are:

- Scientific basis/interpretation of available science, including the potential long-term impact for this project on fishery stocks due to life cycle level impacts, and
- Survey timing.

These are addressed in the Assessment of Merit in Section 3.4 of the EP. Where COPA has not agreed with SIV and TSIC, we have explained our rationale in detail below and continued to invite further discussion.

Scientific basis for assessment of impacts

Fishing Stakeholder position

The fishing industry felt that there had been insufficient consideration or mis-representation of some data, including:

- Interpretation and application of the FRDC/IMAS data.
- impacts to reduced egg production, recruitment failure and ultimately reduced Total Allowable Catches in the longer term (3 year +) in relation to:
    - Southern rock lobster or Tasmanian giant crab larvae (any stages) in the water column
    - Impact of MSS on newly settled rock lobster or giant crab

COPA's consideration

The UTAS/IMAS submission to the Senate Inquiry on the Impact of Seismic Testing on Fisheries and the Marine Environment notes that quantification of the ecological impacts of the FRDC 2012/008 project is not possible and that the lobster population in the Derwent River with existing damage to their mechanosensory organ (similar to what may be observed after exposure to MSS) is thriving, suggesting that the damage to the mechanosensory organ is not causing any obvious impairment. An EP prepared in 2017 for the CarbonNet Pelican 3D marine seismic survey incorporated the findings of this research and was accepted by NOPSEMA. This seismic survey was undertaken in shallow waters (15-40 m) in February 2018 with known southern rock lobster habitat present. A post-seismic survey investigation of known southern rock lobster reef habitats found no decrease in southern rock lobster abundance.

More generally, ConocoPhillips agrees that there have been no studies of impact from seismic sound on free swimming SRL eggs and larvae. There is, and there will likely continue to be, disagreement on the implications of the data and literature available on the impacts of seismic to SRL eggs. ConocoPhillips have communicated to SIV and TSIC that the results of our impact assessment showed that within 170 m of the sound source there could be mortal effects to SRL eggs. ConocoPhillips has also shared the information that shows recruitment into the Tasmanian Rock Lobster Fishery occurs from eggs distributed across the whole Otway bioregions and that the SRL biomass is a single, connected population. Based on these facts, there is no cause effect pathway between SRL egg mortality within 170 m of the sound source and a change in recruitment into the fishery.

During engagement COPA's has explored options to measure the potential long term life-cycle and socio- economic impacts from the Sequoia seismic survey and demonstrate acceptable level standards within its revised EP, including baseline and modelling. These were considered as management measures and rejected.

COPA's current view of the literature is that the physiological impacts to individuals are of acceptable nature – acknowledging some uncertainty and this is an area in the EP where COPA believe the precautionary principal is most applicable.

Final position presented in EP

- ConocoPhillips updated the EP to include additional detail around the biology and ecology of SRL and Giant Crab, with a focus on the larval stages.
- There is no cause effect pathway identified through the assessment process that could have a stock level impact on the sustainability of the fishery. As a result of the activity we are not predicting mortal affects to adult lobster or giant crabs, with the only mortal effects on early life cycle stages limited to approximately 200m from effect. Seismic activities do not operate to a no impact standard. Instead, the acceptable level of risk is determined and permissioned by NOPSEMA, taking into account consultation with stakeholders and the information they provide. The assessment demonstrates that there is limited uncertainty in the prediction of these impacts and COPA are confident in the prediction (with exception of giant crabs where due to increased uncertainty the activity was redesigned to mitigate risk). Notwithstanding this, the widespread distribution and abundance of stock means that it can tolerate a large amount of mortality.
- COPA will apply the precautionary principle to address the level of uncertainty regarding Giant Crab, it has been agreed that COP will:
  - fund UTAS to complete a literature review of seismic effects on Giant Crabs, and suitable analogue crabs, to provide information that could inform an increase in the low-power excise area prior to the Sequoia MSS commencing and identify future research priorities
  - excision of the key commercial catch areas mostly targeted by the giant crab fishery over the southern most lead (140-300m plus buffers) from the acquisition area.

ConocoPhillips Australia acknowledges that this is a growing and developing area of research h with some knowledge gaps still present.

Survey timing

Fishing Stakeholder position

ConocoPhillips Australia examined claims that the timing coincides with important life-cycle stages for rock lobster and giant crab.

Key concerns from fishing stakeholders were:

- Timing of the survey may impact gathering for spawning or occur at time of moulting.
- Timing may impact period when larval concentrations are at their peak in the area prior to dispersion

COPA's consideration

COPA included additional information on the ecology of southern rock lobster and giant crab to the EP. Key life phases for these species is as follows:

- Southern rock lobster (*Jasus edwardsii*) – mate from April to July, fertilized eggs carried for 4-6 months before being released between September and November. The larvae (phyllosoma) then live in the plankton and undergo 11 developmental stages over 12-24 months while being carried by ocean currents, often far beyond the continental shelf. The phyllosoma then moult and metamorphose into a puerulus larvae, still living in the water column and then settle on reef in shallower waters, moulting again into pigmented juvenile lobsters. In adults, moulting generally occurs in September and October. Southern rock lobster reach commercial fishing size after 3 to 10 years.

- Giant crab (*Pseudocarcinus gigas*)– this species is endemic to the waters of southern Australia, living along the upper slope of the continental shelf. Giant crabs breed in June and July, with the females carrying eggs for about four months. After the eggs hatch between October to November, the larval duration is about 50 days. This species can live up to 30 years and is slow growing (reaching 12-14 cm at maturity, but up to 20 cm and 10 kg in weight). Juveniles moult their carapace every 3-4 years and adult females about once every nine years. Mating is only possible when the new shell is still soft.

In deciding the optimal time to undertake the Sequoia 3D MSS, ConocoPhillips Australia has balanced the ecology of these species with those of key threatened cetaceans known to occur in the region, particularly for the migration and foraging seasons of the pygmy blue whale (PBW) and southern right whale (SRW) and key periods for target fishery species. (cross ref to timing table in EP). This figure clearly demonstrates that there is no one period of time through the year where critical life stages for species of concern to stakeholders can be entirely avoided by the survey, though peak migration times for whales are avoided. ConocoPhillips Australia has aimed to undertake the survey that best protects threatened whale species and avoids overlap with peak periods of commercial fishing for the giant crab and southern rock lobster. The 30 day period after the 1 May which was suggested as the optimal period to avoid larval impacts represents the peak migration period for the humpback whale and general periods of activity for other threatened whales species. It would also overlap with peak fishing periods for the southern squid jig and the southern rock lobster fisheries. Given the long residence time in the water for larval stages (up to 2 years) COPA is unable to time the survey to avoid the larval stages entirely.

The majority of the SRL population will not have soft shells during the period of seismic acquisition, with female SRL moulting between February and May and male SRL moulting mainly in August (Gardiner and Mills 2013). New shell remains soft for approximately 20 days (Gardiner and Musgrove 2004) and there is some indication that moulted lobsters take shelter to avoid predation (Professor McCauley - Inquiry into the impact of seismic testing on fisheries and the marine environment 2020). However, the exact effects of seismic exposure on soft shelled SRL after moulting is not well understood and the release of new research is pending. Giant Crabs are not expected to be in moult during the survey. Whilst the spawning period of the giant crab may overlap with the survey timing (October) the species is distributed from central NSW to south-west WA (Kailola et al, 1993). The Sequoia MSS timeframe may overlap with berried female phase of the reproductive cycle (FRDC, 2017). No change to development rate in exposed fertilised crab eggs/embryos is expected compared with unexposed eggs/embryos (Payne et al, 2008; Christian et al, 2003; DFO, 2004; Pearson et al, 1994).

Final position presented in EP

- Recognising the multiple constraints the Aug-Oct period selected tried to minimise impacts across all sectors. The proven impact to receptors was prioritised over potential impact on larval stages as there is no cause effect pathway between SRL egg mortality within 170 m of the sound source and a change in recruitment into the fishery.

- Recognising the uncertainty around the Giant Crab fishery, COPA has reduced the overall size of the acquisition area, including excising a section in the SW corner based on the giant crab target fishing depth. Further research, as described below will also be undertaken by COPA.
- COPA has reduced the acquisition time.

Attachment A: Information Sheets

Sequoia 3D Seismic Survey

ConocoPhillips

Project Summary | August 2020

ConocoPhillips Australia is planning to undertake a three-dimensional (3D) marine seismic survey (the Sequoia 3D seismic survey) in Exploration Permit T/49P to enable assessment of the natural gas reservoirs in the eastern offshore Otway Basin. The permit is located in waters west of Tasmania's King Island.

In order to undertake the seismic survey, ConocoPhillips Australia is required to submit an Environment Plan (EP) to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment. Only once NOPSEMA has accepted the EP can the seismic survey commence. It is anticipated that the seismic survey will be acquired in 2021. ConocoPhillips Australia has an 80 percent interest and operatorship of T/49P though a farmout agreement with 3D Oil Limited.

About ConocoPhillips

ConocoPhillips is a global exploration and production company with operations and activities in 17 countries. We explore for, develop and produce crude oil and natural gas. A commitment to safety, operating excellence and environmental stewardship guide our operations.

Delivering resources safely around the globe

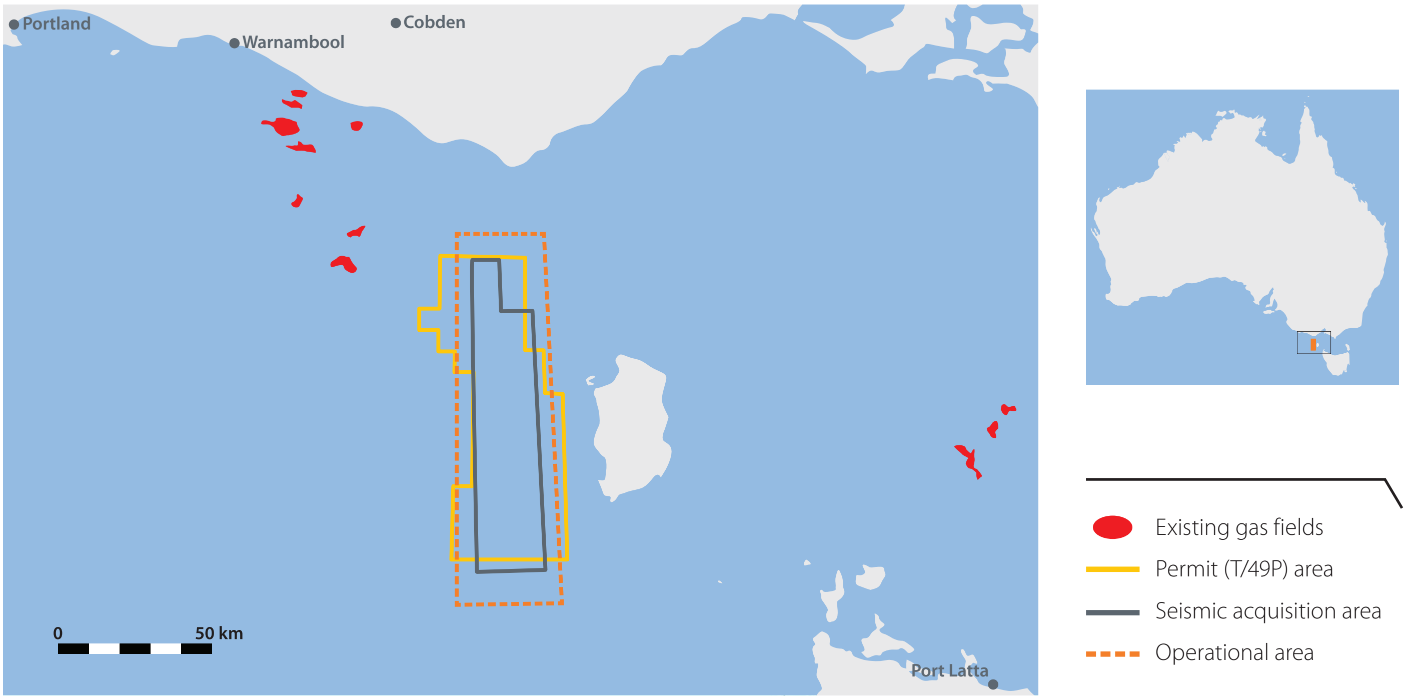
17

Countries with operations and activities

ConocoPhillips Australia was established almost two decades ago. Headquartered in Brisbane, Queensland, we are a 37.5 percent shareholder in Australia Pacific LNG and operate the LNG facility on Curtis Island. We are also pursuing exploration opportunities in Australia. We have a proud track record for safety and environmental performance and draw from a global knowledge set to explore for, develop and produce oil and gas for our domestic and global customers.

Location

The permit T/49P is in the eastern offshore Otway Basin, 14 km (7.5 nm) west of King Island at its closest point. While the permit covers an area of 4,960 km^2, the proposed Sequoia 3D seismic survey will cover an area of approximately 2,840km^2 with a total operational area of approximately 6,500 km^2.



Sequoia 3D Seismic Survey

ConocoPhillips

Timing

It is anticipated the survey will take approximately 60 days and be carried out in the second half of 2021. The timing of the survey will be confirmed after consultation with stakeholders, appropriate regulatory approvals are received and confirmation of vessel availability. ConocoPhillips Australia is cognisant of the approved EP that 3D Oil Limited obtained in 2019 for its proposed Dorrigo seismic survey, and will incorporate learnings from that approvals process when determining the window of opportunity to acquire the survey that balances ecological and socio-economic sensitivities.

How

ConocoPhillips Australia intends to use ConocoPhillips' proprietary Compressive Seismic Imaging (CSI) technology to acquire the Sequoia 3D seismic survey. CSI technology acquires a clearer resolution of rock formations below the Earth's surface from fewer samples.

A 3D marine seismic survey using CSI technology is undertaken in a similar way to a conventionally acquired 3D marine seismic survey. A seismic survey vessel will tow an acoustic source and hydrophone receivers. The acoustic source transmits sound waves into the geological structures beneath the seabed, which reflect the sound signals to the hydrophone receivers.

The acoustic source transmits these sound waves at points identified using the CSI technology along each grid line. Once acquired, high performance computing is used to process the data which is then analysed by geophysicists to create a 3D map of the subsea structures to identify potential natural gas reservoirs.

Consultation

ConocoPhillips Australia understands the importance of thorough, meaningful and ongoing consultation with stakeholders. We undertake stakeholder engagement under a set of guiding principles as part of the way we do business as well as meet our regulatory commitments. Initial consultation will enable us to understand different stakeholder opinions, interests and activities that may be relevant, or need to be taken into account when preparing the EP and designing controls to avoid, minimise or mitigate for impacts and risks.

Stakeholder consultation and feedback will be a key element alongside technical and environmental assessments as the EP is prepared for submission.

This flyer introduces you to ConocoPhillips Australia and the Sequoia 3D seismic survey. Additional information will be provided as the survey design progresses.

Please note that under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, all records of stakeholder correspondence, including emails, phone calls and meetings, are required to be submitted to NOPSEMA with the EP.

COVID-19 travel restrictions

The global COVID-19 pandemic and associated travel restrictions will impact ConocoPhillips Australia's ability to undertake face-to-face consultation for the foreseeable future. Whilst travelling to undertake face-to-face consultation is not currently possible, ConocoPhillips Australia still intends to undertake virtual engagement during this time. As restrictions ease, face-to-face consultation will be used.

Contact us

ConocoPhillips Australia seeks to understand different stakeholder opinions, interests and activities that may be relevant, or need to be taken into account when preparing the EP for the Sequoia 3D seismic survey. You are invited to provide feedback, request a meeting and ask questions on the proposed Sequoia 3D seismic survey by contacting us in one of the following ways:

E sequoia@conocophillips.com

P 07 3182 7122

conocophillips.com.au

Sequoia 3D Seismic Survey

Proposed Survey Area Summary | September 2020

To progress the development of the Environment Plan, ConocoPhillips Australia has refined the area of the proposed Sequoia 3D marine seismic survey in Exploration Permit T/49P. The area is compromised of an operational area and a seismic acquisition area.

Operational Area

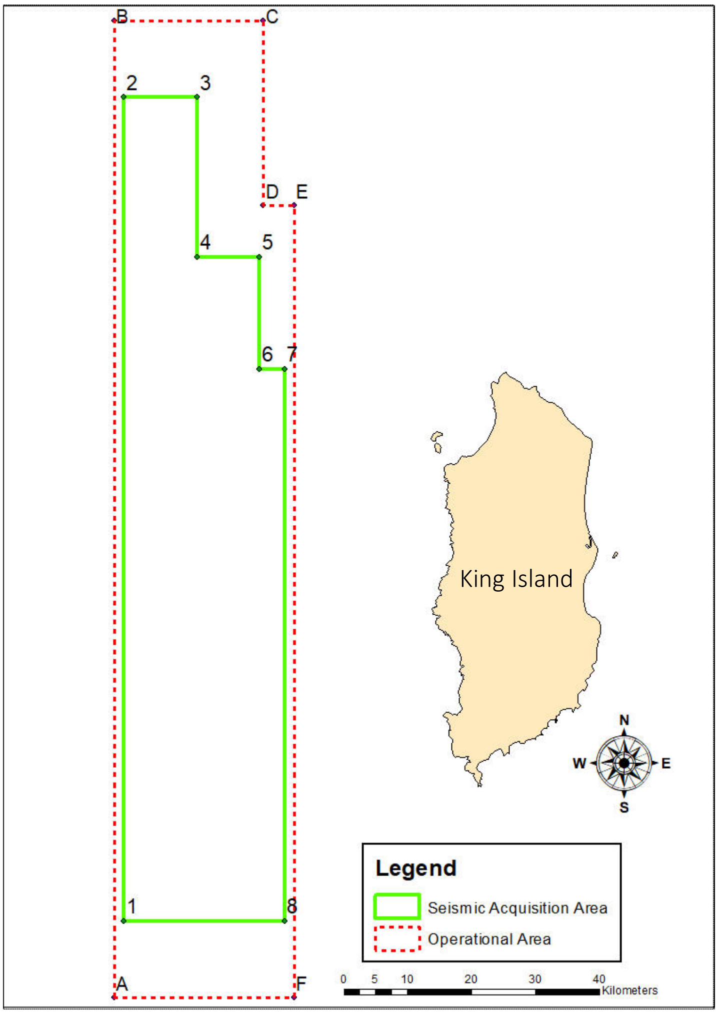
The operational area is the outer boundary of where the seismic vessel will operate and is required for activities such as vessel turnaround.Unless there is an emergency, the seismic vessel will remain within this area during the seismic program.

Seismic Acquisition Area

The seismic acquisition area is the area where seismic will be acquired. Seismic sources and receivers will only be active in this area.

Vertex	Latitude (D,M,S)	Longitude (D,M,S)
Operational Area		
A	40° 28' 31.82" S	143° 15' 54.00" E
B	39° 05' 52.85" S	143° 13' 12.91" E
C	39° 05' 33.17" S	143° 29' 26.23" E
D	39° 21' 09.79" S	143° 29' 59.41" E
E	39° 21' 06.07" S	143° 32' 50.56" E
F	40° 28' 07.30" S	143° 35' 20.83" E
Seismic Acquisition Area		
1	40° 22' 1.68" S	143° 16' 44.52" E
2	39° 12' 20.64" S	143° 14' 27.64" E
3	39° 12' 11.14" S	143° 22' 26.74" E
4	39° 25' 41.42" S	143° 22' 54.19" E
5	39° 25' 32.86" S	143° 29' 42.47" E
6	39° 35' 1.96" S	143° 30' 2.85" E
7	39° 34' 58.38" S	143° 32' 47.44" E
8	40° 21' 39.26" S	143° 34' 32.05" E

GDA94, MGA Zone 54



Contact Us

You are invited to contact us regarding the Sequoia 3D seismic survey in one of the following ways.

E sequoia@conocophillips.com P 07 3182 7122 www.conocophillips.com.au

Sequoia 3D Seismic Survey

ConocoPhillips

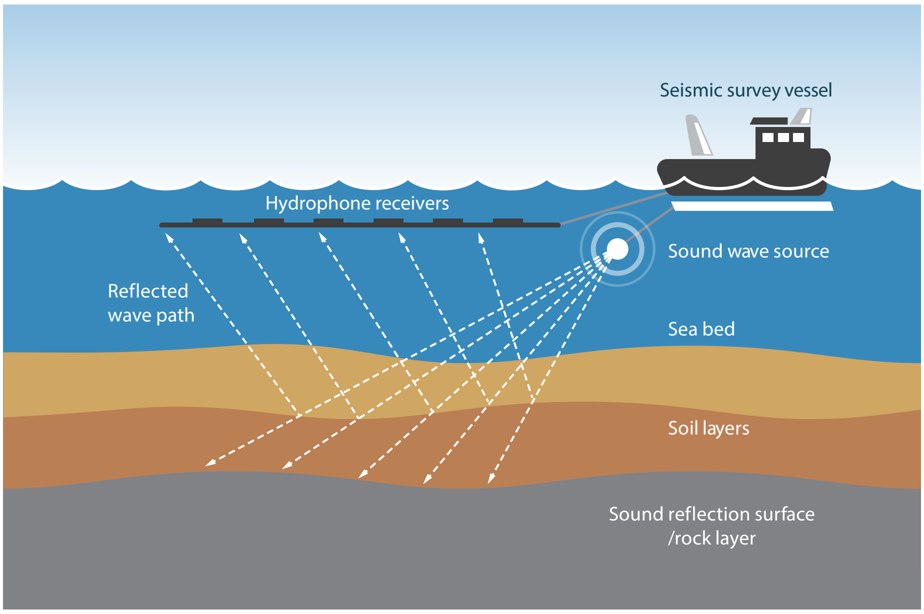
How we will undertake a 3D seismic survey | September 2020

ConocoPhillips Australia is planning to undertake a three-dimensional (3D) marine seismic survey (the Sequoia 3D seismic survey) in Exploration Permit T/49P in waters 14km (7.5nm) west of Tasmania's King Island. The survey will use ConocoPhillips' proprietary Compressive Seismic Imaging (CSI) Technology which acquires similar information to conventional seismic but with fewer samples and in less time.

Marine seismic surveys

A marine seismic survey is used for initial exploration for oil and gas and is essential for identifying geological features that could contain oil or gas deposits. A seismic survey vessel will tow an acoustic source and hydrophone receivers with the vessel sending sound waves into the rock layers beneath the sea floor and recording the time it takes for each wave to bounce back, as well as measuring the strength of each returning wave.

Once acquired, high performance computing is used to process the data which is then analysed by geophysicists to create a 3D map of the subsea structures to identify potential natural gas reservoirs.



About CSI Technology

ConocoPhillips developed Compressive Seismic Imaging (CSI) technology for marine seismic surveys on the back of our long history and global experience with seismic acquisition. The technology has been successfully used and proven across our global operations, including Australia, over the last decade. Our proprietary CSI Technology generates the same information as conventional seismic surveying, however, processing of the CSI acquired data results in a higher resolution product.

To obtain the same higher resolution data set using conventional methods would require the seismic acquisition vessel to be in the water towing a greater number of streamers for a longer period of time. ConocoPhillips's CSI approach therefore significantly reduces the duration, risk and impact of the seismic acquisition program.

Further due to CSI's higher quality data, subsurface uncertainty is potentially reduced when compared with conventional seismic techniques. This has the potential to reduce the number of future seismic surveys required for the development of a gas project in the area.

How will we use CSI?

For the Sequoia 3D Seismic Survey ConocoPhillips Australia will use a marine seismic vessel towing 14 approximately 6km longstreamers with a non-uniform distribution behind the vessel.

At the defined non-uniform intervals, the acoustic source will transmit sound waves into the geological structures beneath the seabed, which reflect the sound signals to the hydrophone receivers. We will then process the data using our CSI processing techniques to generate a data set that is much higher resolution than what could be acquired using conventional methods.

Sequoia 3D Seismic Survey

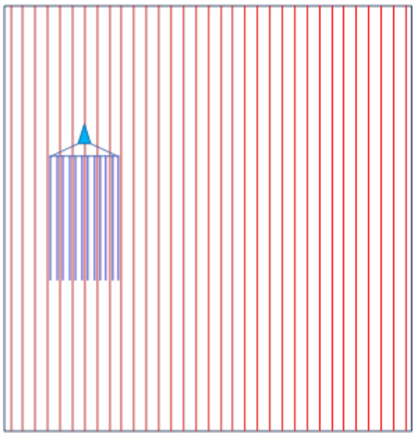
ConocoPhillips

How does CSI work?

CSI applies compressive sensing technology which is a mathematical sampling theory first used by the medical industry to speed up imaging processes such as MRIs. CSI enables geophysicists to reconstruct a higher quality, more accurate picture with less data compared to conventional seismic technology.

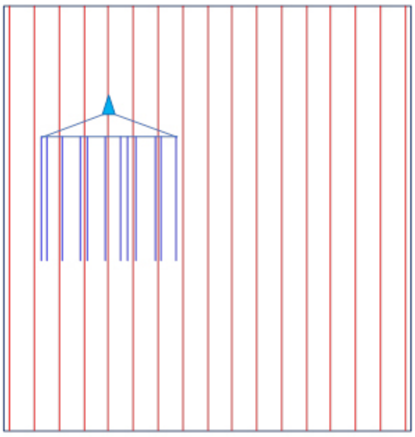
As shown on the diagram below instead of uniform sampling, which involves data gathered from a regular dense grid, CSI uses algorithm processes to achieve a fuller picture and improved outcomes from non-uniform or irregular grid with less data collection points.

Conventional Survey



Conventional Survey: 2x number of sail lines, 2x number of sources, ~2x longer to acquire. More effort, more time.

CSI Survey



CSI Survey: Half as much effort and time for same quality as conventional survey.

Understanding how CSI Technology works

If several people in a room were talking at once, the CSI algorithm would use sensing devices to listen to low-definition random samples of the voices making up the entire conversation. The CSI algorithm would be able to use those random low-definition samples to reconstruct the recording to a high-definition recording of the complete conversation.

How is CSI more efficient?

During CSI data processing the data acquired is reconstructed to look like it was acquired with twice as many streamers than deployed. This is due to the streamers being deployed in a non-uniform pattern rather than a regular pattern. Using ConocoPhillips's proprietary CSI processing we are able to use the data acquired from the non-uniform streamers to reconstruct a higher resolution data set that looks like it was acquired with twice as many streamers spaced much closer together.

Comparing technologies

If we compare CSI technology to conventional acquisition and processing technology to obtain a similarly sized survey and obtain the same high resolution data, a conventional survey design would require the seismic acquisition vessel to be in T/49P for longer while sailing a greater distance.

	CSI Technology	Conventional Technology
Indicative Survey Size	2840km^2	2840km^2
Indicative Survey Duration	60 days	98 days
Indicative timing	Sept – Oct 2021	Aug – Oct 2021
Number of streamers	14	16
Indicative Distance Travelled (sail line kms)	5,700 km	10,000 km

Contact Us

ConocoPhillips Australia seeks to understand different stakeholder opinions, interests and activities that may be relevant, or need to be taken into account when preparing the Environmental Plan for the Sequoia 3D seismic survey. You are invited to provide feedback, request a meeting and ask questions on the proposed Sequoia 3D seismic survey by contacting us in one of the following ways:

E sequoia@conocophillips.com P 07 3182 7122 www.conocophillips.com.au

Sequoia 3D Seismic Survey

ConocoPhillips

Vessel Marine Diesel Oil Spill Modelling and Controls | October 2020

ConocoPhillips Australia has commissioned independent experts in vessel marine diesel oil (MDO) spill modelling to undertake vessel MDO spill modelling as part of the development of the Sequoia 3D marine seismic survey Environment Plan (EP). Vessel MDO spill modelling is a tool used to support spill preparedness, response planning and environmental impact assessment. While offshore MDO spills from vessels are rare, ConocoPhillips Australia believes it is important that risks and impacts are assessed and mitigated to as low as reasonably practicable.

This information sheet presents the results of the modelling undertaken to support the Sequoia 3D seismic survey in Exploration Permit T/49P.

What scenario was modelled?

As part of the risk assessment process a vessel collision resulting in a fuel tank rupture, while highly unlikely, was identified as the most significant, credible risk.

The scenario modelled was a loss of containment of 373 m^3 of MDO over a six-hour period with weathering and spread simulated for a 28-day period. This volume represents the average volume of an externally located fuel tank for potential seismic vessels.

What is Marine Diesel Oil?

MDO is a commonly used fuel for larger sized vessels. It is characterised by a high percentage of volatile components (95 per cent), which evaporates rapidly when on the sea surface. It also contains five per cent persistent hydrocarbons, which do not evaporate as rapidly and can be entrained in the water column and breakdown over time due to decay.

How is modelling undertaken?

Spill modelling takes into consideration water currents, tides and wind speeds, as well as the type of hydrocarbon and release rate to understand the potential spread and effect in the unlikely event of a MDO spill.

Both stochastic and deterministic modelling methods are used.

Stochastic modelling is created by overlaying a large number (often hundreds) of individual, computer-simulated hypothetical spills to result in an overall area of effect.

Deterministic modelling creates a computer simulation of a single hypothetical MDO spill subject to a single set of wind and weather conditions. Deterministic modelling is commonly used to model the 'worst-case' MDO spill scenario (i.e. the case that results in the area of greatest surface water or shoreline exposure).

What type of MDO exposure was modelled?

Three types of exposure were modelled:

Surface water MDO is the spread of MDO on the water surface.

Shoreline MDO is the accumulation of MDO on shorelines.

In-water MDO is the five percent of MDO that doesn't evaporate from the surface of the water and remains in the water column.

What are the vessel MDO spill modelling results?

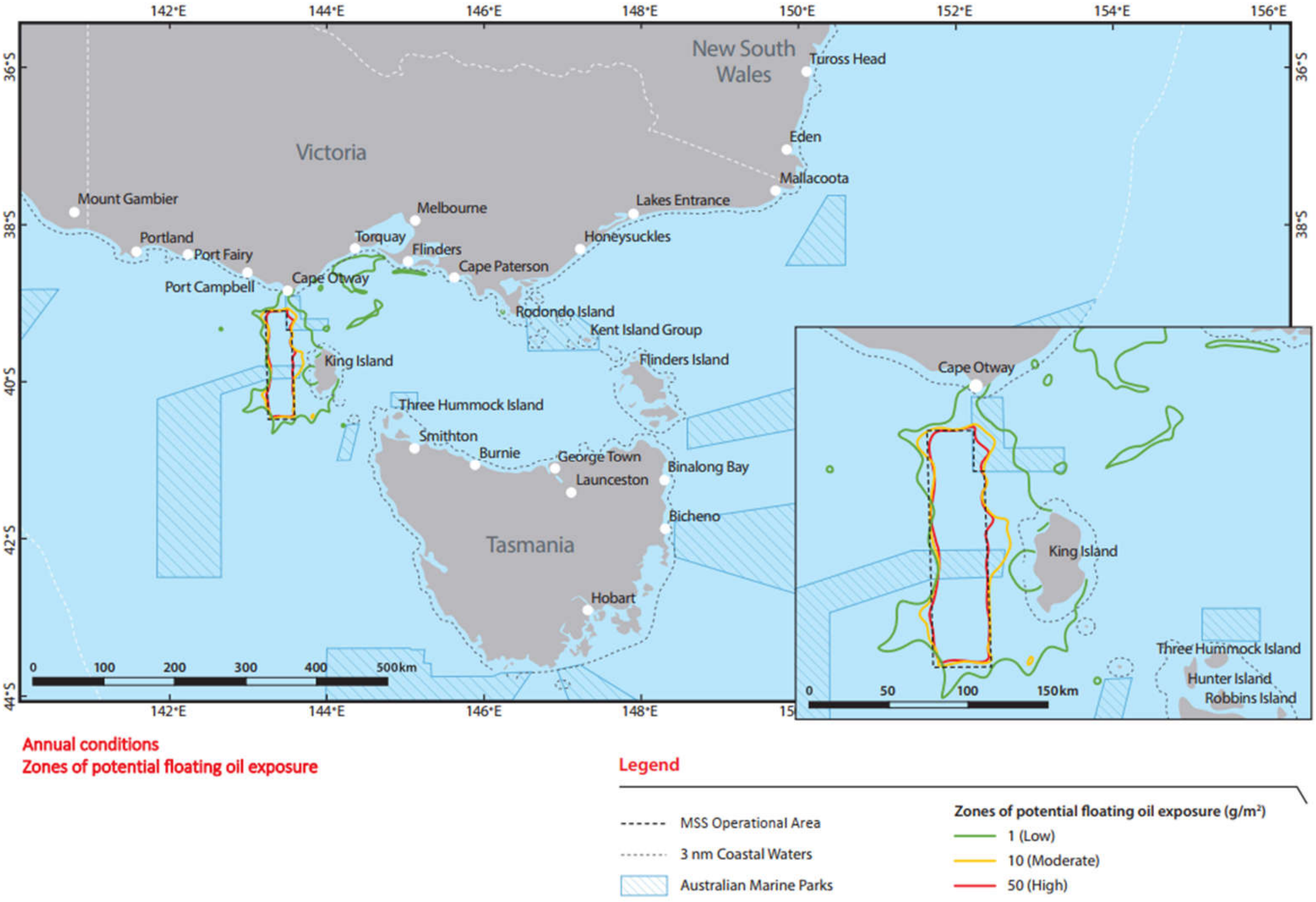
In the extremely rare event that a spill of MDO occurred, the following maps outline the potential exposures. It's important to note that the three stochastic exposure maps identify the amalgamation of the 100 modelled simulations and not the result of a single spill simulation.

Surface Water Exposure

Exposure to floating oil was predicted at a range of sensitive receptors including the Apollo and Zeehan Australian Marine Parks (AMP), the West Tasmania Canyons Key Ecological Feature (KEF) and the Point Addis Marine National Park.

Stochastic modelling showed that the minimum time before exposure at or above the low threshold ranged from 1 hour for sensitive receptors located within the operational area and up to 6.67 days for sensitive receptors such as Wilsons Promontory Marine Reserve national park.

The map below shows an amalgamation of 100 spill simulations under varying weather and ocean conditions. It is not representative of one single spill simulation.



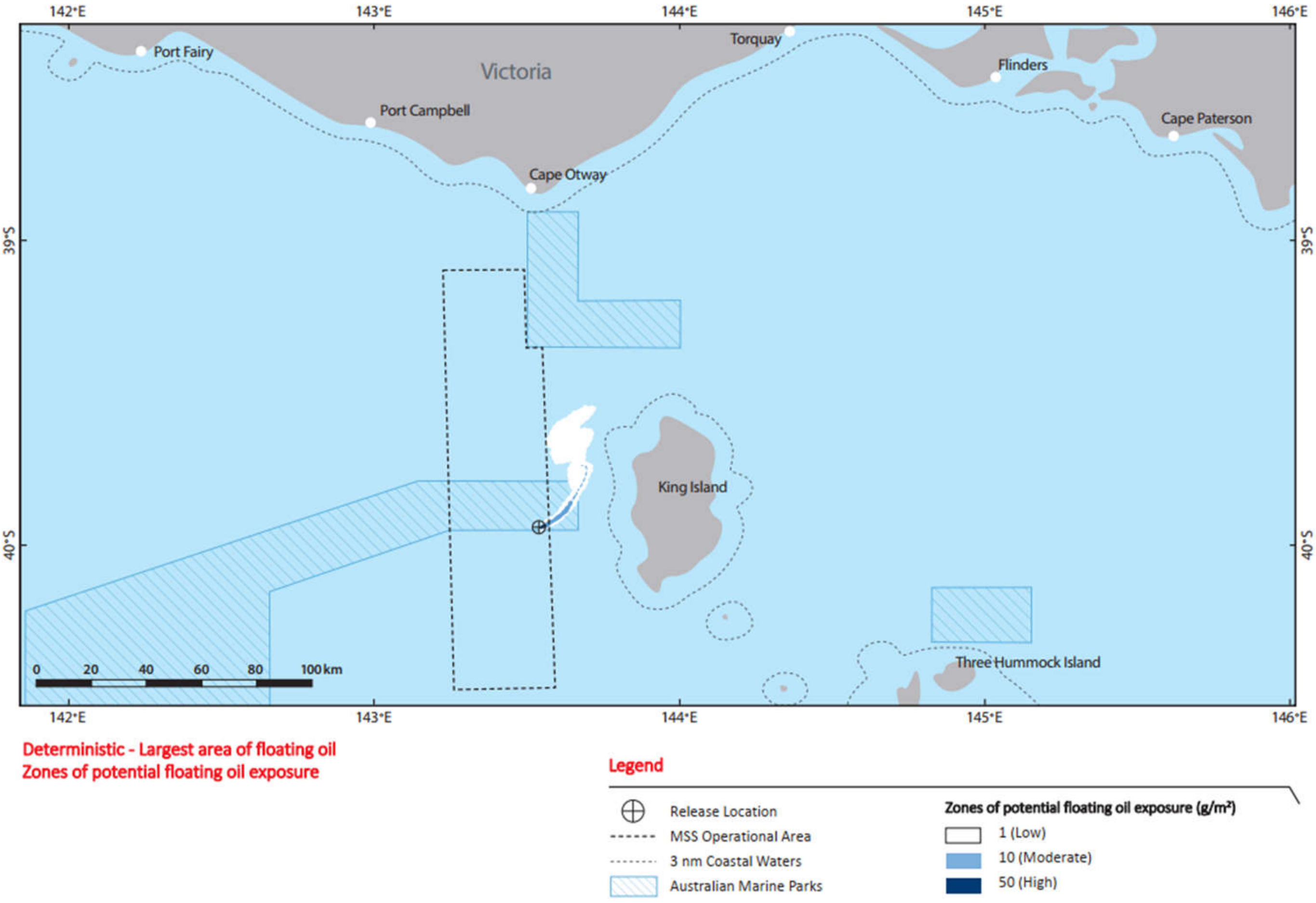
Exposure level	Threshold (g/m²)	Description of potential impact
Low	1	Exposure at this level is unlikely to affect species but would be visible and detectable by instrumentation and may cause a range of socio-economic effects, like the temporary closure of beaches
Moderate	10*	Exposure at this level would likely result in behavioural changes such and changes in reproduction or growth in some species. Exposure at this level is unlikely to result in death, however, this may occur MDO was ingested.
High	50	Exposure at this level would likely result in changes in reproduction or growth in some species and would reduce survival rates of sensitive species.

* 10 g/m² also used to define the threshold for actionable sea surface MDO.

Largest Area of Floating MDO

Deterministic modelling was used to model a spill trajectory that was the largest area of low (1-10 g/m^2) surface water MDO exposure. This used the most severe weather conditions on record for the modelling period.

The map below shows the potential zone of exposure from floating MDO for the worst-case spill simulation. The low floating MDO exposure was predicted to extend a maximum of ~48 km from the release site towards the northeast. Moderate (10-50 g/m^2) and high (≥50 g/m^2) exposure MDO extended a maximum of ~26 km north and 3.3 km northeast from the release location, respectively.



Deterministic - Largest area of floating oil
Zones of potential floating oil exposure

Fuel Tank Comparison

How a seismic vessel fuel tank compares to other vessels in the Otway Basin.

Container Ships	Seismic Vessels	Fishing Vessels
~7 000 m^3 – 13 000 m^3	~2000 m^3	~35 m^3 – 60m^3

Did You Know?

Based on a review of the Australian Transport Safety Bureau's marine safety database there are no recorded instances of collisions, grounding or sinking of a seismic vessel or its support vessels in Australian waters in at least the last 30 years.

Although a seismic vessel has a fuel tank volume of ~2000 m^3 ConocoPhillips Australia has undertaken MDO spill modelling on a volume of 373 m^3 . This is because the seismic vessels have multiple, separate tanks, with externally located tanks averaging 373 m^3 .

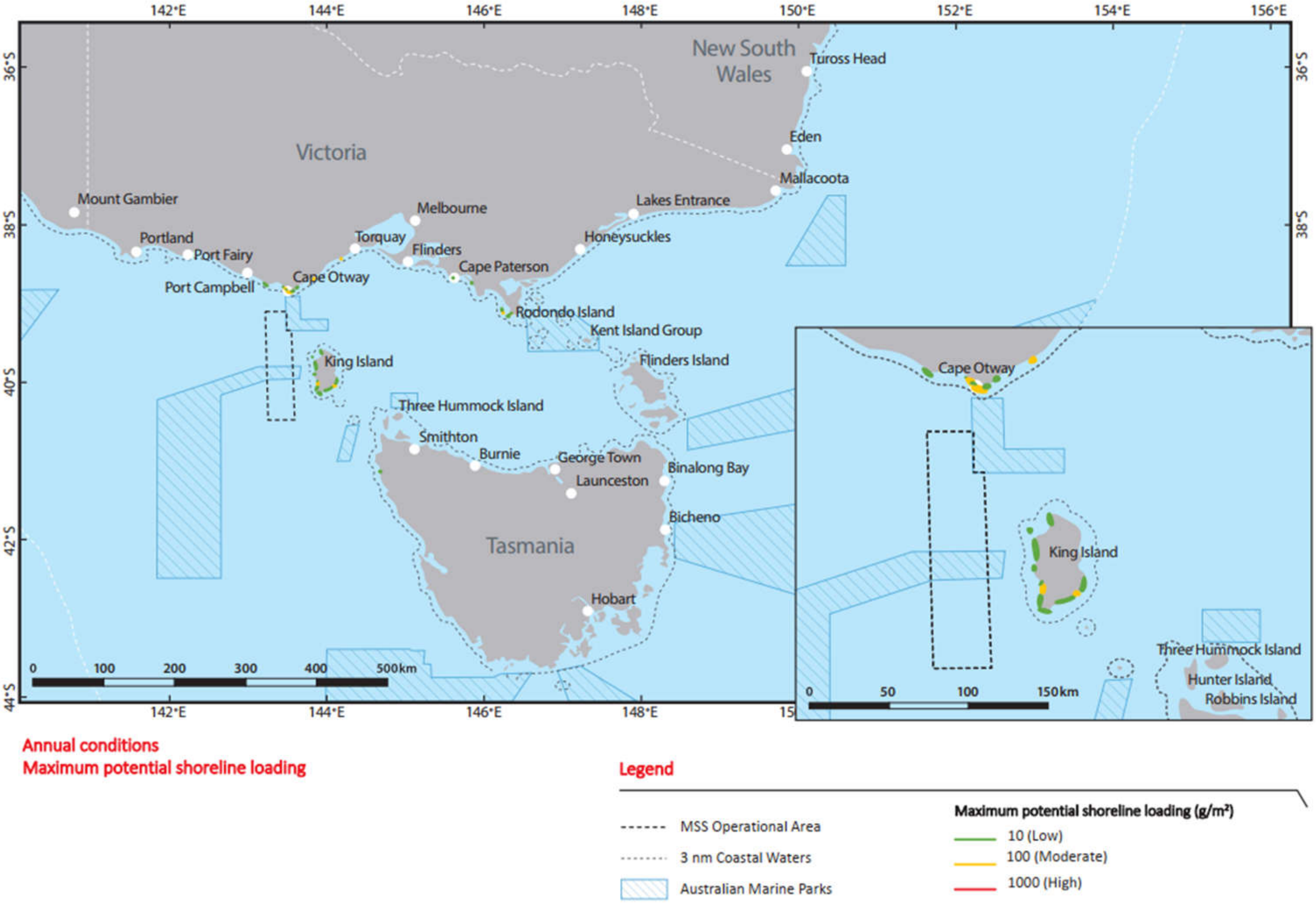
Sequoia 3D Seismic Survey

Shoreline Exposure

Modelling found a probability of a MDO spill originating within the Sequoia 3D marine seismic operational area coming into contact to any shoreline at, or above, the low threshold (10 – 100 g/m^2) was 16 per cent. The minimum time before shoreline contact was approximately 1.67 days (40 hours) while the greatest volume of MDO ashore was predicted as 27.6m^3. Additionally, the greatest length of shoreline contacted by MDO at, or above the low thresholds was 37.5 km.

The stochastic modelling demonstrated potential MDO accumulation on the western and south-eastern coastline of King Island and isolated areas around Port Campbell, Cape Otway and Wilson Promontory. The time to contact King Island was predicted to be 50 hours and the longest length of shoreline contacted above the low threshold is predicted as 18.5 km.

The map below shows an amalgamation of 100 spill simulations under varying weather and ocean conditions. It is not representative of one single spill simulation.



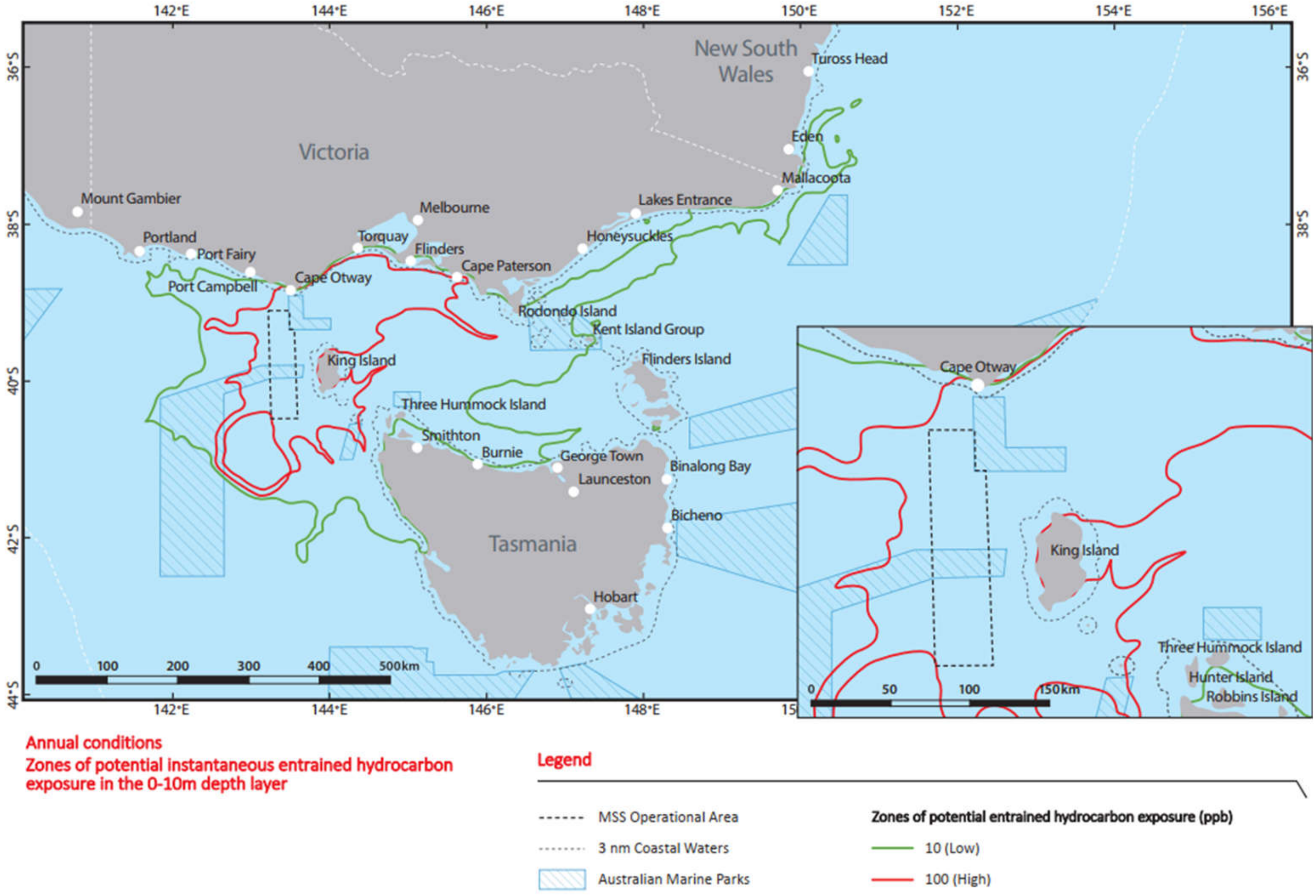
Exposure level	Threshold (g/m^2)	Description of potential impact
Low	10	Exposure at this level is unlikely to affect species but would be visible and detectable by instrumentation and may cause a range of socio-economic effects, like the temporary closure of beaches
Moderate	100*	Exposure at this level would likely result in behavioural changes such and changes in reproduction or growth in some species. Exposure at this level is unlikely to result in death, however, this may occur if MDO was ingested.
High	1 000	Exposure at this level would likely result in changes in reproduction or growth in some species and would reduce survival rates of sensitive species.

* 100 g/m^2 also used to define the threshold for an actionable shoreline MDO exposure.

In-water Exposure

Stochastic modelling demonstrated that MDO in the water column at or above the low threshold (10-100 parts per billion) could potentially travel up to a maximum distance of 742 km east-northeast from the operational area. This distance decreases to 236 km east for high exposure (≥100 parts per billion).

The map below shows an amalgamation of 100 spill simulations under varying weather and ocean conditions. It is not representative of one single spill simulation.



Annual conditions
Zones of potential instantaneous entrained hydrocarbon exposure in the 0-10m depth layer

Exposure level	Threshold (ppb)	Description of potential impact
Low	10	Exposure at this level is unlikely to affect species but would be visible and detectable by instrumentation and may cause a range of socio-economic effects, like the temporary closure of beaches
High	100	Exposure at this level would likely result in changes in reproduction or growth in some species and would reduce survival rates of sensitive species.

Sequoia 3D Seismic Survey

How will ConocoPhillips Australia reduce the risk of a vessel MDO spill occurring?

ConocoPhillips Australia will put in place a range of controls to avoid and minimise the risk of a MDO spill occurring as part of the Sequoia 3D marine seismic survey.

A range of controls have been identified and divided into three categories: compliance with regulation; emergency response preparedness and operations. These will be implemented to ensure the risk of a MDO spill as the result of a vessel collision is reduced to as low as reasonably practicable.

Control Category	Controls
Compliance with regulation	The survey vessel will have a current ship oil pollution emergency plan (SOPEP) in place.
	The survey vessel will hold a valid International Oil Pollution Prevention (IOPP) Certificate in accordance with vessel class requirements.
	The survey and chase vessels will maintain appropriate lighting, navigation and communication at all times to inform other users of the position and intentions of the survey vessel.
Operational Controls	The Australian Hydrographic Service (AHS) will be advised of the survey details (survey location and timing) four weeks prior to mobilisation and following demobilisation to allow for the distribution of Notice to Mariners.
	The Australian Maritime Safety Authority (AMSA) will be advised of the survey vessel's details, satellite communications details, area of operation and requested clearance distances from other vessels 24 to 48 hours before operations commence so that AusCoast warnings can be issued.
	One or more chase vessel will undertake surveillance at all times when streamers are deployed to manage interactions with other vessels transiting near the seismic vessel or streamers.
	Survey and chase vessels will only use MDO, not heavy fuel oil.
	The survey team and bridge crew will monitor the hull clearance and streamers depths at all times during seismic acquisition.
Emergency Response	There will be an approved Oil Pollution Emergency Plan (OPEP) in place prior to survey operations commencing, which will be implemented in the event of a MDO spill.
	The approved OPEP and SOPEP will be tested in a desktop exercise prior to the survey vessel commencing operations.
	The responsibilities of survey crew under the OPEP and SOPEP will be communicated to relevant personnel and included as part of survey induction.
	All relevant crew will be trained in the implementation of the OPEP and SOPEP.

Detailed Information:

Detailed information on the Sequoia 3D marine seismic vessel MDO spill modelling and controls will be available in the Environment Plan.

E sequoia@conocophillips.com P 07 3182 7122

Sequoia 3D Seismic Survey

Underwater Sound Modelling and Controls | October 2020

ConocoPhillips Australia has commissioned independent experts in underwater acoustic modelling and monitoring to undertake underwater sound modelling as part of the development of the Sequoia 3D marine seismic survey (MSS) Environment Plan (EP). Underwater sound modelling is used to predict underwater sound levels expected to be produced by the Sequoia 3D MSS and the distances to effects on various marine fauna groups. This information sheet presents the results of the modelling undertaken to support the Sequoia 3D MSS in Exploration Permit T/49P.

What is the sound generated by marine seismic activities?

Marine seismic surveys involve the use of seismic source arrays that produce high intensity, low frequency air pulses. Sound is produced at regular intervals with the pulses directed primarily towards the seafloor. However, sound will also radiate at angles close to horizontal potentially spreading sound over long distances. The weakening of sound with distance is influenced by bathymetry, seabed composition and oceanographic properties such as temperature and salinity.

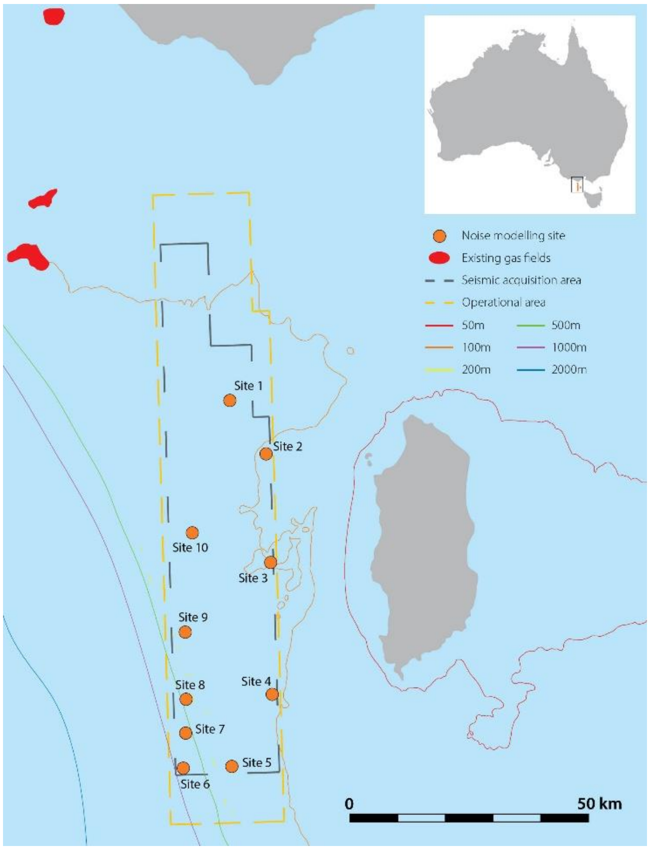
ConocoPhillips Australia has been working with geophysicists, environmental scientists, and seismic vessel contractors to ensure the sound levels from acoustic pulses are kept as low as possible while still meeting our survey objectives. Through this work, the acoustic source proposed for use is a 3,480 cubic inch array, which is a similar size to other marine seismic surveys recently undertaken in Australia.

What was the modelling approach?

Ten underwater sound modelling sites were selected, representative of the different water depths within the survey area. Two scenarios representing 24 hours of operation were considered to determine the accumulated sound levels (for relevant receptors).

How were the modelling sites chosen?

The survey lines were extracted from a nominal acquisition plan for the survey, and selected as they are representative of the range of bathymetry within the survey acquisition area along the continental shelf edge and continental slope that is relevant to Biologically Important Areas (BIAs) for pygmy blue whales and for southern right whales, as well as other key sensitive areas in the region, including the West Tasmanian canyons key environmental feature.



Sequoia 3D Seismic Survey

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How does the proposed seismic survey impact marine life?

ConocoPhillips Australia has used guidelines developed from the best scientific evidence available to inform the EP and continues to keep abreast of all research being released.

There have been numerous studies on the effects of underwater sound on marine receptors with a range of effects identified. Marine seismic surveys in Australia are well regulated and there is Australian and international guidance available for managing potential impacts to sound-sensitive marine fauna.

Sound-sensitive fauna, like whales, fish, seals, and invertebrates (e.g., rock lobsters and giant crabs) are identified as residing in or migrating through the survey area. There is potential for the Sequoia 3D MSS to impact this fauna. The research indicates that these results are generally temporary and localised.

The EP will present the environment impact assessment for each receptor group based on the most relevant thresholds using the latest science.

Understanding the acquisition window

While we expect to be acquiring seismic over a 60-day window, we will be recording seismic data using the seismic acoustic pulses for approximately 30 days. The 60-day window allows for downtime associated with bad weather and/or environmental restrictions such as the presence of whales.

Maximum horizontal distances for species in the water column

The table below outlines the maximum horizontal distance to noise effect criteria from the seismic sound pulse for single-impulse (PK) modelled sites and cumulative modelled sites for pelagic fauna.

The modelling predictions presented in the table represent the variation in results for the 10 modelling sites, which range in water depths from 69 m to 798 m. It is important to note that in accordance with the requirements of the various criteria, only the furthest distance to reach threshold criteria is reported, regardless of whether this is in the water column or seabed, single pulse or 24-h exposure.

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Plankton	*	*	*	*	210 m	There are no scientifically accepted criteria for injury or behaviour to model against.
Cephalopods (octopus & squid)	3.66 km	*	*	*	*	The behavioural threshold reported here is that at which inking has been observed. For this survey, it is predicted that the maximum distance in which this may occur is 3.66 km from the sound source. No other metrics for effect are currently available.

Maximum horizontal distances for species in the water column continued

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Cetaceans – low frequency (LFC) (e.g., blue, humpback, southern right whales)	11.1 km	56.6 km[µ]	1.18 km	*	*	The SEL$_{24h}$ is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixedposition. More realistically, marine mammals would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL$_{24h}$ criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 hours.
Cetaceans – mid-frequency (MFC) (e.g., dolphins)		80 m	<20 m	*	*	
Cetaceans – high-frequency (HFC) (e.g., Kogia)		620 m	340 m	*	*	
Fur-seals (otarrid pinnipeds)	5.4 km	80 m	<20 m	*	*	Refer to Notes for low and mid-frequency cetaceans on the accumulation of SEL.
Turtles	1.66 - 5.43 km[±]	500 m	80 m	*	*	There is limited information on turtle hearing. Refer to Notes for low and mid-frequency cetaceans on the accumulation of SEL. Turtles are likely to be presentonly as vagrants in and around the survey area.

Maximum horizontal distances for species in the water column continued

Fauna group	Behavioural	Injury or Impairment			Mortality/ potential mortality	Notes
		Temporary Threshold Shift (TTS)	Permanent Threshold Shift (PTS)	Recoverable injury		
Fish (with no swim bladders, including sharks)	Near^ – high risk Intermediate ^ –moderate risk Far^ – low risk	2.55 km	*	80 m	81 m	Mortality is likely only within very close distance to the sound source (up to 70 m in the water column and 80 m at the seabed), noting that studies to date have not demonstrated mortality of adult fish. Distances to mortality or recoverable injury from 24 hrs of cumulative impact reduce to a distance of 80 m (and are not triggered for fish living near the seabed).
Fish (with swim bladders, involved and not involved in hearing)	Near – high risk Intermediate – moderate to high risk Far – low to moderate risk	2.55 km	*	170 m	170 m	Distance to recoverable injury (e.g., loss of sensory hair cells) is 170 m in the water column. Many fish species sense sound pressure through gas-filled chambers called swim bladders. Mortality is likely only within very close distance to the sound source (up to 170 m in the water column), noting that studies to date havenot demonstrated mortality ofadult fish. Distances to mortality or recoverable injury from 24 hrs of cumulative exposure reduce to a distance of 80 m (and are not triggered for fish living near the seabed), noting that fish in the survey area are unlikely to remain within 80 m of the moving sound source for a continuous period of 24 hours.
Fish eggs and larvae	Near – moderate risk Intermediate – low risk Far – low risk					

In accordance with the requirements of the various criteria, only the furthest distance to reach threshold criteria is reported, regardless of whether this is in the water column or seabed, single pulse or 24-hour exposure.

** No exposure criteria is available to measure against.*

^ Near = tens of metres, intermediate = hundreds of metres, far = thousands of metres.

± Depending on the exposure criteria applied.

µ Noting that the MSS will be acquired when these whales are not present in the region.

Maximum horizontal distances for benthic invertebrate species

The below table outlines maximum horizontal distance to particle motion exposure for benthic invertebrates.

Fauna group	Behavioural	TTS	PTS	Risk of recoverable injury	No effect	Assessment
Sponges and coral	*	*	*	*	4 m	The threshold adopted is the distance to no impacts, that is, beyond 4 m from the centre of the array, directly below the source, there is no impact to sponges or corals.
Crustaceans (giant crab, rock lobster)	*	*	*	414 m	*	The threshold adopted here is a pseudo-threshold in so far as a scientifically agreed threshold has yet to be decided. The maximum distance to effect of 138-414 m (depending on water depth) is based on comparison against the sound pressure noted as causing damage to mechano-sensory systems (but not mortality).
Bivalves (scallops)	*	*	*	*	214 m	The various thresholds adopted here are pseudo-thresholds in so far as a scientifically agreed threshold has yet to be decided. The maximum distance to effect of 138-214 m (depending on water depth) is based on comparison to the results of various studies on scallops in 2016, 2017 and 2019 noted as resulting in chronic effects that could result in mortality in the weeks and months following exposure.

** No formal or defined exposure criteria is available to measure against*

Sequoia 3D Seismic Survey

ConocoPhillips

How will ConocoPhillips Australia reduce the impact of underwater sound?

ConocoPhillips Australia will put in place a range of controls to minimise the risks of underwater sound to marine life to as low as reasonably practical. The controls are listed in the table here and will be refined as the survey planning and the EP preparation progress.

Control Category	Controls
Compliance with regulation	The survey will be conducted in compliance with EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: Industry Guidelines.
Survey Timing	The survey will be acquired in the months that have the least impact to sensitive receptors such as commercial fisheries (e.g. rock lobster and giant crab) and sensitive fauna (e.g. pygmy blue whale migration and foraging). The window of least impact to most species is in the September to October timeframe. That is why we are applying for the August to October timeframe with a preference for a 60-day window in September to October for seismic acquisition.
Survey Design	The survey will use the lowest sound pressure to achieve the desired data quality.
	The survey will optimise its operational area to reduce the area of impact.
	The survey will use ConocoPhillips CSI Technology, which significantly reduces the duration of seismic activity compared to conventional methods. More information on the CSI Technology can be found on our website.
	The extent of the survey area is designed to reduce the likelihood of having to return to acquire more data at a later time.
Operational Controls	The survey will limit the number of days where seismic is actively acquired.
	Two dedicated trained and experienced marine fauna observers will be stationed on the survey vessel for the duration of the survey
	Survey and support vessel crews will be inducted to ensure they are aware of the EPBC Guideline 2.1 requirements and methodologies to undertake visual assessment for marine fauna species.
	Operations will include : • A.3.1: Pre-startup visual observation • A.3.2: Soft-start procedures • A.3.3: Start-up delay procedures • A.3.4: Operational procedures (shut-down on line turns) • A.3.5: Stop work procedures • A.3.6: Night-time and low visibility procedures.
	There will be no discharge of the acoustic source outside the survey operational area.
	In the event of another survey operating at the same time, procedures will be in place to ensure that a minimum 40 km separation is maintained between seismic surveys

Detailed Information

Detailed information on the Sequoia 3D MSS underwater sound modelling and controls will be available in the Environment Plan.

E sequoia@conocophillips.com **P** 07 3182 7122 www.conocophillips.com.au

Sequoia 3D Seismic Survey

Project Update | October 2020

ConocoPhillips Australia is planning to undertake a three-dimensional (3D) marine seismic survey (the Sequoia 3D seismic survey) in Exploration Permit T/49P to enable assessment of the natural gas reservoirs in the eastern offshore Otway Basin. The permit is located in waters west of Tasmania's King Island.

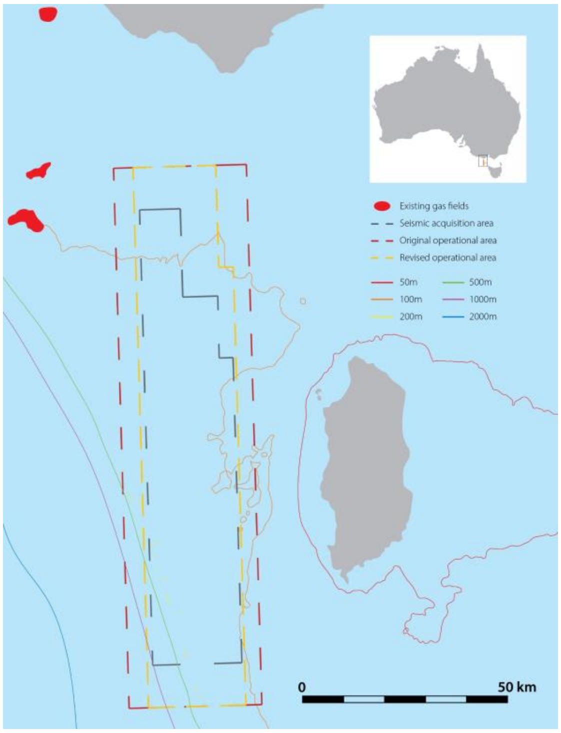
This is the second project update information sheet. Detailed factsheets on topics suchas CSI Technology, Noise Modelling and Spill Modelling are also available.

Changes to the Operational Area

Through ongoing consultation with stakeholders to progress the development of the Environment Plan, ConocoPhillips Australia has reduced the operational area of the Sequoia 3D seismic survey from 6500km^2 to 4090km^2 .

The operational area is slightly larger than the acquisition area as it allows for vessels to turnaround. The reduction in the operational area has resulted in a:

- 27 per cent reduction of Victorian fishing grids affected.
- 19 per cent reduction of Tasmanian Rock lobster grids affected.
- Complete avoidance of the Apollo Marine Park.



Marine Diesel Oil Spill Modelling

ConocoPhillips Australia has commissioned independent experts in vessel marine diesel oil (MDO) spill modelling to undertake vessel MDO spill modelling as part of the development of the Sequoia 3D marine seismic survey Environment Plan (EP). Vessel MDO spill modelling is a tool used to support spill preparedness, response planning and environmental impact assessment. While offshore MDO spills from vessels are rare, ConocoPhillips Australia believes it is important that risks and impacts are assessed and mitigated to as low as reasonably practicable.
Modelling demonstrated that, in the unlikely event of a MDO spill from a seismic vessel:

- There would be minimal entrained oil within the water column
- Low levels of floating oil had the potential to reach a range of sensitive receptors
- Low to moderate levels of oil had the potential to reach Kind Island and Cape Otway.

DID YOU KNOW? Based on a review of the Australian Transport Safety Bureau's marine safety database, there are no recorded instances of collisions, grounding or sinking of a seismic vessel or its support vessels in Australian waters in at least the last 30 years.

Sequoia 3D Seismic Survey

Noise Modelling

ConocoPhillips Australia has commissioned independent experts in underwater acoustic modelling and monitoring to undertake underwater sound modelling as part of the development of the Sequoia 3D marine seismic survey Environment Plan (EP). Underwater sound modelling is used to predict underwater sound levels expected to be produced by the Sequoia 3D marine seismic survey sound source and the distances to effects on marine fauna.

Modelling demonstrated that:

- Sound-sensitive fauna, like whales, fish, seals, and invertebrates (e.g., rock lobsters and giant crabs) are identified as residing in or migrating through the survey area.
- There is potential for the Sequoia 3D MSS to impact this fauna. The research indicates that these results are generally temporary and localised.

More information on noise and marine diesel oil modelling is available at:
www.conocophillips.com.au/what-we-do/otway-basin/

Controls ConocoPhillips Australia will put in place to reduce impacts

Based on the science available to us, we will apply controls to reduce the risks and minimise acoustic disturbance to marine life to as low as reasonably practicable. These include:

- Acquiring seismic in the months that have least impact commercially and environmentally. That is why we are applying for the August to October timeframe with a preference for a 60 day window in September to October for seismic acquisition on T/49P.
- Reducing the operational area. We have reduced the operational area from 6500km^2 to 4090km^2.
- Using our CSI Technology which significantly reduces the duration we are acquiring seismic (vs conventional methods). The Dorrigo EP as approved by NOPSEMA was approximately 25 days of acquisition for 1580km^2, we are proposing approximately 30 days of acquisition for 2840km^2.
- Limiting the number of days we are actively acquiring seismic. While we expect to be acquiring seismic over a 60-day window, we will be recording seismic data using the seismic acoustic pulses for approximately 30 days. We allow time for vessel movements and a buffer in case of bad weather and/or environmental restrictions such as the presence of whales.
- Implementing EPBC Act requirements, including:
  - Soft-start procedures- This involves turning on the acoustic pulses at low power and gradually increasing the output.
  - Precaution and Shutdown zones – to minimise potential impact on whale species.
- Using the lowest sound pressure to achieve the desired data quality.
- Designing a survey in such a way reduces the likelihood of having to return to acquire more data and increases our knowledge of the subsurface which could lower the amount of wells that may be drilled.

Contact us

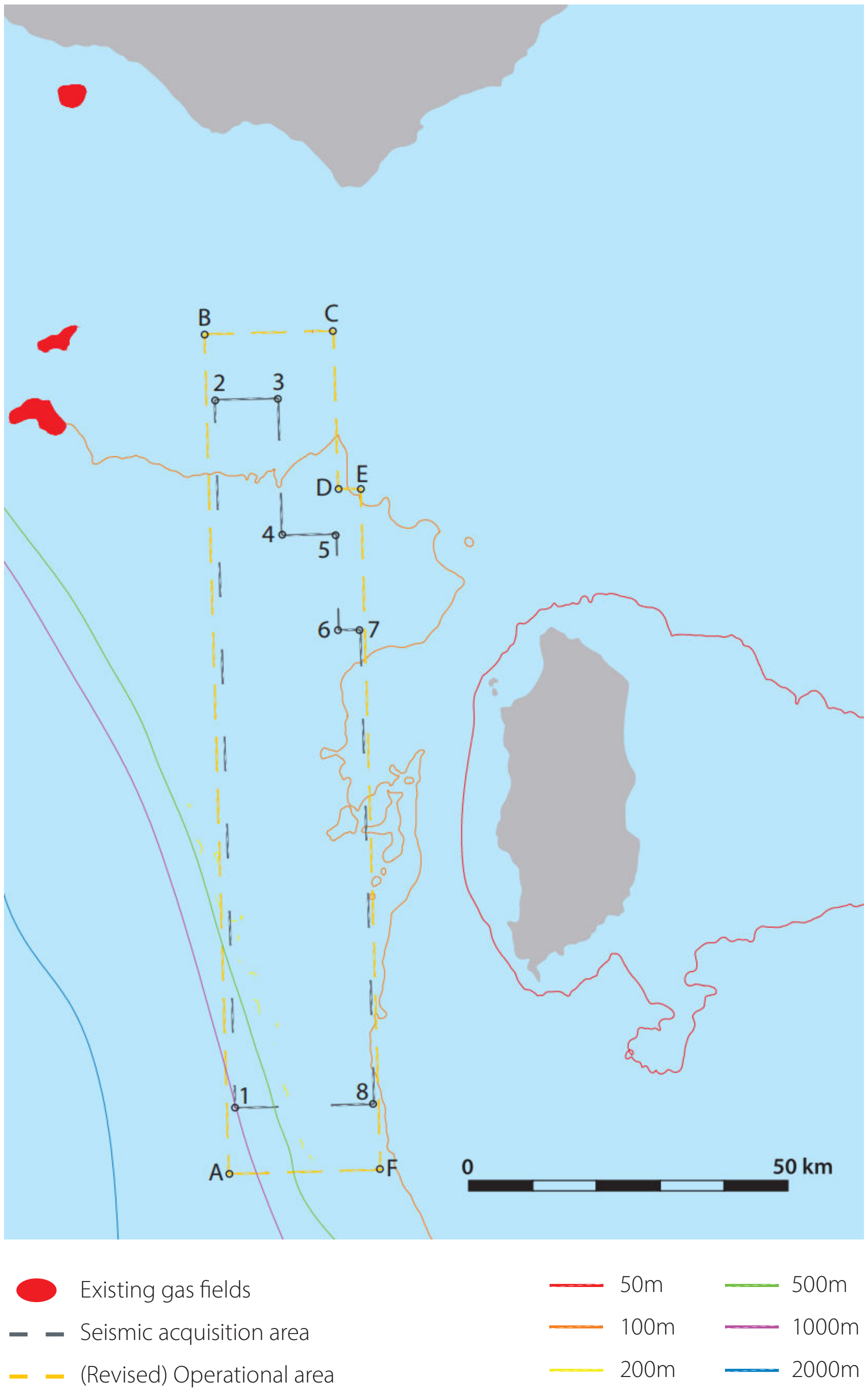
ConocoPhillips invites you to provide feedback, request a meeting and ask questions on the proposed Sequoia seismic survey by contacting us in any one of the following ways:

E sequoia@conocophillips.com **P** 07 3182 7122 www.conocophillips.com.au

Sequoia 3D Seismic Survey

ConocoPhillips

Proposed Survey Area Summary | September 2020



Vertex	Degrees, Min, Sec	
	Latitude	Longitude
Operational Area		
A	40° 28′ 31.82″ S	143° 15′ 54.00″ E
B	39° 05′ 52.85″ S	143° 13′ 12.91″ E
C	39° 05′ 33.17″ S	143° 29′ 26.23″ E
D	39° 21′ 09.79″ S	143° 29′ 59.41″ E
E	39° 21′ 06.07″ S	143° 32′ 50.56″ E
F	40° 28′ 07.30″ S	143° 35′ 20.83″ E
Seismic Acquisition Area		
1	40° 22′ 1.68″ S	143° 16′ 44.52″ E
2	39° 12′ 20.64″ S	143° 14′ 27.64″ E
3	39° 12′ 11.14″ S	143° 22′ 26.74″ E
4	39° 25′ 41.42″ S	143° 22′ 54.19″ E
5	39° 25′ 32.86″ S	143° 29′ 42.47″ E
6	39° 35′ 1.96″ S	143° 30′ 2.85″ E
7	39° 34′ 58.38″ S	143° 32′ 47.44″ E
8	40° 21′ 39.26″ S	143° 34′ 32.05″ E

Contact us

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Sequoia 3D Seismic Survey

ConocoPhillips

Project Update | February 2021

ConocoPhillips Australia is planning to undertake a three-dimensional (3D) marine seismic survey (the Sequoia 3D seismic survey) in Exploration Permit T/49P to enable assessment of the natural gas reservoirs in the eastern offshore Otway Basin. The permit is located in waters west of Tasmania's King Island.

Since the last project update regarding the proposed Sequoia 3D marine seismic survey, ConocoPhillips Australia has continued to consult with relevant stakeholders and the Environment Plan was available for public comment by NOPSEMA.

Changes to the seismic acquisition area

In considering feedback from relevant stakeholders and based on submissions received during the public comment period we have opted to add an additional control to the proposed Sequoia 3D marine seismic survey.

The new control will be to excise the giant crab habitat in the south west region of the survey area from the seismic acquisition area (see Figure 1). Based on the Department of Environment and Energy's 2014 assessment of the Tasmanian Giant Crab fishery, most harvesting of giant crab occurs at depths between 140 and 300 metres. Based on the available research, additional acoustic modelling has been undertaken to calculate the 'distance to no effect' to the fishery, as a result an additional excise buffer of approximately 450m has been applied either side of the fishery. As such, we will be removing the giant crab habitat within the canyon area in the south west of the survey from the acquisition area, reducing the acquisition area to approximately 2700km^2.

This is in addition to the reduction of the original operational area. In late 2020, based on stakeholder feedback received during Environment Plan development, we reduced the operational area from 6500km^2 to 4090km^2 which resulted in: 27% reduction in Victorian fishing grids, 19% reduction in Tasmanian rock lobster grids and complete avoidance of the Apollo Marine Park.

Timing

Our primary control is to acquire seismic in the months that have least impact commercially and environmentally which is why we are seeking approval in the Environment Plan to undertake the seismic acquisition in the August to October 2021 timeframe. The seismic activity is forecast to take 60 days which incorporates allowances for downtime related to weather and other operational constraints.

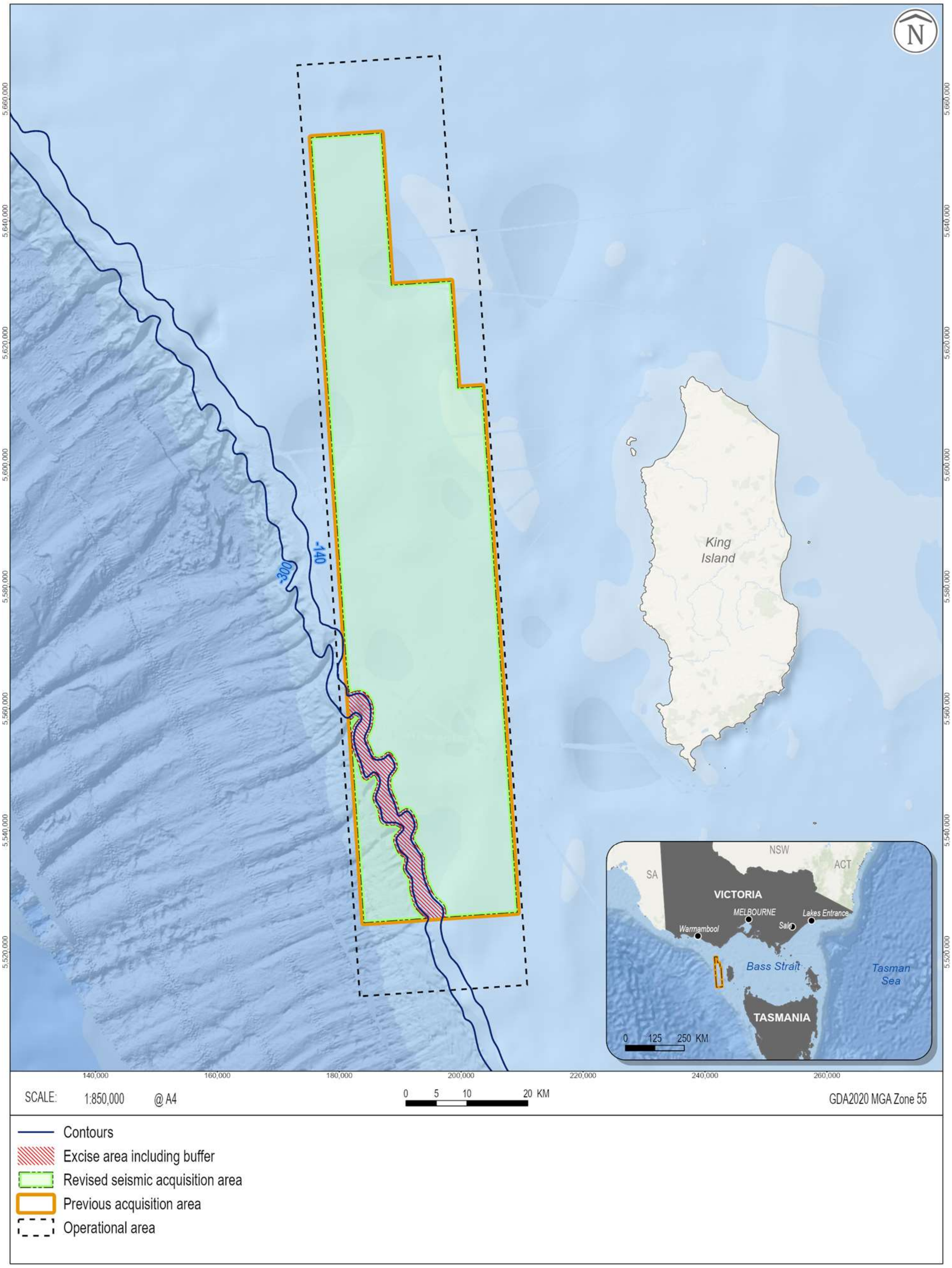

Figure 1.. Revised Sequoia 3D marine seismic survey map

Sequoia 3D Seismic Survey

ConocoPhillips

Frequently asked questions

What approvals are required by the Government?

Prior to commencing any activity, ConocoPhillips Australia must submit an Environment Plan to the offshore regulator, NOPSEMA, for approval under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

What is the purpose of an Environment Plan and what does it include?

The purpose of the Environment Plan is to describe the impacts and risks of the proposed activity, assess them and determine whether they are acceptable and are as low as reasonably practicable. The Environment Plan must also include a description of the existing environment and the proposed activity, an evaluation of the impacts and risks associated with the activities, environmental performance outcomes and standards, implementation strategy, and reporting requirements.

Why do you have to do a seismic survey?

Acquiring seismic and the subsequent interpretation of it is a necessary step in the process of delineating potential oil and gas reserves in the offshore environment. Geologists and geophysicists use this data to identify the location of potential oil and gas reserves and to allow appropriate positioning of any potential drilling locations. As acquisition of this type is a necessary step in the appropriate, efficient and safe delineation of oil and gas resources, exploration titles (like T/49P) often have work commitments attached to them that must be fulfilled for a company to retain tenure over that area. T/49P has a regulatory requirement to undertake a marine seismic survey to fulfill the title's work program commitments.

Can you ensure the seismic survey won't have an impact on marine life?

Based on current and available science the proposed activity will have minimal impact on marine life and we have been careful to implement controls to reduce this risk to as low as reasonably practicable. You can read more on our evaluation of the environmental risks and our controls in our Environment Plan: https://info.nopsema.gov.au/environment_plans/524/show_public

Why have you chosen August to October to undertake a marine seismic survey?

Acquiring seismic in the months that have the least impact commercially and environmentally is a control we can apply to reduce the risks and minimise acoustic disturbance to marine life to as low as reasonably practicable. The window of least impact is August to October. This is based on the research available to us on the activities of all fishing industries (including Tasmanian and Victorian Rock Lobster, Tasmanian and Victorian Giant Crab and other fish including the Southern Bluefin Tuna), whales and other important marine life.

How long will the seismic activity take?

We expect the entire seismic activity to take approximately 60-days to complete. This estimate incorporates all operations required to conduct the survey, including arrival and deployment, downtime due to weather events, downtime due to whale sightings, unforeseen operational constraints, actual seismic acquisition, equipment retrieval and demobilisation. A three month period (August to October) allows for uncertainty in this estimate of operational duration. It is important to note that we expect to only be acquiring data and actively using the sound sources for approximately 30 days within this estimate.

Frequently asked questions continued

Why are you resurveying an area where seismic data has already been acquired?

The vast majority of the Sequoia 3D marine seismic survey is being acquired where no 3D seismic has been acquired in the past. We understand the fishing industry's concerns about repeated marine seismic surveys in the one area. To date, a 3D marine seismic survey has been acquired over a small proportion of the T/49P permit in 2014 called the Flanagan 3D. Some 2D seismic data has been acquired over part of the survey area, however, the bulk of this data was acquired between 1960s and the early 2000s.

2D data represents discrete widely spaced lines (in the case of the T/49P area = ~2-5km spacing) of seismic data that is not able to be used for detailed assessment of the subsurface and eventual drilling well placement. 3D seismic data allows a near complete picture of the subsurface which in turn allows appropriate assessment and well placement.

The proposed Sequoia 3D marine seismic survey will partly overlap with the Flanagan 3D only so the two seismic surveys can be joined together to provide a complete picture of the area.

Why don't oil and gas companies share seismic data to reduce resurveying?

Titleholders of petroleum titles in Commonwealth waters of Australia are required to submit all proprietary seismic data acquired to the regulators (NOPTA) within 18 months of the acquisition date. The regulator will make this freely accessible to everyone three years after the date of acquisition.

About ConocoPhillips

ConocoPhillips is a global exploration and production company with operations and activities in 17 countries. We explore for, develop and produce crude oil and natural gas. A commitment to safety, operating excellence and environmental stewardship guide our operations.

ConocoPhillips Australia was established almost two decades ago. Headquartered in Brisbane, Queensland, we are a 37.5 percent shareholder in Australia Pacific LNG and operate the LNG facility on Curtis Island. We are also pursuing exploration opportunities in Australia. We have a proud track record for safety and environmental performance and draw from a global knowledge set to explore for, develop and produce oil and gas for our domestic and global customers.

Contact us

If you would like to ask questions, provide feedback or request a meeting about the proposed Sequoia seismic survey contact ConocoPhillips Australia in any one of the following ways:

E sequoia@conocophillips.com

T 07 3182 7122

W www.conocophillips.com.au

Sequoia 3D Seismic Survey

ConocoPhillips

Fisheries Project Update | May 2021

ConocoPhillips Australia is planning to undertake a three-dimensional (3D) marine seismic survey (the Sequoia 3D seismic survey) in Exploration Permit T/49P to enable assessment of the natural gas reservoirs in the eastern offshore Otway Basin. The permit is located in waters west of Tasmania's King Island.

This fact sheet sets out information presented in the Environmental Plan which was available for public comment between 4 December 2020 and 3 January 2021. It summaries the assessment of Commonwealth and State fisheries that could be considered relevant (Table 1), potential impacts to these fisheries as part of the planned activities and identified risks of unplanned activities, and associated controls and management measures ConocoPhillips Australia will put in place to undertake the Sequoia 3D marine seismic survey.

Timing

The period identified by ConocoPhillips Australia as having the least impact commercially and environmentally is an August to October 2021 timeframe. The seismic activity is forecast to take 32 days with a cap at a maximum of 38 days in the event there is a need for additional infill acquisition.

In deciding the optimal time to undertake the Sequoia 3D MSS, ConocoPhillips Australia has balanced the ecology of key threatened cetaceans known to occur in the region, particularly for the migration and foraging seasons of the pygmy blue whale and southern right whale and key periods for target fishery species. There is no one period of time through the year where critical life stages for species of concern to stakeholders can be entirely avoided by the survey.

Location

The proposed Sequoia 3D marine seismic survey is located in waters west of King Island and will have an operational area of 4090 km^2 and an acquisition area of approximately 2700 km^2 (Figure 1). The acquisition area shows the area over which seismic data will be acquired. The operating area encompasses a larger area to allow for the vessel undertaking the survey to turn. No seismic activity will occur in the red 'Excise Area' in the south-west corner of the acquisition area.

Sequoia 3D Seismic Survey

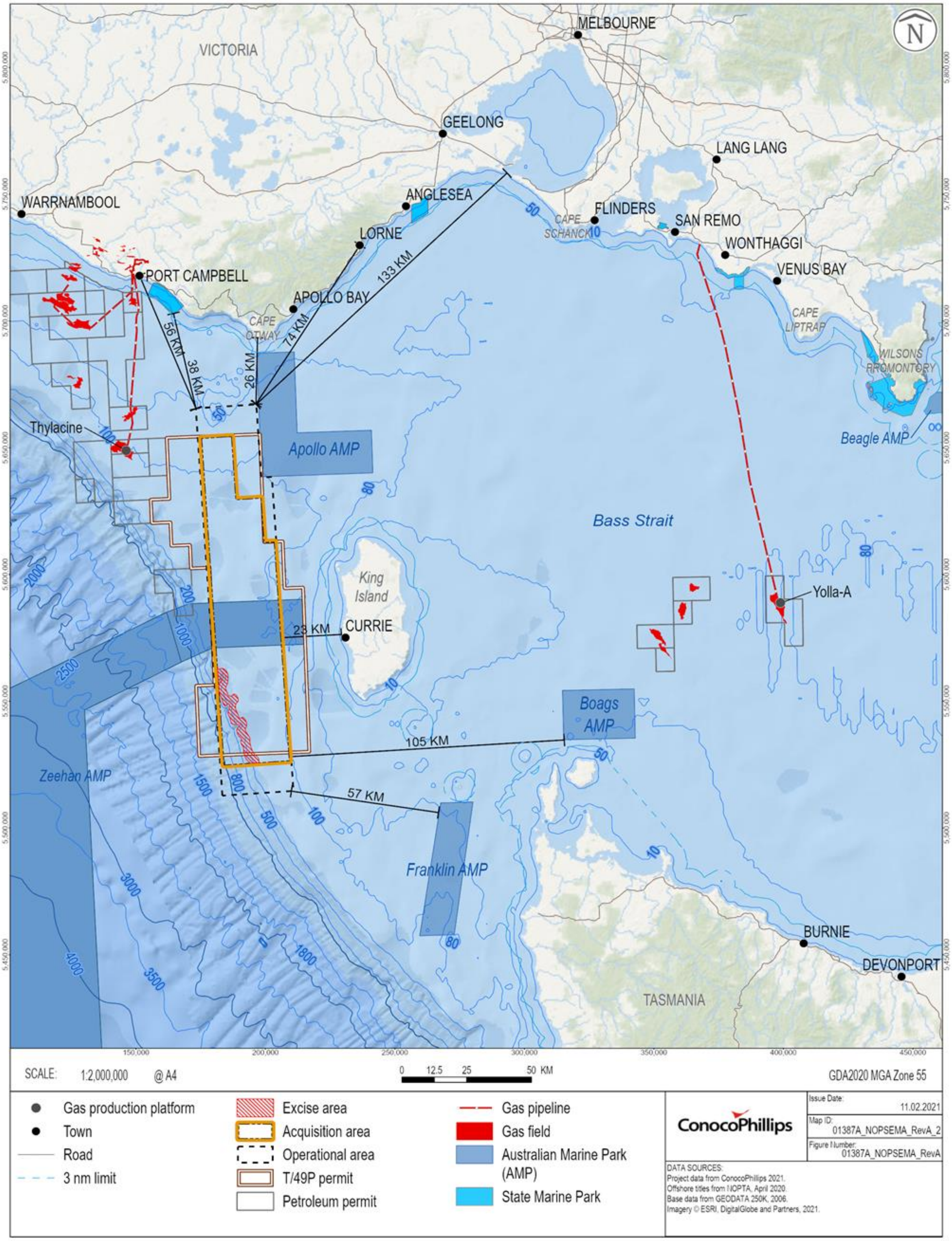

Figure 1. Sequoia 3D marine seismic survey with depth contours

Fishery		Assessment
Commonwealth	**Southern and Eastern Scalefish and Shark Fishery (SESSF) - Shark Gillnet and Shark Hook**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
Commonwealth	**Southern and Eastern Scalefish and Shark Fishery (SESSF) -Commonwealth Trawl Sector (CTS)**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. Recorded fishing in the last 5 years.**
Commonwealth	**Southern and Eastern Scalefish and Shark Fishery (SESSF) - Scalefish Hook Sector (CGS/CSHS)**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. Recorded fishing in the last 5 years.**
Commonwealth	Southern Squid Jig Fishery (SSJF)	✗ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. No historical fishing in this area for last 10 years
Commonwealth	Bass Strait Central Zone Scallop Fishery (BSCZSF)	✗ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region. No historical fishing in this area for last 5 years.
Commonwealth	**Southern Bluefin Tuna (SBTF)**	**✓ Although no overlap between operational area and fishing effort, representative body considered a relevant person based on previous advice that they want to be involved in consultation processes due to upwellings and movement of target species.**
Commonwealth	Eastern Skipjack Tuna Fishery (ESTF)	✗ No recorded historical catch in last 5 years
Commonwealth	Eastern Tuna and Billfish Fishery (ETBF)	✗ No recorded historical catch in last 5 years
Commonwealth	Small Pelagic Fishery (SPF)	✗ No recorded historical catch in last 5 years
VIC	**Southern Rock Lobster**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
VIC	Abalone Fishery	✗ Whilst the fishery overlaps the Operations area, given water depths and hand collection methods for this fishery it is not considered feasible that this fishery would access the Operational Area. Any noise impacts will have dissipated to an acceptable level on reaching the mainland due to the affects of shallow water on underwater noise.
VIC	**Giant Crab (Western Zone)**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
VIC	Wrasse Fishery	✗ Whilst the fishery overlaps the Operations area. The two species of wrasse caught, Purple Wrasse (*Notolabrus fucicola*) and Bluethroat Wrasse (*Notolabrus tetricus*), are typically associated with shallow reefs but can inhabit wasters down to 90 m and 160 m respectively. However, this fishery sells live fish, and to reduce the chance of death through barotrauma, the fishery mainly operates in shallower water then would be expected in the operational area.
VIC	Pipi Fishery (via authorisations on Ocean fishery access licence)	✗ Whilst the fishery overlaps the Operations area, this fishery is primarily a shoreline (intertidal sandy beaches) hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
VIC	**Ocean Access (or Ocean General) Fishery**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
VIC	Ocean Purse Seine Fishery	✗ Whilst the fishery overlaps the Operations area, given only one licence is active in Victorian waters (based out of Lakes Entrance), with fishing focused close to shore and during the day it is not considered feasible that this fishery would access the Operational Area.
TAS	**Giant Crab Fishery**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
TAS	**Rock Lobster Fishery**	**✓ This fishery overlaps the Operations area. Commercial fishers will be potentially active in this region.**
TAS	**Abalone Fishery**	**✓ This dive based fishery overlaps the Noise EMBA. Commercial fishers will be potentially active in this region.**
TAS	Scallop Fishery	✗ This fishery overlaps the Operational Area but fishery is closed
TAS	Shellfish Fishery	✗ Whilst the fishery overlaps the Operations area, this fishery is primarily a nearshore hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
TAS	Seaweed Fishery	✗ Whilst the fishery overlaps the Operations area, this fishery is a shoreline hand collect fishery. It is not considered feasible that this fishery would access the Operational Area.
TAS	Scalefish Fishery	✗ Whilst the fishery overlaps the Operations area, this fishery has no recent catch from the past 10 years. It is not considered feasible that this fishery would access the Operational Area during the survey time.
TAS	**Commercial Dive Fishery**	**✓ This fishery overlaps the Noise EMBA. Commercial fishers will be potentially active in this region.**
TAS	Octopus Fishery	✗ Whilst the fishery overlaps the Operations area, this fishery has no recent catch from the past 8 years. It is not considered feasible that this fishery would access the Operational Area during the survey time.

How could the proposed activity affect day-to-day fishing operations?

The activity could potentially impact the Commonwealth and state fisheries identified above as relevant. The activity has the potential to interfere with fishing operations through:

- Diversion of commercial fishing vessels from their navigation paths - if commercial fishing vessels are transiting through the Operational Area, they may have to detour to go around the survey vessel and streamers. This could amount to a detour of ~ 7 km to go around the vessel and streamers.
- The survey vessel and streamers require other vessels (including commercial fishing vessels) to maintain a safe distance. Pots or gill nets cannot be placed in the area while acquisition occurring to avoid entanglement of both survey and fishers equipment. This can result in commercial fishers not being able to fish in an area where they normally fish while the acquisition is being undertaken in the fishing area. The period of displacement is typically hours to days depending on the location of fishing and fishing equipment and the sail line direction of the seismic vessel. This can lead to fishers having to move to another fishing area that may be at a greater distance or less productive.
- If fishing equipment such as pots and nets are place within the survey vessel and streamer exclusion zone there is potential for them to become entangled in the streamers, resulting in damage or loss. In addition to the cost of repairing or replacing this equipment, it could also result in loss of income from the loss of catch.

To manage these risks we will:

- Notify commercial fishers via Notice to Mariners and through pre-start notifications from ConocoPhillips Australia of when the survey will be undertaken.
- Have in place an 'on-water' cooperation and interaction protocol prior to the commencement of the activity.
- Baring COVID-19 travel restrictions, undertake a visit pre-survey and one visit during the survey to meet with local fishers and communities to hear additional feedback, and to provide updates on the progress of the survey and any changes that may have occurred to the conduct of the activity.
- Directly communicate information about the survey including .kmz files, 5 minutes updates, a 48hr look-ahead, to relevant persons who identified a need for this information.
- Develop a commercial fishing adjustment protocol to allow for compensation of economic loss.

Sequoia 3D Seismic Survey

ConocoPhillips

How are we making sure the survey goes to plan?

The two main unplanned events that could affect fishers are a vessel collision or a hydrocarbon release. Controls to prevent these from occurring are in place and outlined below.

Risk of vessel collision controls

- The Australian Hydrographic Service (AHS) will be advised of the survey details (survey location and timing) four weeks prior to mobilisation and following demobilisation to allow for the distribution of Notice to Mariners.
- The Australian Maritime Safety Authority (AMSA) will be advised of the survey vessel's details, satellite communications details, area of operation and requested clearance distances from other vessels 24 to 48 hours before operations commence so that AusCoast warnings can be issued.
- One or more chase vessel will undertake surveillance at all times when streamers are deployed to manage interactions with other vessels transiting near the seismic vessel or streamers.

Risk of hydrocarbon release controls

- The survey vessel will have a current ship oil pollution emergency plan (SOPEP) in place.
- The survey vessel will hold a valid International Oil Pollution Prevention (IOPP) Certificate in accordance with vessel class requirements.
- The survey and chase vessels will maintain appropriate lighting, navigation and communication at all times to inform other users of the position and intentions of the survey vessel.
- Survey and chase vessels will only use marine diesel oil, not heavy fuel oil.
- The survey team and bridge crew will monitor the hull clearance and streamers depths at all times during seismic acquisition.
- There will be an approved Oil Pollution Emergency Plan (OPEP) in place prior to survey operations commencing, which will be implemented in the event of a marine diesel oil spill.
- The approved OPEP and SOPEP will be tested in a desktop exercise prior to the survey vessel commencing operations.
- The responsibilities of survey crew under the OPEP and SOPEP will be communicated to relevant personnel and included as part of survey induction.
- All relevant crew will be trained in the implementation of oil spill response.

Noise modelling

We have undertaken noise modelling to predict the impacts on all life stages (including eggs and larvae) of commercial stocks. A full copy of the noise modelling report is available on request or can be found in the appendices at: https://info.nopsema.gov.au/environment_plans/524/show_public.

This noise modelling used a conservative maximum distance to 'no effect' criteria specific to each species that have been published in peer reviewed journals. For crustaceans (lobster, crab), a peak to peak sound level of 202 dB re 1 µPa (Payne et al. 2008), is associated with no mortality or damage to mechano-sensory systems and recoverable injury, and was applied at the seafloor. It should be noted that there is no specific literature on the effects of seismic sound on giant crab in this region with sound criteria for southern rock lobster used as a proxy. Peer reviewed studies on snow crabs suggest the southern rock lobster 'effect' criteria would be conservative. The sound exposure guidelines from Popper et al. (2014) for eggs and larvae was applied. The exposure guidelines from Popper et al. (2014) are comparable to other studies such as Day et al. (2016) for embryonic lobsters and Fields et al. (2019) for copepods.

Available scientific literature has demonstrated no direct mortality of more sound sensitive fish species (i.e. with a swim bladder), in response to seismic source emissions under field operating conditions (DFO, 2004b; Carroll et al., 2017; Popper et al., 2014; Popper et al., 2016). Injury in shark species is considered remote given their biology (i.e. no swim bladder), their observed response to sound through near-field particle motion (Myrberg, 2001; Klimley and Myrberg, 1979; Casper et al, 2010) and their unlikely potential to remain close enough to the sound source to be physically injured. This information sheet therefore focuses on potential impacts to lobster.

Sequoia 3D Seismic Survey

What are the predicted impacts to commercially targeted species from underwater sound?

Modelling predicted that the maximum distance at which an effect is seen from the underwater sound will be 414m for lobster and giant crab (Figure 2). It is not predicted that the underwater sound levels will result in the death of any adult lobster or giant crabs. Within the 414m area the effects that are predicted include:

- No increased mortality, delayed development or abnormal development to the egg mass carried by any 'berried' females, if present, or larvae produced from those eggs is likely.
- Damage to statocysts in adult lobsters near the acoustic source is likely, however statocyst damage is known to exist in wild southern rock lobster populations that have very high survival rates and are near carrying capacity.
- Changes to haemolymph biochemistry, an indicator of acute or chronic metabolic stress, in adult lobsters near the acoustic source are unlikely.
- Changes to haemocyte count(an indicator of immune response function) in adult lobsters near the acoustic source is likely.

Within 170m of the sound source there could be mortal effects to larvae and eggs. Recruitment into the Giant Crab and Rock Lobster Fishery occurs from eggs distributed across the whole Otway bioregions and that the biomass is a single, connected population. Based on these facts, there is no cause-effect pathway between localised egg mortality within 170m of the sound source and a change in recruitment.

ConocoPhillips Australia is confident that there is limited uncertainty in the prediction of these impacts, with the exception of giant crab where research specific to the species and location is sparse. ConocoPhillips Australia will apply the precautionary principles to address the level of uncertainty regarding giant crab:

- Fund the University of Tasmania to complete a literature review of seismic effects on giant crabs, and suitable analogue crabs, to provide information that could inform an increase in the low-power excise area prior to the Sequoia 3D MSS commencing and identify future research priorities.
- Excision of the key commercial catch areas mostly targeted by the giant crab fishery over the southern most lead (140-300m plus buffers) from the acquisition area.

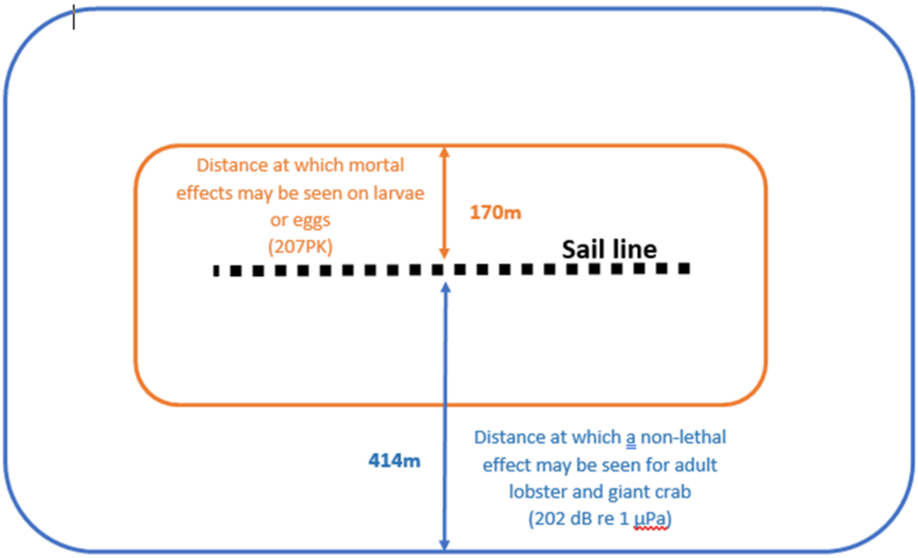

Figure 2. Predicted area of impact for rock lobster and giant crab

Have moulting and spawning periods been considered?

Yes, moulting and spawning periods were considered and an overview of this for southern rock lobster and giant crab is outlined below.

Southern Rock Lobster:

- The majority of the southern rock lobster population will not have soft shells during the period of seismic acquisition, with female southern rock lobster moulting between February and May and male southern rock lobster moulting mainly in August (Gardiner and Mills 2013).
- New shell remains soft for approximately 20 days (Gardiner and Musgrove 2004) and there is some indication that moulted lobsters take shelter to avoid predation (Professor McCauley - Inquiry into the impact of seismic testing on fisheries and the marine environment 2020). However, the exact effects of seismic exposure on soft shelled southern rock lobster after moulting is not well understood and the release of new research is pending.

Giant Crabs:

- Giant crabs are not expected to be in moult during the survey.
- Whilst the spawning period of the giant crab may overlap with the survey timing (October) the species is distributed from central NSW to south-west WA (Kailola et al, 1993).
- The Sequoia 3D MSS timeframe may overlap with the berried female phase of the reproductive cycle (FRDC, 2017).
- No change to development rate in exposed fertilised crab eggs/embryos is expected compared with unexposed eggs/embryos (Payne et al, 2008; Christian et al, 2003; DFO, 2004; Pearson et al, 1994).

How will sound impacts on stocks be mitigated and managed?

To ensure impacts are reduced to as low as possible and that they are as predicted we will:

- Use the lowest sound pressure to achieve the desired data quality.
- Use ConocoPhillips CSI Technology, which significantly reduces the duration of seismic activity compared to conventional methods.
- Ensure there is no operation of the acoustic source outside of the Operational Area.
- Operation of the acoustic source array will only occur in water depths >70 m.
- Excise the identified giant crab habitat, based on fishery data, from the survey area, reducing impacts where the highest density of giant crab is expected in the survey area.
- Ensure that a minimum 40 km separation is maintained between any potential adjacent seismic surveys.

What about dive-based fisheries?

Commercial abalone divers have the potential to be impacted by underwater sound. We are working on ways that we can adjust the survey to minimise interference with abalone divers off King Island’s west coast but have identified the potential for overlapping operations. The extent of the area of impact is predicted to be on the most western coastal areas of King Island within a short period (>2 hours for three seismic lines) over the duration of the scheduled 90 days (between August and October). We will be following the Diving Medical Advisory Committee (DMAC) on the Safe Diving Distance from Seismic Surveying Operations and if needed a simultaneous operations plan (SIMOPS Plan) will be developed.

Will ConocoPhillips Australia compensate commercial fishers if economically impacted?

Yes, ConocoPhillips Australia has committed to having a commercial fishing adjustment protocol in place prior to the commencement of the Sequoia 3D MSS. ConocoPhillips Australia is working in consultation with Seafood Industry Victoria, Tasmanian Seafood Industry Council and the South East Trawl Fishery Industry Association to develop this protocol.

Sequoia 3D Seismic Survey

Contact us

If you would like to ask questions, provide feedback or request a meeting about the proposed Sequoia seismic survey contact ConocoPhillips Australia in any one of the following ways:

E sequoia@conocophillips.com

T 07 3182 7122

W www.conocophillips.com.au

Attachment B: Media

Radio advert:

Do you have questions about the ConocoPhillips seismic survey that is proposed for the west of King Island? ConocoPhillips will be on hand to answer your questions on Monday the 10th of May at the King Island Hotel. Come and chat with ConocoPhillips' experts between the times of twelve to two pm, or from four to seven thirty pm.

Radio message – rescheduled notification

The rescheduled ConocoPhillips Australia seismic survey information booth will be held on Monday the ~~10th~~ tenth of May at the King Island Hotel. ConocoPhillips' experts will be available between the times of twelve to two pm and four ~~and~~to seven thirty pm to answer your questions.

ConocoPhillips
Australia

Seismic Survey Information Booth

ConocoPhillips Australia is proposing to undertake a 3D marine seismic survey west of King Island. You are invited to meet our experts, ask questions and learn more about the survey.

All members of the community are welcome to the information booth.

Date: Wednesday 28 April 2021
Location: King Island Hotel, Cataraqui Room
7 Main Street, Currie

Drop in times between: 11am-2pm and 4pm-7.30pm

For more information please visit: https://www.conocophillips.com.au/what-we-do/otway-basin/

ConocoPhillips
Australia

Seismic Survey Information Booth

ConocoPhillips Australia is proposing to undertake a 3D marine seismic survey west of King Island. You are invited to meet our experts, ask questions and learn more about the survey.

All members of the community are welcome to the information booth.

Date: Monday 10 May 2021

Location: King Island Hotel, Cataraqui Room
7 Main Street, Currie

Drop in times between: 12am-2pm and 4pm-7.30pm

This is the rescheduled session.

For more information please visit: https://www.conocophillips.com.au/what-we-do/otway-basin/

Sequoia 3D Marine Seismic Survey

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

Submitted to:

Giulio Pinzone
Aventus Consulting Pty Ltd

Authors:

Matthew Koessler
Craig McPherson
Sam Welch

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JASCO Applied Sciences (Australia) Pty Ltd
Unit 1, 14 Hook Street
Capalaba, Queensland, 4157
Tel: +61 7 3823 2620
www.jasco.com

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Disclaimer:

The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

Contents

Figures

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Executive Summary

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the proposed Sequoia 3D Marine Seismic Survey (MSS) to assist in understanding the potential acoustic effect on receptors including marine mammals, fish, sea turtles and invertebrates. The Sequoia 3D MSS is proposed by ConocoPhillips Australia SH1 Pty Ltd (ConocoPhillips Australia). Modelling considered a 3480 cubic inch (in^3) seismic source in a dual source configuration (18.75 m inter pulse interval), towed at 6 m depth behind a single vessel.

A specialised airgun array source model was used to predict the acoustic signature of the seismic source, and complementary underwater acoustic propagation models were used in conjunction with the modelled array signature to estimate sound levels over a large area around the source. Single-impulse sound fields were predicted at eleven sites within the survey acquisition area. The water depths at the modelled sites ranged between 61 and 798 m. Accumulated sound exposure fields were predicted for two representative scenarios for likely operations within the survey area over 24 hours.

The modelling methodology considered source directivity and range-dependent environmental properties in each location assessed. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; L_{pk-pk}), particle acceleration (peak magnitude), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied to all modelling.

The sound footprints are highly directional, and while the maximum distances to criteria are presented in the summary, this distance may not be relevant to receptors or areas of interest in a specific direction. For example, the distances to SPL thresholds for behavioural response in marine mammals, and behavioural response and disturbance in turtles are typically greater for the shallower sites, then those close to the continental shelf. However, the orientation of the source is also key, as the array has a pronounced directivity pattern, with greater distances to sound levels in the broadside direction (perpendicular to the tow direction) as compared to the endfire direction (along the tow direction).

The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. Where the corresponding SEL_{24h} radii are larger than those for peak pressure criteria, they often represent an unlikely worst-case scenario. More realistically, marine mammals, fish and sea turtles would not stay in the same location for 24 hours (especially in the absence of location-specific habitat, such as reef), but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either permanent threshold shift (PTS) or temporary threshold shift (TTS)) if it remained in that location for 24 hours.

The analysis considered the distances away from the seismic source at which several effects criteria or relevant sound levels were reached. The results are summarised over page for the representative single-impulse sites and accumulated SEL scenarios in Tables 1–4. The impact criteria for impairment of marine mammals, fish and sea turtles use dual metrics (PK and SEL_{24h}), and the longest distance associated with either metric is required to be applied, and thus is presented in this summary.

Marine mammals

Table 1. Maximum (R_{max}) horizontal distances (in km) from modelled sites or within SEL_{24h} modelled scenarios to behavioural response, TTS and PTS thresholds for marine mammals (maximum-over-depth).

Hearing group	**Modelled distance (in km) to effect threshold (R_{max})**		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
Low-frequency (LF) cetaceans	11.1	56.6	1.18
Mid-frequency cetaceans		0.08	-
High-frequency cetaceans		0.62	0.34
Phocid pinnipeds in water		0.72	0.08
Otariid pinnipeds in water		0.08	–

[1] Noise exposure criteria: NOAA (2019)

[2] Noise exposure criteria: NMFS (2018a)

A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Sea turtles

Table 2. Maximum (R_{max}) horizontal distances (in km) from modelled sites or within SEL_{24h} modelled scenarios to behavioural response, TTS and PTS thresholds for sea turtles (maximum-over-depth).

Hearing group	**Modelled distance (in km) to effect threshold (R_{max})**			
	Behavioural response[1]	Behavioural disturbance[2]	Impairment: TTS[3]	Impairment: PTS[3]
Turtles	1.66	5.43	0.50	0.08

[1] Noise exposure criteria: NSF (2011)

[2] Noise exposure criteria: McCauley et al. (2000a)

[3] Noise exposure criteria: Finneran et al. (2017)

Fish, fish eggs, and fish larvae

This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:

- Fish without a swim bladder (also appropriate for sharks in the absence of other information)
- Fish with a swim bladder that do not use it for hearing
- Fish that use their swim bladders for hearing
- Fish eggs and fish larvae

Table 3. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL$_{24\text{h}}$ modelled scenarios, maximum-over-depth.

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Injury	SEL$_{24\text{h}}$	0.08	SEL$_{24\text{h}}$	0.08
	TTS	SEL$_{24\text{h}}$	2.55	SEL$_{24\text{h}}$	2.52
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Injury	PK	0.17	PK	0.13
	TTS	SEL$_{24\text{h}}$	2.55	SEL$_{24\text{h}}$	2.52
Fish eggs, and larvae	Injury	PK	0.17	PK	0.13

Table 4. Summary of maximum fish TTS onset distances for SEL$_{24\text{h}}$ modelled scenarios, seafloor receptors.

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	TTS	SEL$_{24\text{h}}$	2.36	SEL$_{24\text{h}}$	2.40
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing					
Fish eggs, and larvae					

Invertebrates, Sponges, Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following were determined:

- Crustaceans (lobster and crab): The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) was considered for seafloor sound levels; the sound level was reached at ranges between 0.324 and 0.414 km depending on the modelled site.
- Bivalves: The distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). The maximum distance to this particle acceleration level was 1.5 m for the two considered sites.

- Sponges and coral: the PK sound level at the seafloor directly underneath the seismic source was estimated at all modelled sites and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was reached at 4 m from a single modelled site.
- Octopus and squid: The maximum (R_{max}) and 95% ($R_{95\%}$) distances to the sound level of 162 dB re 1 µPa²·s from Fewtrell and McCauley (2012) associated with inking, and referred to as a startle response threshold, was estimated to be 3.34 and 2.14 km respectively.

1. Introduction

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the proposed Sequoia 3D Marine Seismic Survey (MSS) to assist in understanding the potential acoustic effect on receptors including marine mammals, fish, sea turtles, octopus and squid, benthic invertebrates, plankton, sponges and corals. The Sequoia 3D MSS is proposed by ConocoPhillips Australia SH1 Pty Ltd (ConocoPhillips Australia).

JASCO's specialised Airgun Array Source Model (AASM) was used to predict acoustic signatures and spectra for two comparable arrays under initial consideration for the Sequoia 3D MSS. The total volumes of each array were 3440 cubic inches (in^3) and 3480 in^3. AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions.

Complementary underwater acoustic propagation models were used in conjunction with the selected array signature to estimate sound levels considering environmental effects. Single-impulse sound fields were predicted at eleven defined locations within the potential survey area, and an accumulated sound exposure field was predicted for two representative scenarios for survey operations over 24 h (Section 2). A conservative sound speed profile that would be most supportive of sound propagation conditions for the potential survey period was defined and applied throughout.

The modelling methodology considered source directivity and range-dependent environmental properties. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; L_{pk-pk}), particle acceleration (peak magnitude), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different, species specific noise effect sound levels, guidelines and thresholds.

Section 3 explains the metrics used to represent underwater acoustic fields and the effect criteria considered. Section 4 details the methodology for predicting the source levels and modelling the sound propagation, including the specifications of the seismic source and all environmental parameters the propagation models require. Section 5 presents the results, which are then discussed and summarised in Section 6.

2. Modelling Scenarios

Eleven standalone single impulse sites and two scenarios for survey operations over 24 hours to assess accumulated SEL were modelled. The locations of all modelled sites are listed in Table 5, with all sites and the acquisition lines shown in Figure 1 along with the survey boundaries. Based on input from ConocoPhillips Australia, the modelling assumed that a survey vessel sailed along survey lines at ~4.5 knots, with an impulse interval of 18.75 m.

The single impulse sites and the accumulated SEL scenarios were selected based on the proposed survey line plan option where the survey will be acquired along survey lines orientated either 0 or 180°. The locations of the single impulse sites considered the entire line along with the seismic source would be operational at full-power, including run-outs sections of lines. Therefore, some single impulse modelling sites and sections of the considered acquisition lines for each 24 h SEL scenario are outside the Full Fold Area, but within the Acquisition Area (defined as the area where the seismic source can be operated at full power). The selected locations are considered representative of the range of water depths that will be covered during the Sequoia 3D MSS and the potential sound propagation characteristics that may arise during survey acquisition. The line scenarios were selected to incorporate both potential acquisition line orientations (referred to as either 0 or 180°), and the offshore and inshore sections of the Acquisition Area, to aid in the assessment of sound levels within the Biologically Important Area (BIAs), Key Ecological Features (KEFs) and Australian Marine Parks (AMPs) within the region, along with the Waterwitch Reef Abalone Research Area (WRARA).

Both accumulated SEL scenarios consisted of one full line and one partial line during a 24-hour period and included 9 472 seismic impulses. During line turns, the seismic source was not operating. It is computationally prohibitive to perform sound propagation modelling for every seismic impulse. Therefore, a subset of seismic impulse locations was selected based on the variation in environmental properties within the entire survey area. For this study, 10 locations were considered sufficient to represent the variation in sound propagation along the modelled survey lines; their selection was mainly based on the variation in water depth within the survey area. The modelled sound fields at these 10 single impulse sites were transposed along the survey lines to model the scenarios' SEL_{24h} sound fields (see Appendix C.3). An eleventh location (Site A) was chosen to represent the shallowest point within the Acquisition Area. This location was used to calculate single impulse metrics at the seafloor for impacts to fish and benthic fauna.

Table 5. Location details for the single impulse modelled sites and associated SEL_{24h} scenario.

Relevant SEL_{24} Scenario	Site	Latitude (°S)	Longitude (°E)	MGA Zone 54, GDA1994		Water depth (m)	Tow direction (°)
				X (m)	Y (m)		
1	1	39° 32' 59.4733"	143° 26' 19.3794"	709541	5619362	103	0/180
	2	39° 40' 06.7164"	143° 32' 16.2022"	717686	5605953	69	
	3	39° 54' 02.2895"	143° 33' 26.1863"	718617	5580140	102	
	4	40° 11' 11.5813"	143° 34' 04.2856"	718606	5548375	115	
1 & 2	5	40° 20' 36.9605"	143° 27' 16.1199"	708470	5531214	118	
2	6	40° 20' 56.8961"	143° 19' 04.1966"	696847	5530912	798	
	7	40° 16' 21.1050"	143° 19' 34.8480"	697794	5539398	606	
	8	40° 12' 07.4725"	143° 19' 28.5108"	697849	5547223	299	
	9	40° 03' 08.4701"	143° 19' 17.8496"	698031	5563850	125	
	10	39° 50' 12.3846"	143° 20' 18.0476"	700085	5587743	106	
N/A	A†	39° 40' 07.2803"	143° 31' 43.9395"	716917	5605957	61	N/A

†Shallowest location within Acquisition Area, only seafloor receptors assessed via VSTACK.

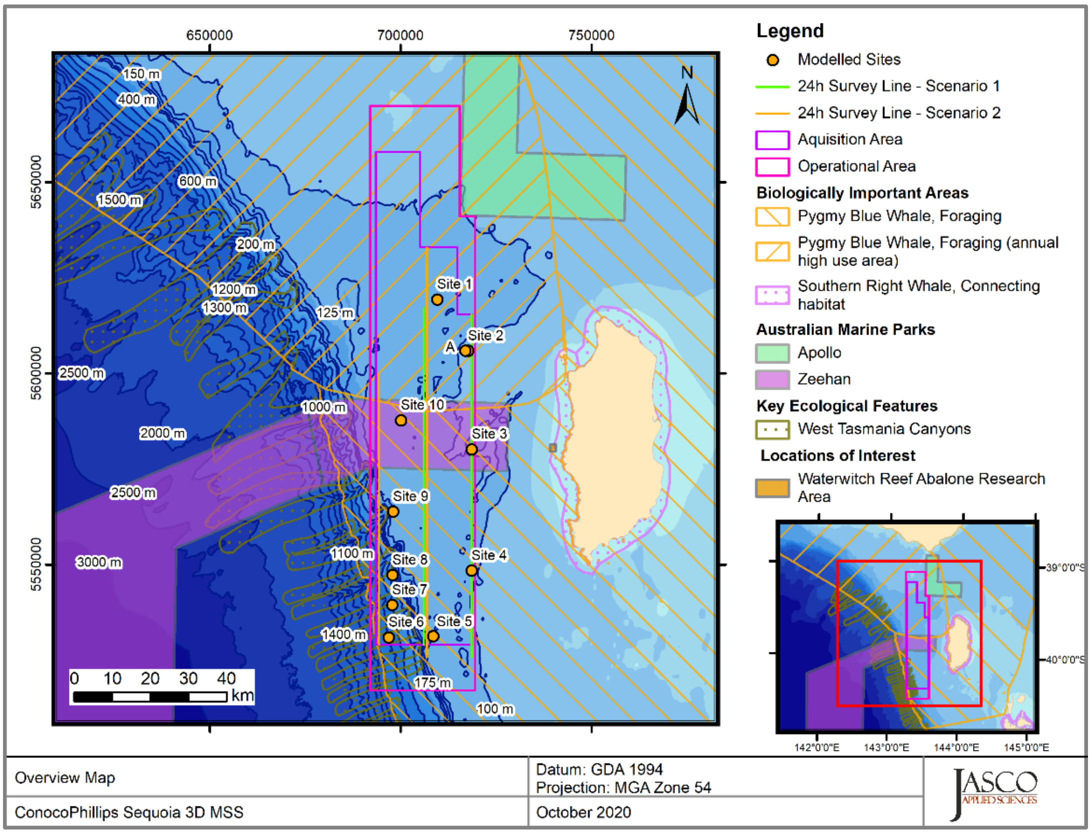


Figure 1. Overview of the modelled sites, acquisition lines, and features for the Sequoia 3D MSS.

3. Noise Effect Criteria

The perceived loudness of sound, especially impulsive noise such as from seismic airguns, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content. Several sound level metrics, such as PK, SPL, and SEL, are commonly used to evaluate noise and its effects on marine life (Appendix A). The period of accumulation associated with SEL is defined, with this report referencing either a “per pulse” assessment or over 24 h. Appropriate subscripts indicate any applied frequency weighting; unweighted SEL is defined as required. The acoustic metrics in this report reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405:2017 (2017).

Whether acoustic exposure levels might injure, impair or disturb marine fauna is an active research topic. Since 2007, several expert groups have developed SEL-based assessment approaches for evaluating auditory injury and impairment, with key works including Southall et al. (2007), Finneran and Jenkins (2012), Popper et al. (2014), United States National Marine Fisheries Service (NMFS 2018a) and Southall et al. (2019). The number of studies that have investigated the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially.

The following thresholds, guidelines and sound levels for this study were chosen because they represent the best available science, and sound levels presented in literature for fauna with no defined thresholds:

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from the U.S. National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018a) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals.
2. Marine mammal behavioural threshold based on the current NOAA (2019) criterion for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources.
3. Sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Popper et al. 2014).
4. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from Finneran et al. (2017) for the onset of PTS and TTS in turtles.
5. Sea turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p) (NSF 2011), as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000b, 2000a).
6. Peak-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$) at the seafloor to help assess effects of noise on crustaceans through comparing to results in Day et al. (2016a), Day et al. (2019), Day et al. (2016b), Day et al. (2017) and Payne et al. (2008).
7. For comparison to published literature, a no effect sound level for sponges and corals of 226 dB re 1 µPa (PK; L_{pk}) is reported for comparing to Heyward et al. (2018).
8. An squid/octopus startle (inking) response sound level of 162 dB re 1 µPa^{2}s per-pulse SEL (L_E) (Fewtrell and McCauley 2012).
9. An SPL human health assessment threshold of 145 dB re 1 µPa (SPL; L_p) for sound exposure to people swimming and diving derived from Parvin (2005), and considering Ainslie (2008).

Additionally, to assess the size of the low-power zone required under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1, Department of the Environment, Water, Heritage and the Arts (DEWHA 2008), the distance to an unweighted per-pulse SEL of 160 dB re 1 µPa^2·s (SEL; L_E) is reported.

The following sections (Sections 3.1–3.5, along with Appendix A.4 and A.6), expand on the thresholds, guidelines and sound levels for marine mammals, fish, fish eggs, fish larvae, sea turtles, benthic invertebrates and humans.

3.1. Marine Mammals

There are two categories of auditory threshold shifts or hearing loss: PTS, a physical injury to an animal's hearing organs; and TTS, a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued.

To help assess the potential for the possible injury and hearing sensitivity changes in marine mammals, this report applies the criteria recommended by NMFS (2018a), considering both PTS and TTS, which are numerically identical to Southall et al. (2019). These criteria, along with the applied behavioural criteria (NOAA 2019), are summarised in Table 6, with descriptions included in Appendix A.4.1 (auditory impairment) and Appendix A.4.2 (behavioural response), with frequency weighting explained in Appendix A.5.

Table 6. Unweighted SPL, SEL_{24h}, and PK thresholds for acoustic effects on marine mammals.

Hearing group	**NOAA (2019)**	**NMFS (2018a)**			
	Behaviour	**PTS onset thresholds* (received level)**		**TTS onset thresholds* (received level)**	
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)	PK (L_{pk}; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)	PK (L_{pk}; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196
Phocid pinnipeds in water		185	218	170	212
Otariid pinnipeds in water		203	232	188	226

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

L_p-denotes sound pressure level period and has a reference value of 1 µPa.

L_{pk}, flat–peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.

L_E - denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 µPa^{2}s.

Subscripts indicate the designated marine mammal auditory weighting.

3.2. Fish, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Turtles was formed to continue developing noise exposure criteria for fish and turtles, work begun by a panel convened by NOAA two years earlier. The resulting guidelines included specific thresholds for different levels of effects and for different groups of species (Popper et al. 2014). These guidelines defined quantitative thresholds for three types of immediate effects:

- Mortality, including injury leading to death.
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma.
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. However, as these depend upon activity-based subjective ranges, these effects are not addressed in this report and are included in Table 7 for completeness only. Because the presence or absence of a swim bladder has a role in hearing, fish's susceptibility to injury from noise exposure varies depending on the species and the presence and possible role of a swim bladder in hearing. Thus, different guidelines were proposed for fish without a swim bladder (also appropriate for sharks and applied to whale sharks in the absence of other information), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Turtles, fish eggs, and fish larvae are considered separately. Table 7 lists relevant effects thresholds from Popper et al. (2014).

The SEL metric integrates noise intensity over some period of exposure. Because the period of integration for regulatory assessments is not well defined for sounds that do not have a clear start or end time, or for very long-lasting exposures, it is required to define a time. Popper et al. (2014) recommend applying a standard period, where this is either defined as a justified fixed period or the duration of the activity; however, Popper et al. (2014) also included caveats about how long the fish will be exposed because they can move (or remain in location) and so can the source. 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 study for SEL, which is similar to that applied for marine mammals in NMFS (2016, 2018a).

Additional information is provided in Appended A.6.

Table 7. Guidelines for seismic noise exposure for fish, adapted from Popper et al. (2014).

Type of animal	**Mortality and Potential mortal injury**	**Impairment**			**Behaviour**
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	>219 dB SEL_{24h} or >213 dB PK	>216 dB SEL_{24h} or >213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae (relevant to plankton)	>210 dB SEL_{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: Peak sound level (PK) dB re 1 µPa; SEL_{24h} dB re 1µPa^2·s. All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist. Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

3.3. Sea Turtles

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. Popper et al. (2014) suggested thresholds for onset of mortal injury (including PTS) and mortality for sea turtles and, in absence of taxon-specific information, adopted the levels for fish that do not hear well (suggesting that this likely would be conservative for sea turtles).

Finneran et al. (2017) presented revised thresholds for sea turtle injury and hearing impairment (TTS and PTS). Their rationale is that sea turtles have best sensitivity at low frequencies and are known to have poor auditory sensitivity (Bartol and Ketten 2006, Dow Piniak et al. 2012). Accordingly, TTS and PTS thresholds for turtles are likely more similar to those of fishes than to marine mammals (Popper et al. 2014).

McCauley et al. (2000b) observed the behavioural response of caged sea turtles—green (*Chelonia mydas*) and loggerhead (*Caretta caretta*)—to an approaching seismic airgun. For received levels above 166 dB re 1 µPa (SPL), the sea turtles increased their swimming activity and above

175 dB re 1 µPa they began to behave erratically, which was interpreted as an agitated state. The 166 dB re 1 µPa level has been used as the threshold level for a behavioural disturbance response by NMFS and applied in the Arctic Programmatic Environment Impact Statement (PEIS) (NSF 2011). In addition the 175 dB re 1 µPa level from McCauley et al. (2000b) is recommended as a criterion for behavioural disturbance. The Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017) acknowledges the 166 dB re1 µPa SPL reported by McCauley et al. (2000b) as the level that may result in a behavioural response to marine turtles. These thresholds are shown in Table 8.

Table 8. Acoustic effects of impulsive noise on sea turtles: Unweighted SPL, SEL_{24h}, and PK thresholds

Effect type	**Criterion**	**SPL (L_p; dB re 1 µPa)**	**Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)**	**PK (L_{pk}; dB re 1 µPa)**
Behavioural response	NSF (2011)	166	NA	
Behavioural disturbance	McCauley et al. (2000a)	175		
PTS onset thresholds* (received level)	Finneran et al. (2017)	NA	204	232
TTS onset thresholds* (received level)			189	226

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
L_p denotes sound pressure level period and has a reference value of 1 µPa.
$L_{pk,flat}$ denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²s.

3.4. Invertebrates

3.4.1. Benthic Invertebrates (crustaceans and bivalves)

Research is ongoing into the relationship between sound and its effects on crustaceans (lobster and crabs) and bivalves, including the relevant metrics for both effect and impact. Available literature suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. Water depth, seabed material, 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, more likely relevant to effects on crustaceans and bivalves, while the reverse is true in deeper water.

At the seafloor interface, crustaceans and bivalves are subject to particle motion stimuli from several acoustic or acoustically induced waves. These include the particle motion associated with an impinging sound pressure wave in the water column (the incident, reflected, and transmitted portions), substrate acoustic waves, and interface waves of the Scholte type. However, it is unclear which aspect(s) of these waves is/are most relevant to the animals, either when they normally sense the environment or their physiological responses to loud sounds so there is not enough information to establish similar criteria and thresholds as done for marine mammals and fish. Including recent research, such as Day et al. (2016b) and Morris et al. (2018), current literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for an assessment for potential effect. This includes the consideration of what particle motion levels lead to a behavioural response, or mortality. Therefore, at this stage, authoritative thresholds to inform the impact assessment are not available. However, levels can be determined for pressure metrics presented in literature to assist the assessment.

The pressure and acceleration examples provided in Day et al. (2016a)(Figures 11 and 12) indicate that the acceleration and pressure signals occurred simultaneously, which was interpreted as an indication that the waterborne sounds were responsible for the accelerations measured by the geophones. For clarity, it is important to distinguish that the acceleration from waterborne sound energy is *not* ground roll, which Day et al. (2016a) correctly define as the sound that propagates along the interface at a speed lower than the shear wave speed of the sediment. However, the report subsequently uses ground roll for all further discussions of particle acceleration. While Day et al. (2016a) discuss that they chose the simplest measure of ground roll, it should have been referring to as 'the acceleration from waterborne sound energy', or 'waterborne acceleration' for short.

For crustaceans (lobster and crab), a PK-PK sound level of 202 dB re 1 µPa (Payne et al. 2008) is considered to be associated with no impact, and it is therefore applied in this assessment. Additionally for context, the maximum PK-PK sound levels measured during the passes of the 150 in^3 airgun (209–213 dB re 1 µPa) and reported in Day et al. (2016a), Day et al. (2016b), and Day et al. (2019), are also included.

For scallops (and bivalves), PK-PK sound levels of 212 and 213 dB re 1 µPa are presented to allow comparison to the maximum sound levels measured in Day et al. (2016a) (also reported in Day et al. (2017)) during the passes of the 150 in^3 airgun (reported in Table 7 of Day et al. (2016a)).

Literature does not present a sound level associated with no impact, and as particle motion is the more relevant metric, particle acceleration from the seismic source has been presented for comparing the results in Table 7 of Day et al. (2016a). The maximum particle acceleration assessed for scallops was 37.57 ms^{-2}.

3.4.2. Plankton

To assess impacts to plankton, there are only a few studies to base threshold criteria on. Popper et al. (2014) cites many of the references and studies on potential impacts of noise emissions on fish eggs and larvae prior to 2014. Results presented in Day et al. (2016b) for embryonic lobsters and Fields et al. (2019) for copepods align with those presented in Popper et al. (2014), which is that mortality and sub-lethal injury are limited to within tens of metres of seismic sources. Additionally, the Popper et al. (2014) criteria (Table 7), are extrapolated from simulated pile driving signals which have a more rapid rise time and greater potential for trauma than pulses from a seismic source.

Other research, such as McCauley et al. (2017), has indicated the potential for effects at longer range, however Fields et al. (2019) noted that it was difficult to reconcile the high mortality reported by McCauley et al. (2017) with the low mortalities reported in the greater previous body of earlier research and their experiment. They recommended further research into whether it is the sound pulse itself (i.e. the energy, peak pressures, or particle acceleration), the (turbulent) fluid flow occurring more slowly (i.e. not related to the sound pulse), or other effects such as the bubble cloud that which might cause higher mortality near the seismic source.

3.4.3. Octopus and Squid

There are no reported studies regarding the response of octopus to airgun signals, however the responses of squid were investigated by Fewtrell and McCauley (2012). The authors conducted a number of experiments and examined the received per-pulse SEL for caged squid. They found that in one trial, where the received level of the first airgun impulse was 162 dB re 1 µPa^2·s, the squid inked. This response was not observed again within this trial, however the authors stated that it was unknown if this was due to depleted ink reserves or habituation. In two other trials, the initial received levels were lower (132 and 146 dB re 1 µPa^2·s per-pulse SEL), and although the received levels did exceed 162 dB re 1 µPa^{2}s, no inking behaviour was observed. The authors hypothesised that the results also suggest that a gradual increase in received levels and prior exposure to air gun impulses decreases the severity of the alarm responses in this species. This aligns with findings of general habituation in response to predators in squid (Long et al. 1989). Recent work (Jones et al. 2020) supports these findings as well, indicating potential rapid, short-term habituation by squid to impulsive noise, however, similar response rates were seen 24 h later, which indicated that squid might re-sensitise to the noise.

The results presented in by Fewtrell and McCauley (2012) were stated by the authors to be preliminary, and while they stated that while it is possible that noise levels greater than 147 dB re 1 µPa^2·s are required to induce avoidance behaviour, the level associated with inking, of 162 dB re 1 µPa^2·s per-pulse SEL, has been considered as a startle response level for both squid and octopus.

3.5. Human health assessment threshold

Underwater, 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 surveys, and as such care is required when considering thresholds for recreational divers and swimmers, particularly for impulsive sounds such as seismic surveys (Ainslie 2008).

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 diver 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 metres. 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).

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. Seismic impulses are broadband sources, and therefore, to be precautionary, the 145 dB re 1 µPa SPL suggested by Fothergill et al. (2001) and Parvin (2005) has been applied in this study as a broadband SPL and as a human health assessment threshold for recreational divers and swimmers. This does not imply that this level is associated with the onset of injury.

4. Methods

4.1. Parameters Overview

Sound propagation was modelled up to 100 km from each single impulse modelled site (listed in Table 5). The specifications of the seismic source and the environmental parameters used in the propagation models are described in detail in Appendix C. A single sound speed profile for July was considered in this modelling study; this was identified as the month that would provide the farthest propagation when considering the months July to October, due to the presence of a slight upward refracting sound speed profile (see Appendix C.4.2). Whilst the potential operational window of the survey is from 1 August to 31 October, July, was included to represent a worst-case scenario, although it is not substantially different to August.

The acoustic properties of the seafloor in the survey acquisition area vary depending on the water depth and the area on the continental shelf. Two geoacoustic profiles were developed and used for various modelled sites (see Appendix C.4.2). Sediment in the survey area was modelled as layered cemented and semi-cemented carbonates for Site A,1–5,9–10 (Table 5) on the continental shelf edge. The deeper modelling sites on the slope sediments (Sites 6-8) were modelled as a succession from soft to hard sediments (silty carbonate sand to cemented limestone) (Table 5).

4.2. Acoustic Source Model

The pressure signature of the individual airguns and the composite decidecade-band point-source equivalent directional levels (i.e., source levels) of the 3440 in^3 and 3480 in^3 seismic sources were modelled with JASCO's Airgun Array Source Model (AASM). Although AASM accounts for notional pressure signatures of each seismic source with respect to the effects of surface-reflected signals on bubble oscillations and inter-bubble interactions, the surface-reflected signal (known as surface ghost) is not included in the far-field source signatures. The acoustic propagation models account for those surface reflections, which are a property of the propagating medium rather than the source.

AASM considers:

- Array layout.
- Volume, tow depth, and firing pressure of each airgun.
- Interactions between different airguns in the array.

All seismic sources considered were modelled over AASM's full frequency range, up to 25 kHz. Appendix B.1 details the AASM model.

4.3. Sound Propagation Models

Three sound propagation models were used to predict the acoustic field around the seismic source:

- Combined range-dependent parabolic equation and Gaussian beam acoustic ray-trace model (MONM-BELLHOP, 5 Hz to 25 kHz).
- Full Waveform Range-dependent Acoustic Model (FWRAM, 5 Hz to 1042 Hz).
- Wavenumber integration model (VSTACK, 10 Hz to 1024 Hz).

The models were used in combination to characterise the acoustic fields at short and long ranges in terms of SEL, SPL, PK, and PK-PK. Appendix B.2 details each model. MONM-BELLHOP was used to calculate SEL of a 360° area around each source location. The model calculated propagation losses up to distances of 100 km from the source in each cardinal direction, with a horizontal separation of 20 m between receiver points along the modelled radials. The sound fields were modelled with a horizontal angular resolution of $\Delta\theta = 2.5°$ for a total of $N = 144$ radial planes. Receiver depths were chosen to span the entire water column over the modelled areas, from 2 m to a maximum of 5000 m, with step sizes that increased with depth. To supplement the MONM results, high-frequency results for propagation loss were modelled using Bellhop for frequencies from 1259 Hz to 25 kHz. The MONM and Bellhop results were combined to produce results for the full frequency-range of interest.

FWRAM was used to model synthetic seismic pulses and to generate a generalised range-dependent SEL to SPL conversion function for the considered modelled sites (Appendix C.2). FWRAM was run to 100 km at four of the eleven single impulse modelling sites, along four radials (fore and aft endfire, and port and starboard broadside) for computational efficiency. Along each radial, the computation was done with a regular depth step of 1 m over the entire water column, and a horizontal range step of 20 m. The range-dependent conversion function was applied to predicted per-pulse SEL results from MONM-BELLHOP to estimate SPL values. FWRAM was also used to calculate water column PK levels.

VSTACK was used to calculate close range PK, PK-PK and particle acceleration magnitudes along transects at the seafloor from the loudest direction of the seismic source at the shallowest modelled sites within each survey area (Site A, 1–2). The maximum modelled range for VSTACK was 1000 m and a variable receiver range increment that increased away from the source was used, which increased from 10 to 25 m. Received PK and PK-PK levels were computed for a receiver 50 cm above the seafloor for assessment of receptors at or just above the seabed. Particle acceleration magnitudes were computed for a receiver 5 cm above the seafloor for assessment of seabed attached receptors.

During a seismic survey, new sound energy is introduced into the environment with each pulse from the seismic source. The vessel towing the airgun was modelled travelling at 4.5 knots, with an overall inter-pulse-interval of 18.75 m. The modelling for Scenario 1 and Scenario 2 included 9472 and 9470 seismic impulses, respectively. While some impact criteria are based on the per-pulse energy released, others, such as the marine mammal, turtle and fish SEL criteria used in this report (Sections 3) account for the total acoustic energy marine fauna is subjected to over a specified period of time, defined in this report as 24 h. An accurate assessment of the accumulated sound energy depends not only on the parameters of each seismic pulse impulse, but also on the number of impulses delivered in a period and the relative positions of the impulses. Appendix C.3 provides additional details on the methods used to calculate the accumulated sound energy for the considered scenarios.

5. Results

5.1. Acoustic Source Levels and Directivity

AASM (Section 4.2) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic source, with results provided in Appendix C.5 along with the horizontal directivity plots.

Preliminary source modelling was conducted to determine the source with the highest equivalent far-field acoustic output of two considered source arrays. This was determined to be a 3480 in^3 seismic source with a 6 m tow depth (see Appendix D for details)

Table 9 shows the PK and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions. The vertical source level that accounts for the “surface ghost” (the out of phase reflected pulse from the water surface) is also presented to make it easier to compare the output of other seismic source models.

Figure C-10 shows the broadside, endfire, and vertical overpressure signature and corresponding power spectrum levels for the source. The signature consists of a strong primary peak, related to the initial release of high-pressure air, followed by a series of pulses associated with bubble oscillations. Most energy was produced at frequencies below 251 Hz. Frequency-dependent peaks and nulls in the spectrum result from interference among airguns in the source and correspond with the volumes and relative locations of the airguns to each other.

Table 9. Far-field source level specifications for the 3480 in^3 seismic source, for a 6 m tow depth. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Direction	**Peak source pressure level ($L_{S,pk}$) (dB re 1 µPa m)**	**Per-pulse source SEL ($L_{S,E}$) (dB 1 µPa²m²s)**	
		10–2000 Hz	2000–25000 Hz
Broadside	248.6	225.3	185.7
Endfire	247.5	225.1	190.6
Vertical	258.1	230.9	197.9
Vertical (surface affected source level)	258.1	233.5	200.9

5.2. Per-Pulse sound fields

This section presents the per-pulse sound fields in terms of maximum-over-depth SPL, SEL, PK, and seafloor PK, PK-PK and particle acceleration. The different metrics are presented for the following reasons:

- SPL sound fields were used to determine the distances to marine mammal and turtle behavioural thresholds (see Sections 3.1 and 3.3) and the human health assessment threshold (Section 3.5).
- Per-pulse SEL sound fields are used as inputs into the 24 h SEL scenarios, to determine the distance to the squid response sound level (Section 3.4.3) and context for the range to 160 dB re 1 µPa²·s, relevant for the EPBC Act Policy Statement 2.1 (DEWHA 2008).
- PK metrics within the water column are relevant to thresholds and guidelines for marine mammals, sea turtles, fish, fish eggs and larvae (as well as plankton) (Sections 3.1–3.3).
- PK metrics at the seafloor are relevant to guidelines for fish, fish eggs and larvae (Section 3.2) and the sound level for no effect on corals and sponges

- PK-PK metrics at the seafloor are relevant to sound levels used in the assessment of impacts to benthic invertebrates (Section 3.4.1).
- Particle acceleration metrics are relevant for the assessment of impacts to bivalves (seabed attached receptors, Section 3.4.1).

The maximum and 95% distances (calculated as detailed in Appendix C.1) for per-pulse SEL and SPL metrics are presented in Tables 10 and 11. The SPL sound fields, and distances to relevant isopleths can be visualised on the contour maps presented in Figures 2 to 14, whilst the per-pulse SEL sound field maps are presented in Appendix E. The SPL sound fields are also presented as vertical slices for selected sites along the endfire and broadside directions out to 20 km, with the airgun array in the centre (Figures 15 to 17).

The distance to the maximum-over-depth SPL isopleth (145 dB re 1µPa, SPL) for the human diver health assessment threshold (Section 3.5) at the three modelling sites closest to King Island is presented in Table 12, with the sound level at three locations relevant to the Waterwitch Reef Abalone Research Area presented in Table 13.

Maximum distances to PK and PK-PK thresholds were calculated for four of the modelled single impulse sites in the water column, with maximum-over-depth results presented in Table 14. Maximum distances to PK and PK-PK thresholds were also calculated for three of the modelled single impulse sites at the seafloor (Tables 15 and 16).

5.2.1. Tabulated results

5.2.1.1. Entire water column

Table 10. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3480 in^3 source to modelled maximum-over-depth per-pulse SEL isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_p; dB re 1 µPa^2·s)	Site 1 (Depth: 103 m)		Site 2 (Depth: 69 m)		Site 3 (Depth:102 m)		Site 4 (Depth: 115 m)		Site 5 (Depth: 118 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
190	0.04	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04
180	0.26	0.2	0.28	0.24	0.24	0.21	0.22	0.2	0.16	0.15
170	1.08	0.84	1.1	0.88	1.02	0.8	0.98	0.77	0.88	0.6
162[‡]	3.06	2.46	3.56	2.51	2.98	2.41	2.96	2.3	3.12	2.45
160[#]	3.84	3.07	4.39	3.27	3.68	2.93	3.54	2.82	3.84	3.07
150	10.5	8.38	12.9	10.3	10.5	8.27	10	7.42	10.9	8.23
140	28.9	23.1	33.6	27.7	25.5	20.1	20.7	17.3	35	27.3
130	53.5	40.8	57.4	46.5	37.5	31.1	51.2	31.7	138	105
120	>100	/	>100	/	>100	/	>100	/	>100	/
Per-pulse SEL (L_p; dB re 1 µPa^2·s)	**Site 6 (Depth: 798 m)**		**Site 7 (Depth: 606 m)**		**Site 8 (Depth:299 m)**		**Site 9 (Depth: 125 m)**		**Site 10 (Depth: 106 m)**	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
190	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
180	0.14	0.12	0.14	0.12	0.14	0.12	0.24	0.2	0.24	0.2
170	0.46	0.39	0.48	0.41	0.8	0.69	0.92	0.7	1.04	0.8
162[‡]	2.14	1.69	2.22	1.69	3.34	2.14	2.64	2.1	3.08	2.4
160[#]	2.8	2.16	3.7	2.18	3.67	3.34	4.44	2.92	3.76	2.93
150	11.8	9.09	11.3	8.41	13.8	9.21	9.28	7.24	9.9	8.16
140	41.6	30.8	55.3	36.8	56.9	40.9	38.7	26.8	24.7	18.8
130	>100	/	>100	/	>100	/	>100	/	68.5	39.3
120	>100	/	>100	/	>100	/	>100	/	>100	/

[#] Low power zone assessment criteria DEWHA (2008).

[‡] Sound level associated with squid behavioural response (inking) to impulsive noise (Fewtrell and McCauley 2012).

A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 11. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3480 in^3 source to modelled maximum-over-depth SPL isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	**Site 1 (Depth: 103 m)**		**Site 2 (Depth: 69 m)**		**Site 3 (Depth:102 m)**		**Site 4 (Depth: 115 m)**		**Site 5 (Depth: 118 m)**	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
190	0.2	0.17	0.24	0.2	0.2	0.17	0.2	0.18	0.18	0.16
180	0.86	0.67	0.96	0.76	0.84	0.68	0.8	0.64	0.74	0.59
175[#]	1.62	1.29	1.66	1.26	1.62	1.28	1.48	1.18	1.42	1.14
170	3.04	2.41	2.98	2.44	2.96	2.37	2.92	2.23	2.8	2.17
166[†]	4.72	3.68	5.43	3.94	4.5	3.55	4.34	3.38	4.62	3.47
160[‡]	8.74	7.21	10.6	8.39	8.7	6.95	8.05	6.26	8.55	6.26
150	23.6	19.6	31.3	25	22.9	17.9	20.1	16.3	36.1	21.3
140	49.5	38.9	48.9	40.4	36	28.1	37.9	28.2	>100	/
130	>100	/	>100	/	>100	/	>100	/	>100	/
SPL (L_p; dB re 1 µPa)	**Site 6 (Depth: 798 m)**		**Site 7 (Depth: 606 m)**		**Site 8 (Depth:299 m)**		**Site 9 (Depth: 125 m)**		**Site 10 (Depth: 106 m)**	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
190	0.12	0.11	0.12	0.11	0.12	0.11	0.18	0.18	0.2	0.18
180	0.4	0.34	0.4	0.34	0.74	0.58	0.74	0.61	0.84	0.68
175[#]	0.75	0.69	1.36	0.77	1.26	0.95	1.38	1.15	1.62	1.31
170	2.42	1.87	3.12	1.86	3.19	2	2.53	2.05	2.94	2.31
166[†]	3.89	2.9	4.45	3.38	5.14	3.78	5.32	3.53	4.2	3.46
160[‡]	11.1	6.48	10.4	6.36	8.88	7.7	7.78	6.07	8.43	6.92
150	32.6	24.9	42.2	27.7	44.3	31	36.8	21.3	21.2	15.9
140	>100	/	>100	/	>100	/	>100	/	49.3	36
130	>100	/	>100	/	>100	/	>100	/	>100	/

[#] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000b).

[†] Threshold for turtle behavioural response to impulsive noise (NSF 2011).

[‡] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).

A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 12. Maximum (R_{max}) horizontal distances (in km) from the 3480 in^3 array to modelled maximum-over-depth SPL isopleth (145 dB re 1µPa, SPL) for the human diver health assessment threshold from Parvin (2005) at three modelling sites closest to King Island (Figure 1), with water depth indicated.

SPL (L_p; dB re 1 µPa)	**Distance R_{max} (km)**		
	Site 2 (Depth: 69 m)	**Site 3 (Depth: 102 m)**	**Site 4 (Depth: 115 m)**
145	41.9	32.4	30.6

Table 13. Maximum-over-depth per-pulse received levels at the Waterwitch Reef Abalone Research Area (WRARA) location of interest for the 3480 in^3 array when array is at Site 3 (see Figure 1, tow heading is due south).

Metric	Received level at western edge of WRARA	Received level at centre of WRARA	Received level at eastern edge of WRARA
SPL (dB re 1 µPa)	146.9	145.3	143.11

Table 14. Maximum (R_{max}) horizontal distances (km) from the 3480 in^3 array to modelled maximum-over-depth peak pressure level (PK) thresholds based on the NOAA Technical Guidance (NMFS 2018a) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for turtles, at four modelling sites (Table 5) , with water depth and tow azimuth indicated.

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)			
		Site 3 (Depth:102 m)	Site 6 (Depth: 798 m)	Site 7 (Depth: 606 m)	Site 10 (Depth: 106 m)
Low-frequency cetaceans (PTS)	219	0.03	0.03	0.03	0.03
Low-frequency cetaceans (TTS)	213	0.07	0.06	0.06	0.06
Mid-frequency cetaceans (PTS)	230	–	–	–	–
Mid-frequency cetaceans (TTS)	224	–	–	–	–
High-frequency cetaceans (PTS)	202	0.34	0.21	0.21	0.33
High-frequency cetaceans (TTS)	196	0.60	0.42	0.41	0.62
Phocid pinnipeds in water (PTS)	218	0.04	0.04	0.04	0.04
Phocid pinnipeds in water (TTS)	212	0.08	0.07	0.07	0.07
Otariid pinnipeds in water (PTS)	232	–	–	–	–
Otariid pinnipeds in water (TTS)	226	–	–	–	–
Sea Turtle (PTS)	232	–	–	–	–
Sea Turtle (TTS)	226	–	–	–	–
Fish: No swim bladder (also applied to sharks)	213	0.07	0.06	0.06	0.06
Fish: Swim bladder not involved in hearing; Swim bladder involved in hearing Fish eggs, and larvae	207	0.17	0.13	0.13	0.14

A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

5.2.1.2. Seafloor

Table 15. Maximum (R_{max}) horizontal distances (in m) from the 3480 in^3 array to modelled seafloor peak pressure level thresholds (PK) from three single-impulse modelled sites (Table 5), with water depth indicated.

Hearing group/animal type	**PK threshold** (L_{pk}; **dB re 1 µPa**)	**Distance R_{max} (m)**		
		Site A (Depth: 61 m)	**Site 1** (Depth: 103 m)	**Site 2** (Depth: 69 m)
Sponges and corals†	226	4	*	*
Fish: No swim bladder (also applied to sharks)	213	80	81	77
Fish: Swim bladder not involved in hearing; Swim bladder involved in hearing Fish eggs, and larvae	207	147	153	154

† Heyward et al. (2018)

An asterisk indicates that the sound level was not reached.

Table 16. Maximum (R_{max}) horizontal distances (in m) from the 3480 in^3 seismic source to modelled seafloor peak-peak pressure levels (PK-PK) from three single-impulse modelled sites (Table 5), with water depth indicated. Results included in relation to benthic invertebrates (Section 3.4.1).

PK-PK (L_{pk-pk}; dB re 1 µPa)	**Explanation**	**Distance R_{max} (m)**		
		Site A (Depth: 61 m)	**Site 1** (Depth: 103 m)	**Site 2** (Depth: 69 m)
213[a,b,c]	Lobster and scallop experiments, maximum single impulse exposure measured.	140	138	144
212[b,c]	Scallop experiments, maximum single impulse exposure measured.	152	154	156
210[a,b]	Lobster experiments, maximum single impulse exposure measured.	181	183	199
209[a,b]	Lobster experiments, maximum single impulse exposure measured.	192	198	214
202[d]	Lobster (no mortality or damage to mechano-sensory systems, recoverable injury)	324	340	414

[a] Day et al. (2019), lobster experiments, maximum single impulse exposure measured.

[b] Day et al. (2016a), lobster and scallop experiments, maximum single impulse exposure measured.

[c] Day et al. (2017), scallop experiments, maximum single impulse exposure measured.

[d] Payne et al. (2008), lobster, no mortality or damage to mechano-sensory systems, recoverable injury

5.2.2. Sound field maps and graphs

5.2.2.1. Sound Level Contour Maps

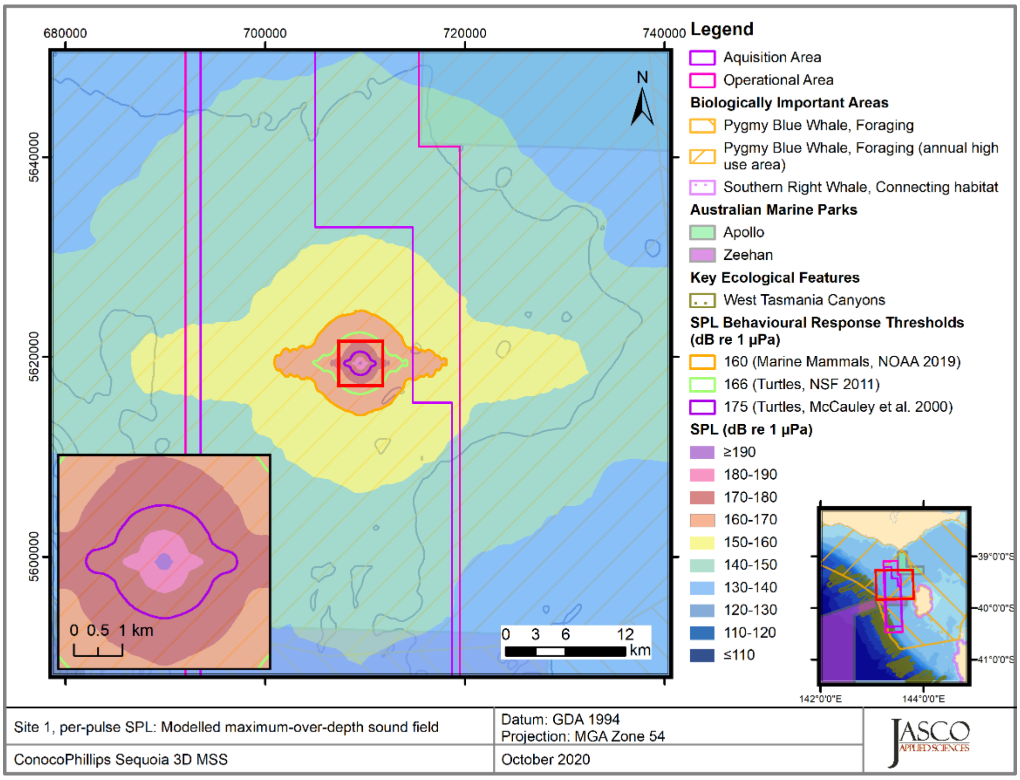


Figure 2. *Site 1, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

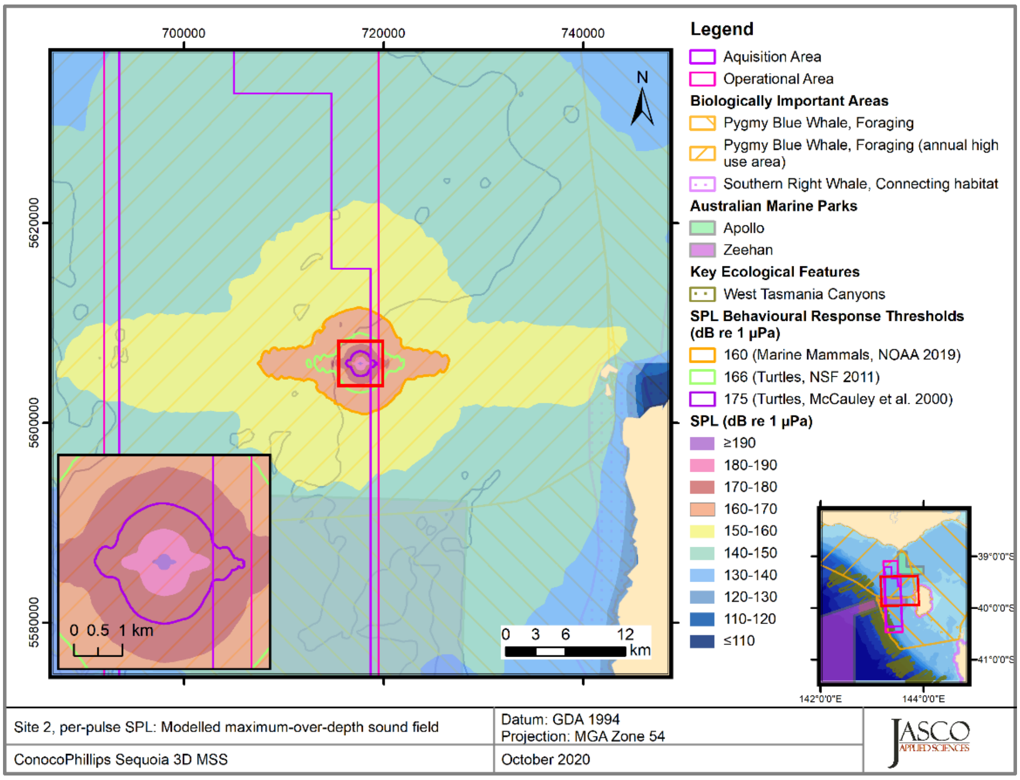


Figure 3. *Site 2, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

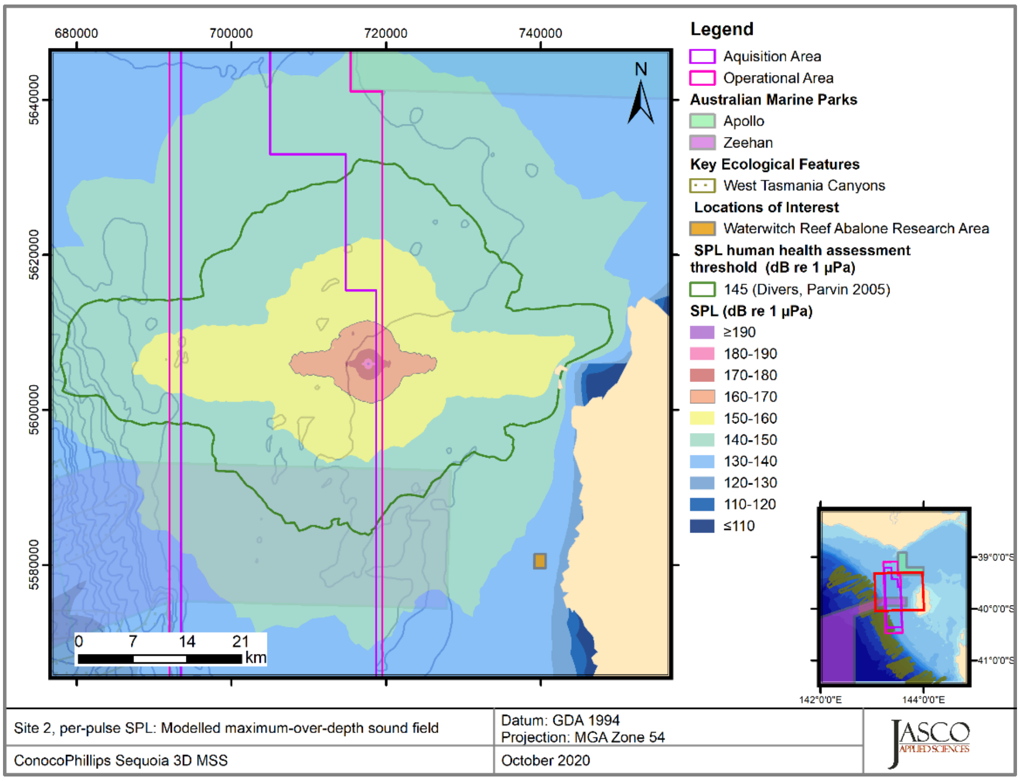


Figure 4 *Site 2, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth for the human divers health assessment threshold.

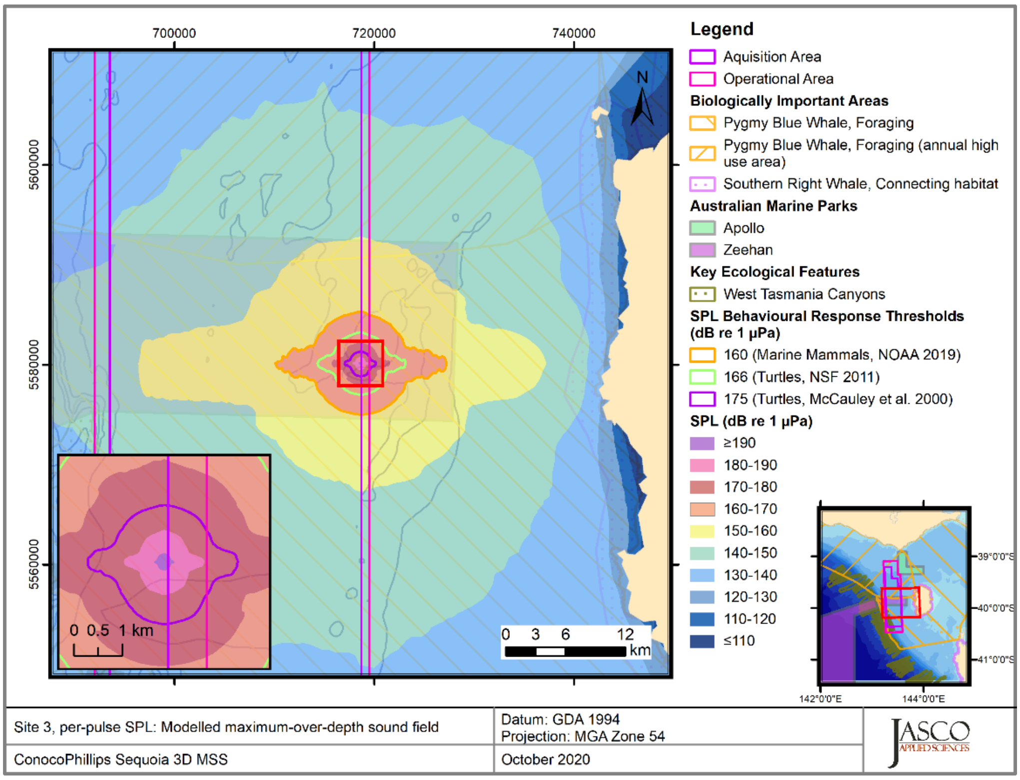


Figure 5. *Site 3, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

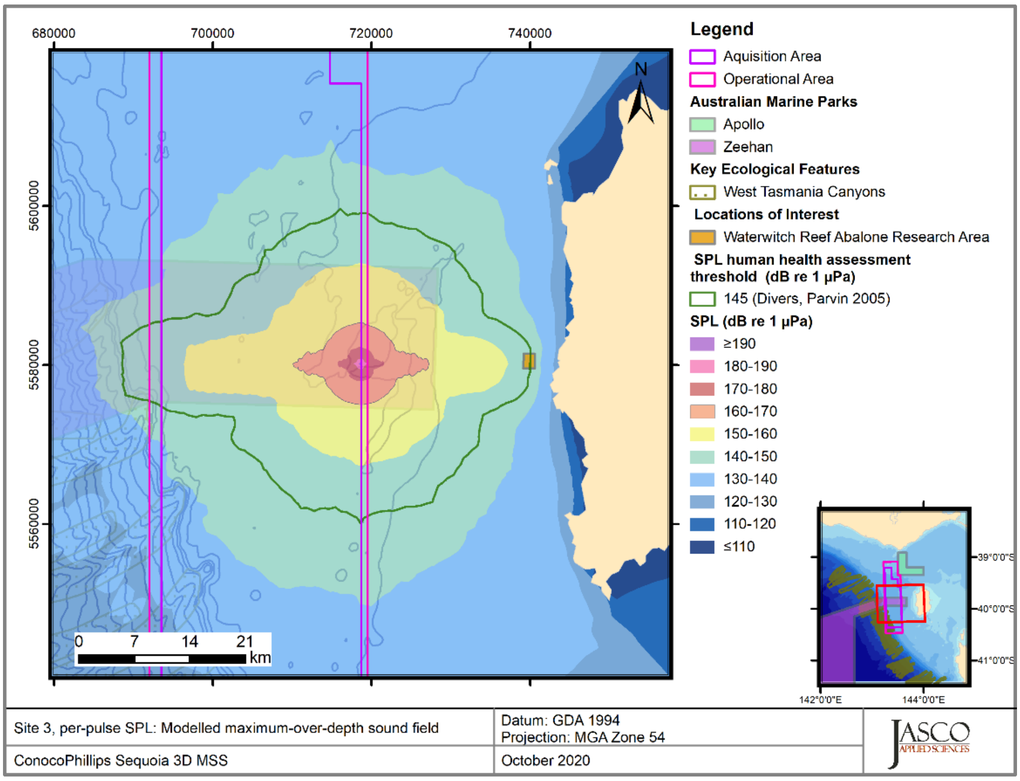


Figure 6 *Site 3, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth for the human divers health assessment threshold.

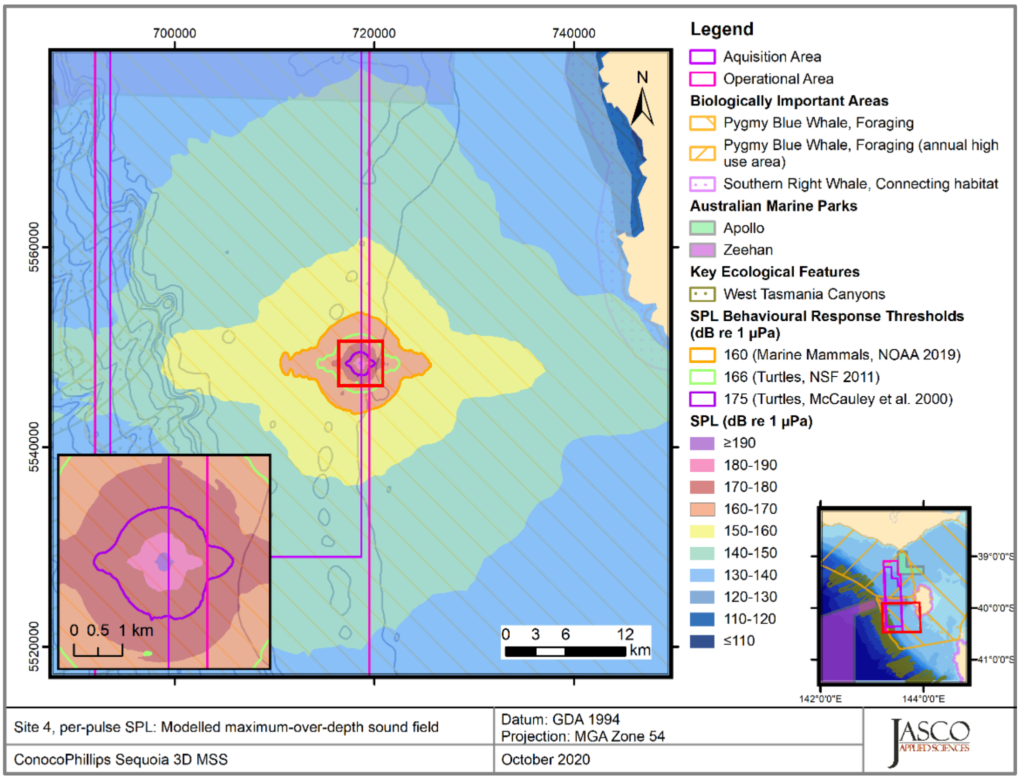


Figure 7. *Site 4, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

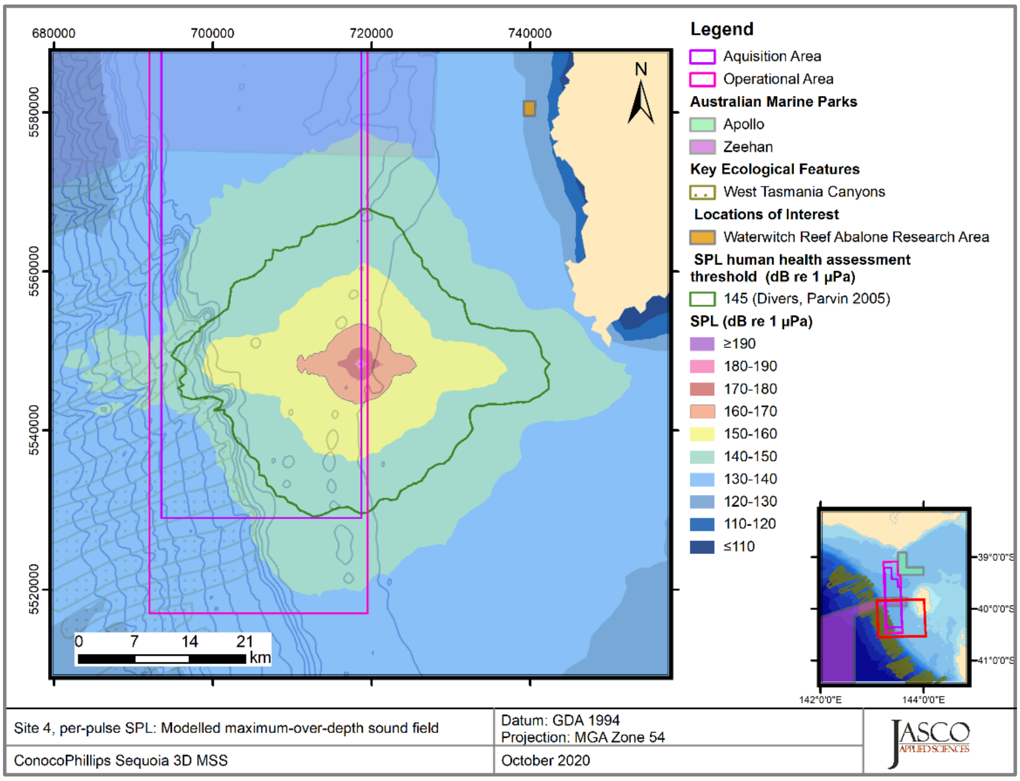


Figure 8 *Site 4, tow azimuth 180º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth for the human divers health assessment threshold.

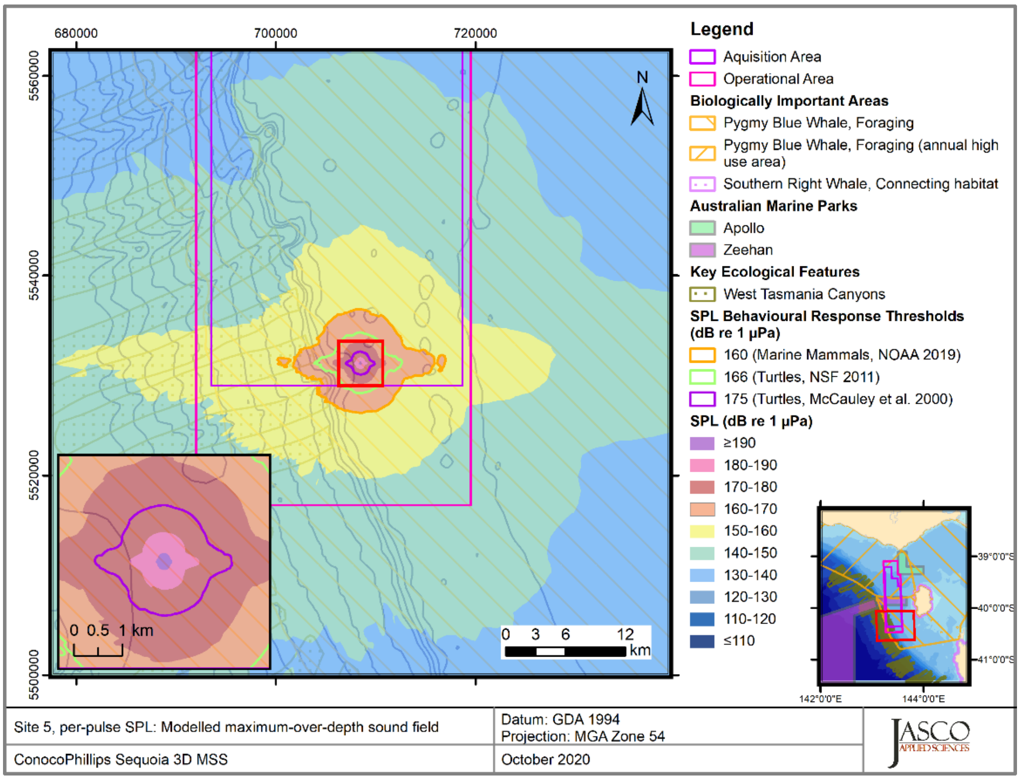


Figure 9. *Site 5, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

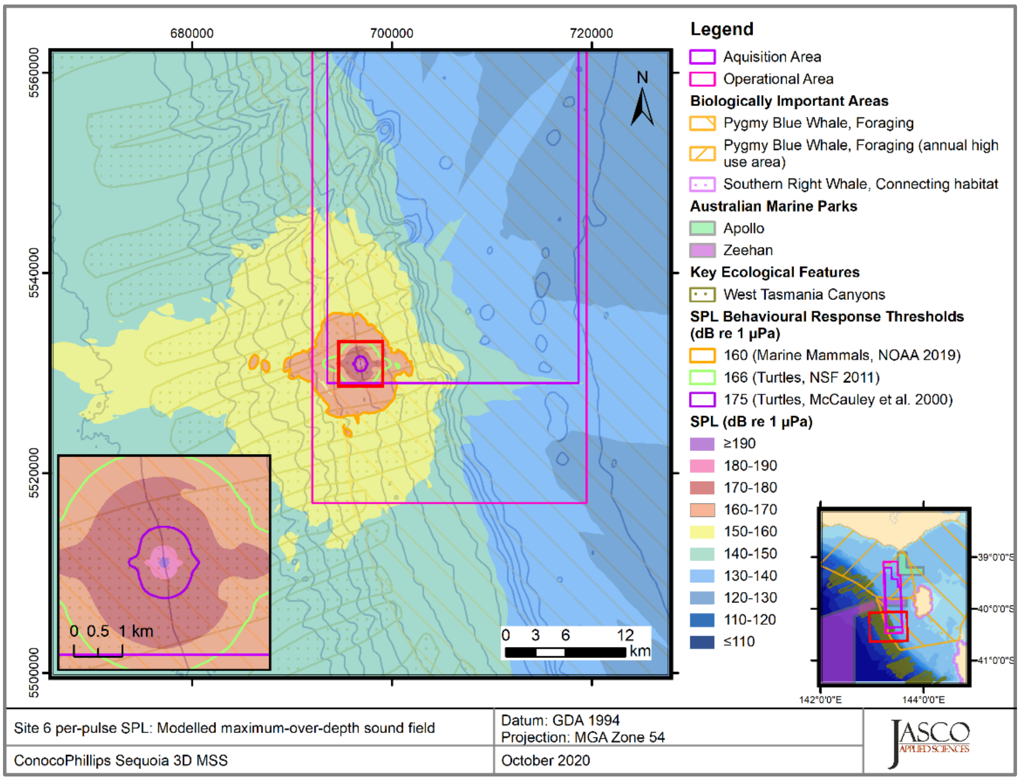


Figure 10. *Site 6, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

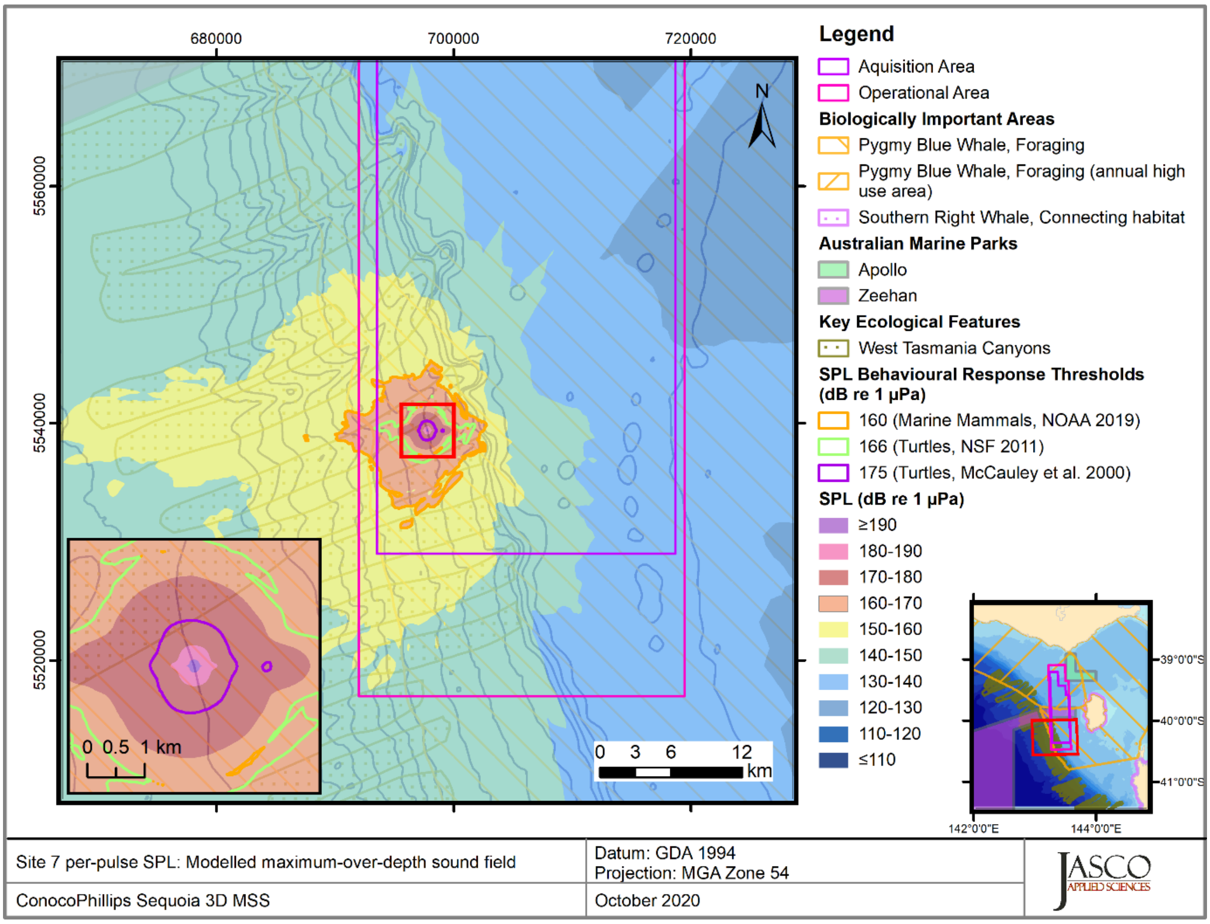


Figure 11. *Site 7, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

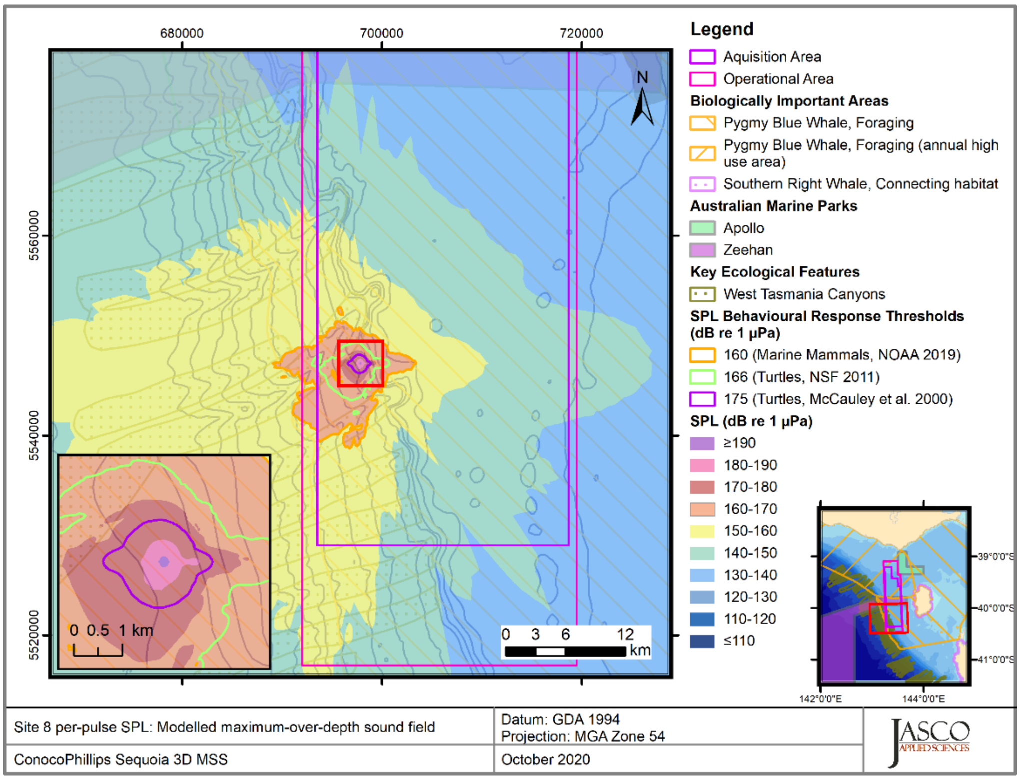


Figure 12. *Site 8, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

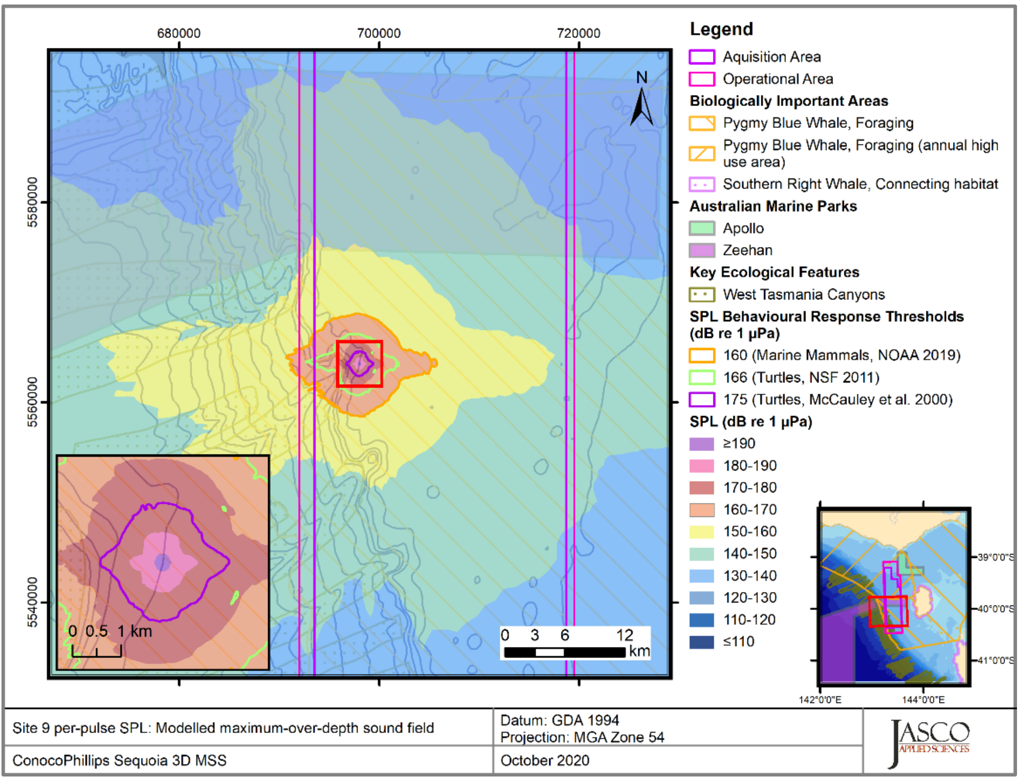


Figure 13. *Site 9, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

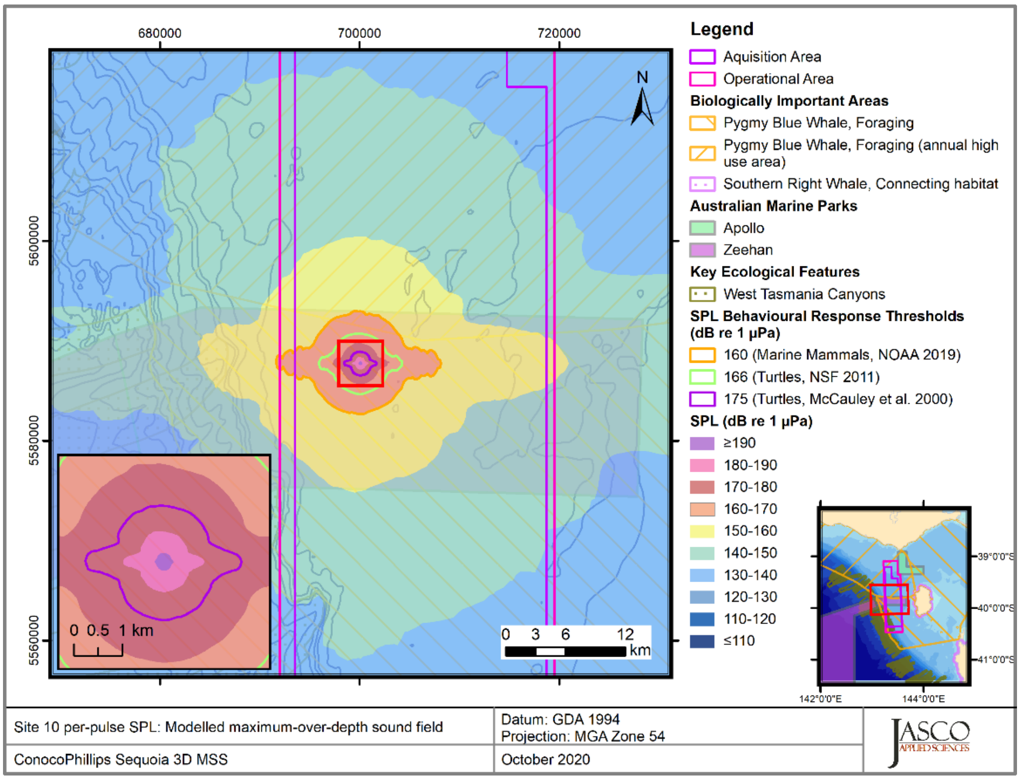


Figure 14. *Site 10, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals and turtles.

5.2.2.2. Vertical Slices of Modelled Sound Fields

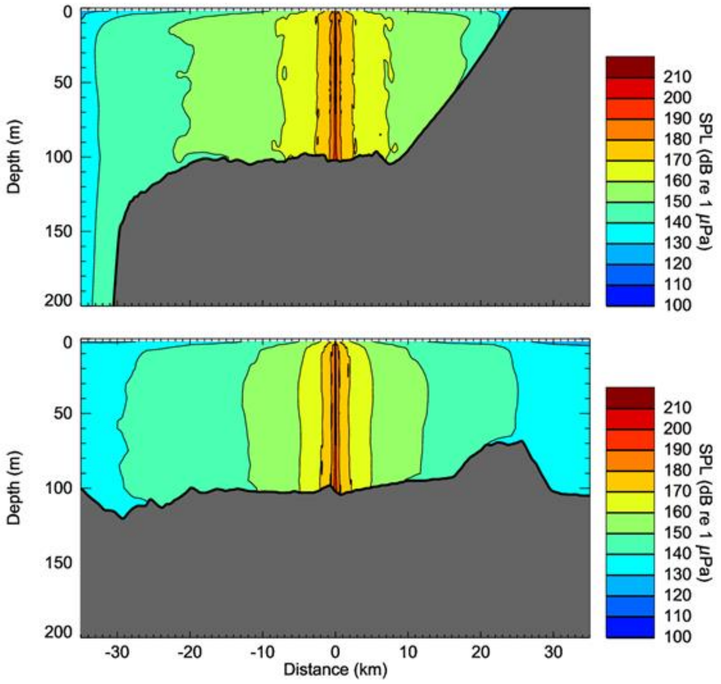


Figure 15. *Site 3, tow azimuth 180º, SPL*: Sound level contours in vertical slice of the sound field, perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in for the broadside slice is 90° counter-clockwise from the tow azimuth. The positive distance for the endfire slice is inline with the tow azimuth (the direction of transit).

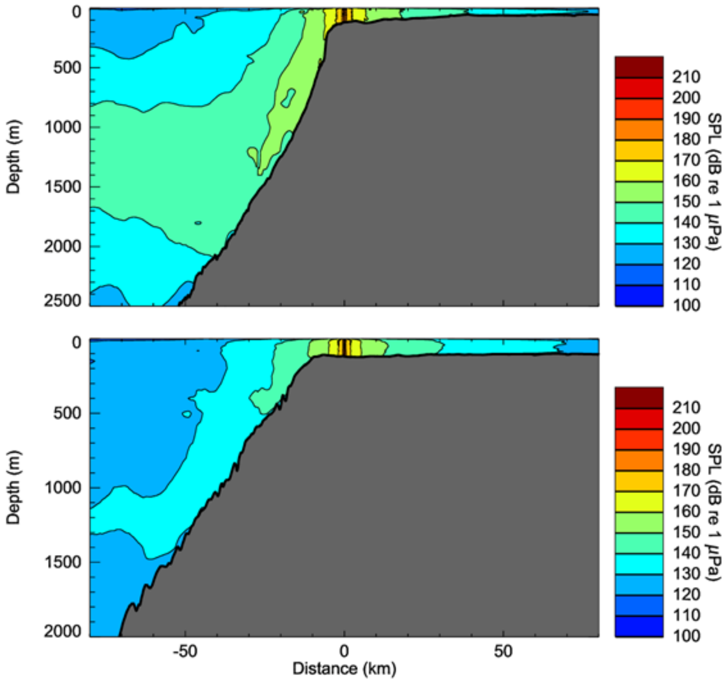


Figure 16. *Site 5, tow azimuth 0º, SPL*: Sound level contours in vertical slice of the sound field, perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in for the broadside slice is 90° clockwise from the tow azimuth. The positive distance for the endfire slice is in line with the tow azimuth (the direction of transit).

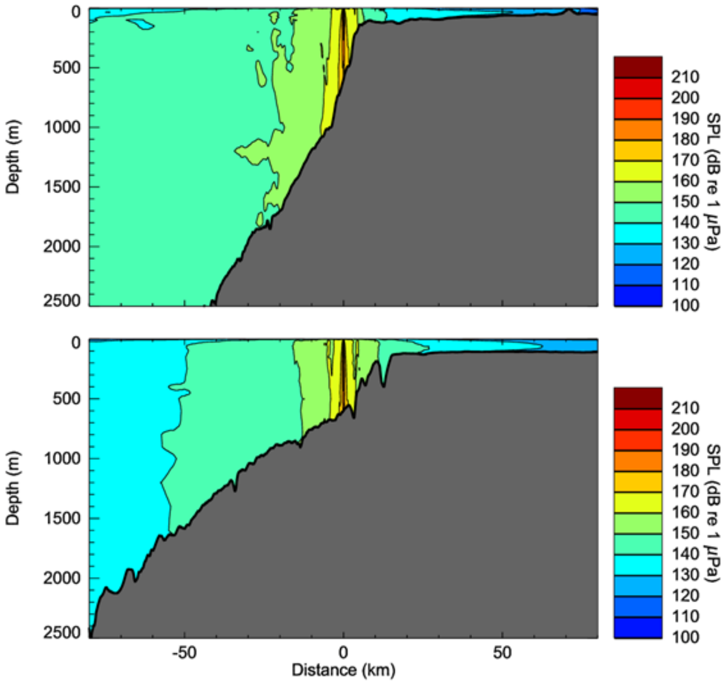


Figure 17. *Site 7, tow azimuth 0º, SPL*: Sound level contours in vertical slice of the sound field, perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in for the broadside slice is 90° clockwise from the tow azimuth. The positive distance for the endfire slice is in line with the tow azimuth (the direction of transit).

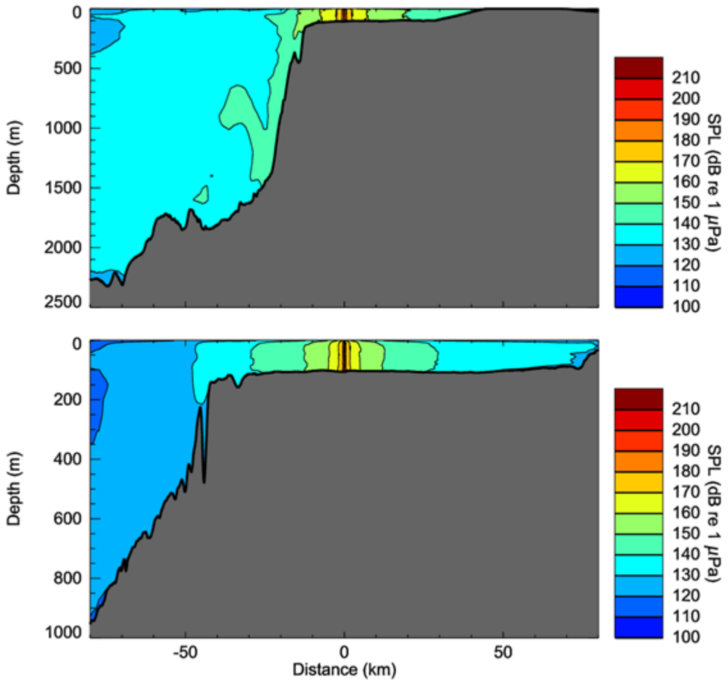


Figure 18. *Site 10, tow azimuth 0º, SPL*: Sound level contours in vertical slice of the sound field, perpendicular to (broadside, top) and along the tow direction (endfire, bottom). The positive distance direction in for the broadside slice is 90° clockwise from the tow azimuth. The positive distance for the endfire slice is in line with the tow azimuth (the direction of transit).

5.2.3. Particle motion

Figures 19–20 show modelled maximum particle acceleration as a function of horizontal range in four perpendicular directions from the centre of the 3480 in^3 seismic source at two modelled Site A and Site 1 (61 and 103 m water depth respectively). The modelling considered a resolution of 10 m, and a receiver positioned 5 cm off the seafloor. The maximum distance to a particle acceleration 37.57 ms^{-2} (Section 3.4.1 and Day et al. (2016a)) occurs at maximum range of 1.5 m for Site A and is not reached at Site 1 (Figures 19 and 20) .

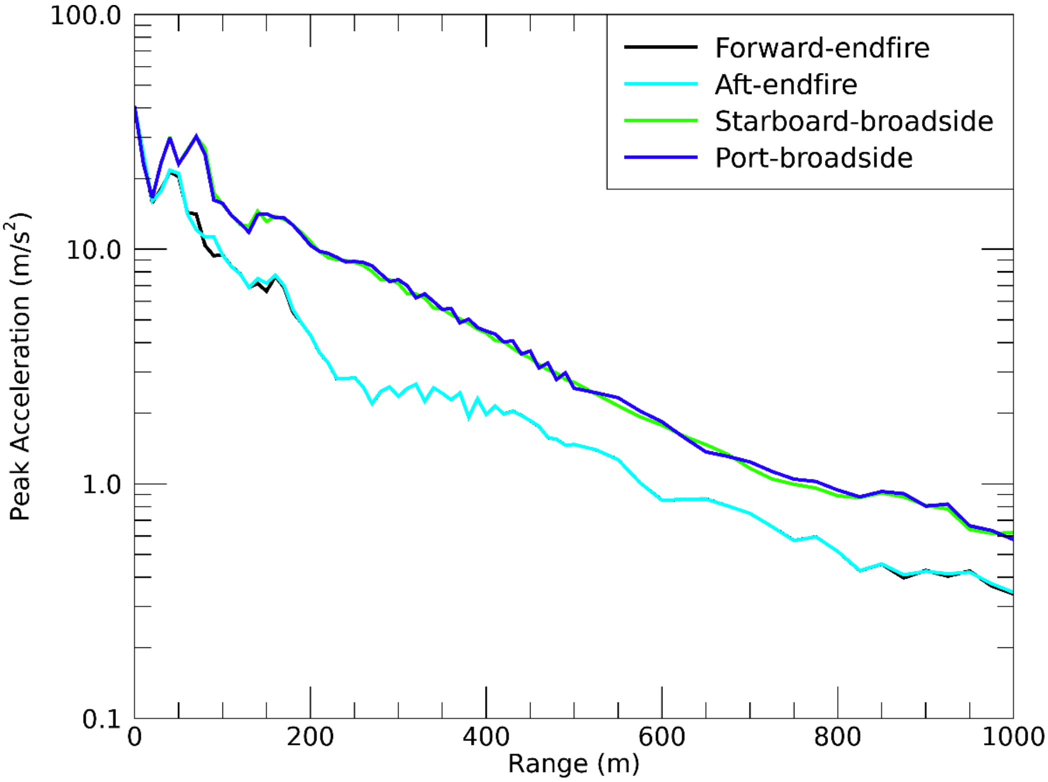


Figure 19. *Site A* (61 m water depth): Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of a single 3480 in^3 seismic source along four directions.

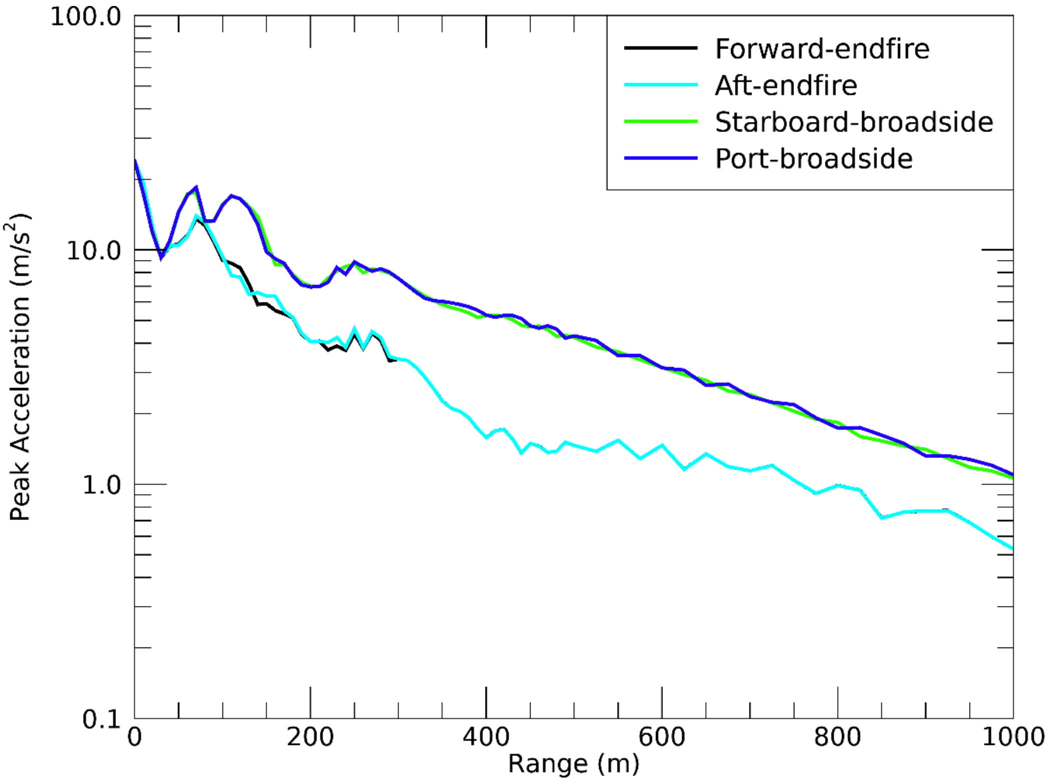


Figure 20. *Site 1* (103 m water depth): Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of a single 3480 in^3 seismic source along four directions.

5.3. Multiple Pulses Sound Fields

This section presents the sound fields in terms of SEL accumulated over 24 hours of survey, for the two modelled SEL$_{24h}$ scenarios. Frequency-weighted SEL$_{24h}$ sound fields were used to estimate the maximum and 95% distances (R_{max} and $R_{95\%}$; calculated as detailed in Appendix C.1) to marine mammals and turtle PTS and TTS thresholds (listed in Table 17), and to estimate maximum distance and the area to injury and TTS thresholds for fish over the entire water column and at the seafloor (Table 18).

The SEL$_{24h}$ sound fields are presented as contour maps in Figures 21 to 24. These figures present the unweighted SEL$_{24h}$ in 10 dB steps, as well as the isopleths corresponding to criteria thresholds. Only contours at ranges larger than the nearfield of the seismic source are rendered.

5.3.1. Tabulated Results

Table 17. *Marine mammal and sea turtle criteria*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the survey lines to permanent threshold shift (PTS) and temporary threshold shift (TTS) thresholds considering 24 h of survey activity (maximum-over-depth).

Hearing group	**Weighted SEL thresholds ($L_{E,24h}$; dB re 1 µPa²·s)**	**Scenario 1**		**Scenario 2**	
		R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)
PTS					
Low-frequency cetaceans	183	1.18	319	0.98	247
Mid-frequency cetaceans	185	-	-	-	-
High-frequency cetaceans	155	0.08	2.21	0.08	3.26
Phocid pinnipeds in water	185	0.08	2.54	0.08	3.26
Otariid pinnipeds in water	203	-	-	-	-
Sea Turtles	204	0.08	2.54	0.08	3.26
TTS					
Low-frequency cetaceans	168	27.9	5317	56.6	6524
Mid-frequency cetaceans	170	0.08	1.72	0.08	2.69
High-frequency cetaceans	140	0.32	98.3	0.28	87.5
Phocid pinnipeds in water	170	0.72	177	0.58	142
Otariid pinnipeds in water	188	0.08	1.9	0.08	3.14
Sea Turtles	189	0.50	145	0.46	124

A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Table 18. *Fish criteria*: Maximum horizontal distances (R_{max}, in km) from the survey lines and area (km^2) to injury and temporary threshold shift (TTS) thresholds considering 24 h of survey activity.

Marine fauna group	**Threshold for SEL$_{24h}$** ($L_{E,24h}$; dB re 1 µPa^2·s)	**Scenario 1**		**Scenario 2**	
		R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)
Mortality and potential mortal injury					
Maximum-over-depth					
I	219	0.08	1.90	0.08	3.14
II, fish eggs and fish larvae	210	0.08	2.54	0.08	3.26
III	207	0.08	2.54	0.08	3.26
Seafloor					
I	219	*	*	*	*
II, fish eggs and fish larvae	210	*	*	*	*
III	207	*	*	*	*
Fish recoverable injury					
Maximum-over-depth					
I	216	0.08	2.54	0.08	3.26
II, III	203	0.09	5.11	0.08	3.98
Seafloor					
I	216	*	*	*	*
II, III	203	*	*	*	*
Fish TTS					
Maximum-over-depth					
I, II, III	186	2.55	827	2.52	768
Seafloor					
I, II, III	186	2.36	706	2.4	661

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
An asterisk indicates that the sound level was not reached.

5.3.2. Sound Level Contour Maps

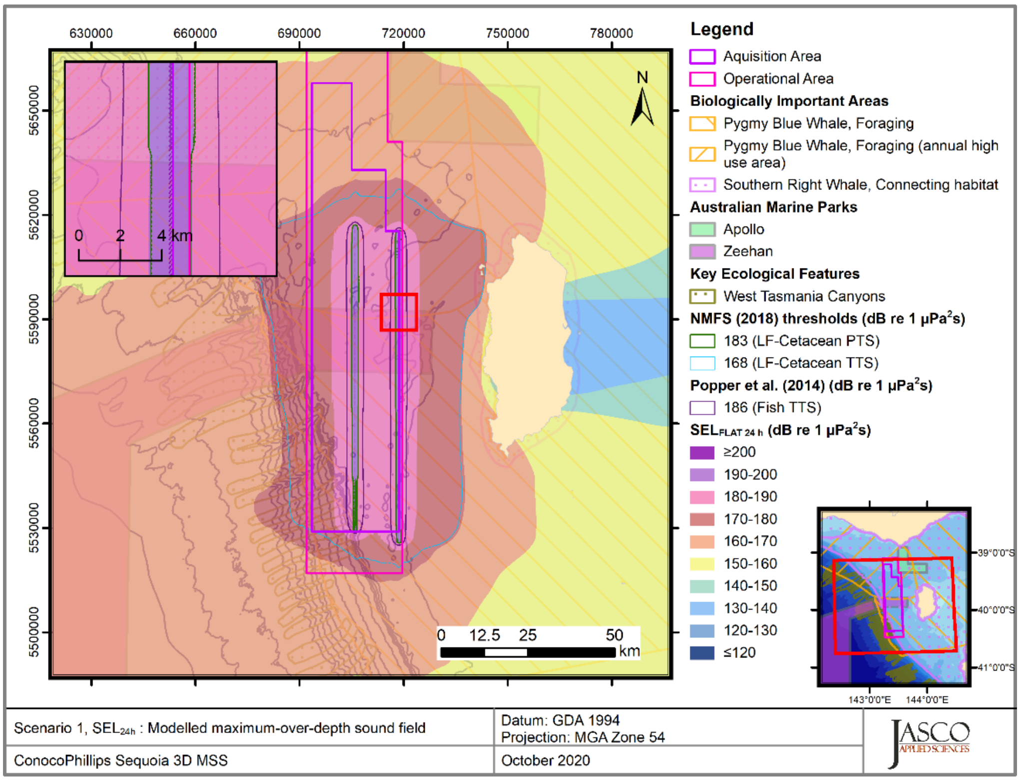


Figure 21. *Scenario 1*: Sound level contour map showing unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 17 and 18 for tabulated radii.

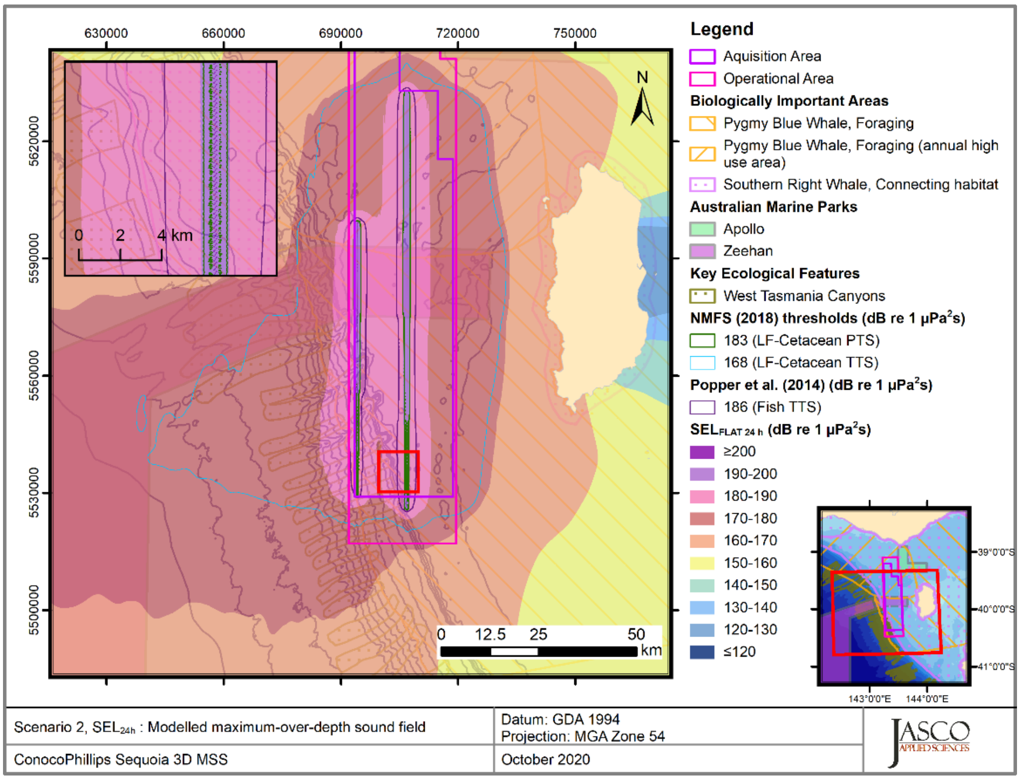


Figure 22. *Scenario 2*: Sound level contour map showing unweighted maximum-over-depth SEL24h results, along with isopleths for cetaceans and fish. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 17 and 18 for tabulated radii.

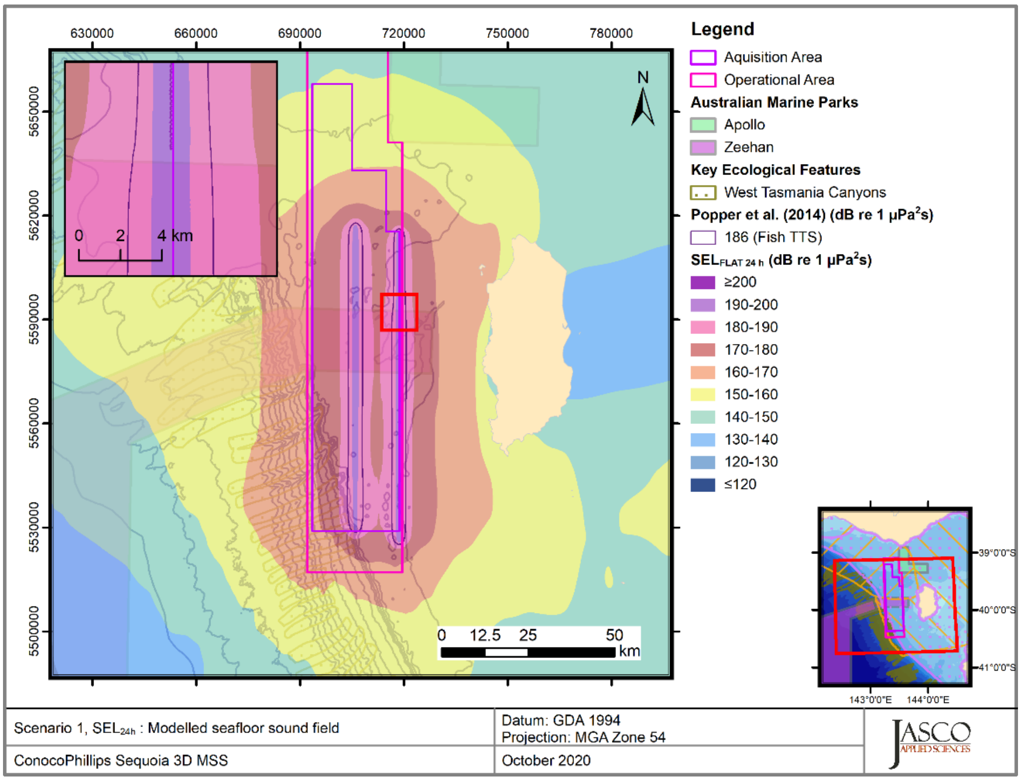


Figure 23. *Scenario 1*: Sound level contour map showing unweighted seafloor SEL24h results, along with isopleths for fish. Thresholds for omitted here were not reached or not large enough to display graphically. Refer to Table 18 for tabulated radii.

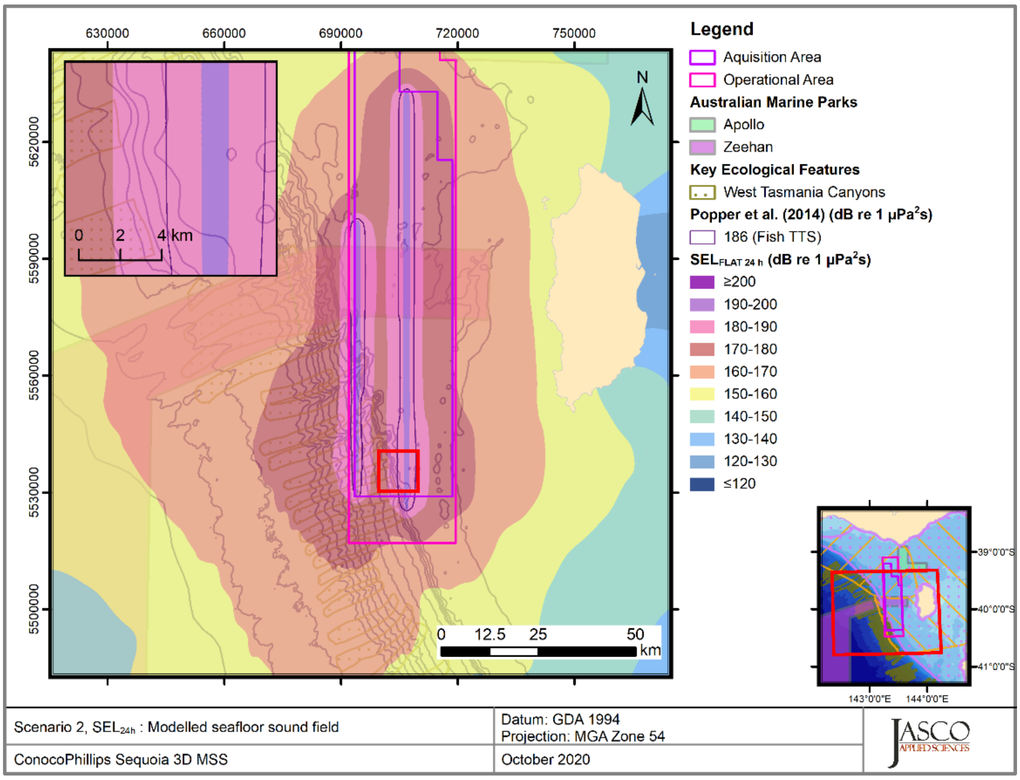


Figure 24. *Scenario 2*: Sound level contour map showing unweighted seafloor SEL$_{24h}$ results, along with isopleths for fish. Thresholds for omitted here were not reached or not large enough to display graphically. Refer to Table 18 for tabulated radii.

6. Discussion and Summary

This modelling study predicted underwater sound levels associated with the planned Sequoia 3D MSS. The underwater sound field was modelled for a 3480 in^3 seismic source (Appendix C.5).

Most acoustic energy from a seismic source is output at lower frequencies, in the tens to hundreds of hertz (see Appendix C.5.1 as an example). The overall broadband (10–25 000 Hz) unweighted per-pulse SEL source level of the 3480 in^3 seismic source operating at 6 m depth was 225.3 dB 1 µPa^{2}m^{2}s in the broadside direction and 225.1 dB 1 µPa^{2}m^{2}s in the endfire direction. The peak source pressure level in the same directions was 248.6 and 247.6 dB re 1 µPa m, respectively (Table 9). Furthermore the modelled 3480 in^3 array had a pronounced broadside directivity for decidecade-bands between ~100 to 251 Hz (Appendix C.5.1), which caused a noticeable axial bulge in the modelled acoustic footprints.

An analysis of seasonal sound speed profiles for the months July to October (presented in Appendix C.4.2) identified that July that would provide the farthest propagation, due to the presence of a slight upward refracting sound speed profile. Whilst the potential operational window of the survey is from 1 August to 31 October, July, was included to represent a worst-case scenario, although it is not substantially different to August. Modelling also accounted for site-specific bathymetric variations (Appendix C.4.1) and local geoacoustic properties (Appendix C.4.3).

6.1. Per-Pulse Sound Levels

The per-pulse modelling sites encompassed water depths from 61 to 798 m across two different geological areas with a single representative water column profile. At all single impulse sites the distances to identified isopleths were greater in the broadside direction than in the endfire direction, a difference apparent in all footprint maps in Section 5.2.2.1. The array directionality and frequency content coupled with the bathymetry had a considerable effect on propagation at longer distances, with generally larger lobes of sound energy extending into the deeper waters perpendicular to the continental shelf.

In discussion of the frequency content of the seismic source, sites located in deeper water have a lower “cut-off frequency (f_c)” than sources in shallower water. The cut-off frequency is a single number that describes how much acoustic energy can propagate with minimal loss between the sea-surface and seafloor interfaces. For a given acoustic signal, frequencies below f_c are subject to higher loss compared to frequencies above the f_c (Jensen et al. 2011). The cut off frequency inversely proportional to water depth; therefore for sites where the water depth was greater than 125 m (Sites 6–8) a large amount of low-frequency energy from the seismic source can propagate in the water column. For shallower sites (Site A, Sites 1–5, 9–10) the very low high energy frequencies of the seismic source do not propagate as effectively as they would in deeper water.

In a similar way the acoustic energy can be trapped between the sea-surface and seafloor, variations in the sound speed profile can form ducts, which can trap acoustic energy within the ocean interior. The sound speed profile (Figure C-7) was primarily downwards refracting down to 1000 m depth apart from a moderate surface duct. This surface duct (≤40 m deep) in the profile shown in Figure C-7 is not deep enough to trap energy below approximately 550 Hz (see Equation 1.36 in Jensen et al. (2011)). The surface duct therefore can only trap the higher frequencies of the array that contribute less to the broadband source level than lower frequencies (Figure C-10). However, when trapped, high frequencies can propagate with little loss and can produce higher levels near the sea-surface than scenarios where no surface duct is present.

The sound speed profile had a minimum sound speed at approximately 1100 m that forms the sound channel axis. For source locations above the continental shelf break, significant amounts energy can be reflected from the seabed and trapped in the sound channel which can then propagate for large distances deep within the ocean interior. This results in larger ranges to all isopleths in the offshore directions, furthermore the largest ranges occur when the broadside azimuth of the array points in the offshore direction. This is particularly obvious in the slice plots showing the broadside direction (Section 5.2.2.2, Figures 15–18).

It is these environmental effects coupled with the directionality of the seismic source the result in the unique sound field footprints, isopleths contours and associated isopleth distances. The vertical slice plots (Section 5.2.2.2) assist in demonstrating the influence of the bathymetry, source location and sound speed profile on the sound field. As an example, the distances to SPL thresholds for behavioural response in marine mammals typically increased as water depth increases (see Table 11) and this can be attributed to lower cut off frequency in deeper ocean. However, the orientation of the source is also key, as the array has a pronounced directivity pattern, with greater distances to sound levels in the broadside direction and offshore direction as compared to the endfire direction.

6.2. Particle Motion

Section 5.2.3 discuss the relevance of particle motion (acceleration) to bivalves on the seabed. Particle acceleration decays rapidly away from the source location within the distance equal to half the water depth. It is then influenced by shallow water propagation effects, such as constructive interference from sea-surface and seabed reflections. This resulted in up to 10 ms^{-2} variation in predicted levels out to a distance equivalent to two water depths, Beyond this distance, it exhibited an almost linear decay (Figures 19 and 20).

Day et al. (2016a) and Day et al. (2016b) included a regression of particle acceleration versus range for the single 150 in^3 airgun used in their study (minimum range of 6 m) and showed that acceleration at 10 and 100 m range was typically 26 and 5 ms^{-2}, respectively. Day et al. (2016a) and Day et al. (2016b) also referenced an unpublished maximum particle acceleration measurement of 6.2 ms^{-2} from a 3130 in^3 airgun array at 477 m range in 36 m of water. In this study, the modelled peak acceleration at 10 m range was predicted to be between 19.1 and 23.1 ms^{-2} depending on the site, the corresponding values at 100 m range are between 9.4 and 15.7 ms^{-2}. At ~477 m, our study predicts acceleration ranging between 2.8 and 4.3 ms^{-2} in the broadside directions. These result aligns with the measurements reported in Day et al. (2016a) and Day et al. (2016b), thus represents what is likely to occur.

JASCO has several measurements of particle acceleration vs distance from seismic airgun arrays made with a variety of sensor types, ranging from extremely close range in shallow water to deeper water and longer ranges. In 110 m of water over a sandy seabed we found seabed accelerations of 20 ms^{-2} at a radial closest point of approach (CPA) distance of 15 m. In much shallower waters, accelerations in excess of 40 ms^{-2} were measured at CPA distances of 50 m, and higher levels again were received at close range in shallow water. The results also show that the specific conditions at each location affect the fine scale results of both modelling and measurements.

For bivalves, the maximum distance to a particle acceleration value to 37.57 ms^{-2} for a receiver 5 cm off the seafloor, is 1.5 m for comparison to literature results in Table 7 of Day et al. (2016a).

6.3. Multiple Pulse Sound Fields

The accumulated SEL over 24 hours of seismic source operation was modelled considering two representative scenarios with a realistic acquisition pattern for the Sequoia 3-D MSS. The modelling predicted the accumulation of sound energy, considering the change in location and the azimuth of the source at each pulse point, which were used to assess distances to the SEL_{24h} based thresholds and guidelines. The results were presented as maps of the accumulated exposure levels and tabulated values of ranges to threshold levels and exposure areas for the given effects criteria (Section 5.3).

The footprints and range maxima for all SEL_{24h} criteria are substantially influenced by the locations of the source near the shelf break and slope. For an acquisition line which transitions from shallow to deep water, more low frequency energy is transmitted into the water column, where it can be trapped in the deep-water sound channel and propagate with minimal loss. This effect is manifested in the large extent for isopleths and R_{max} distances to thresholds in the offshore direction shown Figures 21–22. Furthermore, the rate of attenuation decreases as distance from the acquisition lines increases, and propagation of this nature can further reduce the attenuation rate and allow lower levels to persist to longer ranges.

Considering the discussion of the directionality of the seismic source and the effects of the environment on the modelled single impulse sound fields discussed above, the maximum-over-depth ranges to isopleths like the SEL_{24h} results for TTS threshold for low-frequency cetaceans will occur largest at long ranges off the continental shelf. However, the modelling indicates that at the greatest distances these levels will likely occur within the deep ocean, due to energy being trapped in the deep sound channel. Therefore, the contours and radii may not accurately represent the received exposures for marine mammals at longer ranges if they do not dive to depths associated with the deep sound channel (centred at 1100 m).

6.4. Summary

This section summarises the distances to the noise effect criteria applied in this study (Section 3) for the various fauna groups. The effect criteria for impairment of marine mammals, fish and sea turtles use dual metrics (PK and SEL_{24h}), and the longest distance associated with either metric is required to be applied, and thus is presented in this summary.

The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. Where the corresponding SEL_{24h} effect radii are larger than those for peak pressure criteria, they often represent an unlikely worst-case scenario. More realistically, marine mammals, fish and sea turtles would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 hours.

Marine mammals

Table 19 summarises the distances to effect criteria for marine mammals.

Table 19. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for marine mammals (PK values from Table 14 and SEL_{24h} values from Table 17).

Hearing group	**Modelled distance (in km) to effect threshold (R_{max})**		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
Low-frequency (LF) cetaceans	11.1	56.6	1.18
Mid-frequency cetaceans		0.08	-
High-frequency cetaceans		0.62	0.34
Phocid pinnipeds in water		0.72	0.08
Otariid pinnipeds in water		0.08	–

[1] Noise exposure criteria: NOAA (2019)
[2] Noise exposure criteria: NMFS (2018a)
A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Sea turtles

Table 20 summarises the distances to effect criteria for sea turtles.

Table 20. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for sea turtles (maximum-over-depth, PK values from Table 14 and SEL_{24h} values from Table 17).

Hearing group	Modelled distance (in km) to effect threshold (R_{max})			
	Behavioural response[1]	Behavioural disturbance[2]	Impairment: TTS[3]	Impairment: PTS[3]
Turtles	1.66	5.43	0.50	0.08

[1] Noise exposure criteria: NSF (2011)
[2] Noise exposure criteria: McCauley et al. (2000a)
[3] Noise exposure criteria: Finneran et al. (2017)

Fish, fish eggs, and fish larvae

This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:

- Fish without a swim bladder (also appropriate for sharks in the absence of other information).
- Fish with a swim bladder that do not use it for hearing.
- Fish that use their swim bladders for hearing.
- Fish eggs and fish larvae.

Tables 21 and 22 summarise the distances to injury criteria for fish, fish eggs and fish larvae along with the relevant metric and the location of the information within this report.

Table 21. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios (maximum-over-depth, PK values from Table 14 and SEL_{24h} values from Table 18).

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Injury	SEL_{24h}	0.08	SEL_{24h}	0.08
	TTS	SEL_{24h}	2.55	SEL_{24h}	2.52
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Injury	PK	0.17	PK	0.13
	TTS	SEL_{24h}	2.55	SEL_{24h}	2.52
Fish eggs, and larvae	Injury	PK	0.17	PK	0.13

Table 22. Summary of maximum fish TTS onset distances for SEL_{24h} modelled scenarios, seafloor receptors , values from Table 18.

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	TTS	SEL_{24h}	2.36	SEL_{24h}	2.4
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing					
Fish eggs, and larvae					

Invertebrates, Sponges, Coral and Plankton

To assist with assessing the potential effects on these receptors, the following were determined:

- Crustaceans (lobster and crab): The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008), associated with no mortality or damage to mechano-sensory systems, and recoverable injury for lobster, was considered at the seafloor; the sound level was reached at ranges between 0.324 and 0.414 km depending on the modelled site (Table 16).

  Within the Operational Area the water depths associated with the Tasmanian Giant Crab Fishery are primarily between 130 and 500 m. Modelling Site 1 (103 m depth) was used to assess sound levels at the seafloor, and the distance to sound level of 202 dB re 1 µPa PK-PK at this site was 340 m. At the same modelling site, the maximum single impulse exposure measured in Day et al. (2019) during the lobster experiments, 213 dB re 1 µPa PK-PK, was predicted to occur at 138 m from the centre of array.
- Bivalves: The distance where a particle acceleration of 37.57 ms^{-2} at the seafloor could occur was determined for comparing to results presented in Day et al. (2016a). The maximum distance to this particle acceleration level was 1.5 m for the two sites considered (Section 5.2.3).
- Sponges and coral: the PK sound level at the seafloor directly underneath the seismic source was estimated at all modelled sites and compared to the sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was reached at 4 m from a modelled site A (Table 15).
- Octopus and squid: The maximum (R_{max}) and 95% ($R_{95\%}$) distances to the sound level of 162 dB re 1 $\mu Pa^2 \cdot s$ from Fewtrell and McCauley (2012) associated with inking, and referred to as a startle response threshold, was estimated to be 3.34 and 2.14 km respectively (Table 10).

Glossary

1/3-octave
One third of an octave. Note: A one-third octave is approximately equal to one decidecade (1/3 oct ≈ 1.003 ddec; ISO 2017).

1/3-octave-band
Frequency band whose bandwidth is one one-third octave. Note: The bandwidth of a one-third octave-band increases with increasing centre frequency.

A-weighting
Frequency-selective weighting for human hearing in air that is derived from the inverse of the idealized 40-phon equal loudness hearing function across frequencies.

absorption
The reduction of acoustic pressure amplitude due to acoustic particle motion energy converting to heat in the propagation medium.

attenuation
The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium.

Auditory frequency weighting (auditory weighting function, frequency-weighting function)
The process of band-pass filtering sounds to reduce the importance of inaudible or less-audible frequencies for individual species or groups of species of aquatic mammals (ISO 2017). One example is M-weighting introduced by Southall et al. (2007) to describe “Generalized frequency weightings for various functional hearing groups of marine mammals, allowing for their functional bandwidths and appropriate in characterizing auditory effects of strong sounds”.

azimuth
A horizontal angle relative to a reference direction, which is often magnetic north or the direction of travel. In navigation it is also called bearing.

bandwidth
The range of frequencies over which a sound occurs. Broadband refers to a source that produces sound over a broad range of frequencies (e.g., seismic airguns, vessels) whereas narrowband sources produce sounds over a narrow frequency range (e.g., sonar) (ANSI/ASA S1.13-2005 R2010).

bar
Unit of pressure equal to 100 kPa, which is approximately equal to the atmospheric pressure on Earth at sea level. 1 bar is equal to 10^5 Pa or 10^{11} µPa.

boxcar averaging
A signal smoothing technique that returns the averages of consecutive segments of a specified width.

broadband sound level
The total sound pressure level measured over a specified frequency range. If the frequency range is unspecified, it refers to the entire measured frequency range.

broadside direction
Perpendicular to the travel direction of a source. Compare with endfire direction.

cetacean
Any animal in the order Cetacea. These are aquatic, mostly marine mammals and include whales, dolphins, and porpoises.

compressional wave
A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave.

continuous sound
A sound whose sound pressure level remains above ambient sound during the observation period (ANSI/ASA S1.13-2005 R2010). A sound that gradually varies in intensity with time, for example, sound from a marine vessel.

decade
Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 2006).

decidecade
One tenth of a decade (ISO 2017). Note: An alternative name for decidecade (symbol ddec) is "one-tenth decade". A decidecade is approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct) and for this reason is sometimes referred to as a "one-third octave".

decidecade band
Frequency band whose bandwidth is one decidecade. Note: The bandwidth of a decidecade band increases with increasing centre frequency.

decibel (dB)
One-tenth of a bel. Unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power (ANSI S1.1-1994 R2004).

endfire direction
Parallel to the travel direction of a source. See also broadside direction.

ensonified
Exposed to sound.

far-field
The zone where, to an observer, sound originating from an array of sources (or a spatially distributed source) appears to radiate from a single point. The distance to the acoustic far-field increases with frequency.

fast-average sound pressure level
The time-averaged sound pressure levels calculated over the duration of a pulse (e.g., 90%-energy time window), using the leaky time integrator from Plomp and Bouman (1959) and a time constant of 125 ms. Typically used only for pulsed sounds.

frequency
The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: *f*. 1 Hz is equal to 1 cycle per second.

hearing group
Groups of marine mammal species with similar hearing ranges. Commonly defined functional hearing groups include low-, mid-, and high-frequency cetaceans, pinnipeds in water, and pinnipeds in air.

geoacoustic
Relating to the acoustic properties of the seabed.

hearing threshold
The sound pressure level for any frequency of the hearing group that is barely audible for a given individual in the absence of significant background noise during a specific percentage of experimental trials.

hertz (Hz)
A unit of frequency defined as one cycle per second.

high-frequency (HF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for hearing high frequencies.

impulsive sound
Sound that is typically brief and intermittent with rapid (within a few seconds) rise time and decay back to ambient levels (NOAA 2013, ANSI S12.7-1986 R2006). For example, seismic airguns and impact pile driving.

low-frequency (LF) cetacean
The functional cetacean hearing group that represents mysticetes (baleen whales) specialized for hearing low frequencies.

mean-square sound pressure spectral density
Distribution as a function of frequency of the mean-square sound pressure per unit bandwidth (usually 1 Hz) of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: $\mu Pa^2/Hz$.

median
The 50th percentile of a statistical distribution.

mid-frequency (MF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for mid-frequency hearing.

mysticete
Mysticeti, a suborder of cetaceans, use their baleen plates, rather than teeth, to filter food from water. They are not known to echolocate, but they use sound for communication. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

non-impulsive sound
Sound that is broadband, narrowband or tonal, brief or prolonged, continuous or intermittent, and typically does not have a high peak pressure with rapid rise time (typically only small fluctuations in decibel level) that impulsive signals have (ANSI/ASA S3.20-1995 R2008). For example, marine vessels, aircraft, machinery, construction, and vibratory pile driving (NIOSH 1998, NOAA 2015).

octave
The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

odontocete
The presence of teeth, rather than baleen, characterizes these whales. Members of the Odontoceti are a suborder of cetaceans, a group comprised of whales, dolphins, and porpoises. The skulls of toothed whales are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

otariid
A common term used to describe members of the Otariidae, eared seals, commonly called sea lions and fur seals. Otariids are adapted to a semi-aquatic life; they use their large fore flippers for propulsion. Their ears distinguish them from phocids. Otariids are one of the three main groups in the superfamily Pinnipedia; the other two groups are phocids and walrus.

otariid pinnipeds in water (OPW)
The functional pinniped hearing group that represents eared seals under water.

parabolic equation method
A computationally efficient solution to the acoustic wave equation that is used to model transmission loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of transmission loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

particle acceleration
The rate of change of particle velocity. Unit: metre per second squared (m/s^2). Symbol: a.

particle velocity
The physical speed of a particle in a material moving back and forth in the direction of the pressure wave. Unit: metre per second (m/s). Symbol: v.

peak pressure level (PK)
The maximum instantaneous sound pressure level, in a stated frequency band, within a stated period. Also called zero-to-peak pressure level. Unit: decibel (dB).

peak-to-peak pressure level (PK-PK)
The difference between the maximum and minimum instantaneous pressure levels. Unit: decibel (dB).

percentile level, exceedance
The sound level exceeded n% of the time during a measurement.

permanent threshold shift (PTS)
A permanent loss of hearing sensitivity caused by excessive noise exposure. PTS is considered auditory injury.

phocid
A common term used to describe all members of the family Phocidae. These true/earless seals are more adapted to in-water life than are otariids, which have more terrestrial adaptations. Phocids use their hind flippers to propel themselves. Phocids are one of the three main groups in the superfamily Pinnipedia; the other two groups are otariids and walrus.

phocid pinnipeds in water (PPW)
The functional pinniped hearing group that represents true/earless seals under water.

pinniped
A common term used to describe all three groups that form the superfamily Pinnipedia: phocids (true seals or earless seals), otariids (eared seals or fur seals and sea lions), and walrus.

point source
A source that radiates sound as if from a single point (ANSI S1.1-1994 R2004).

power spectrum density
Generic term, formally defined as power in W/Hz, but sometimes loosely used to refer to the spectral density of other parameters such as square pressure or time-integrated square pressure.

pressure, acoustic
The deviation from the ambient hydrostatic pressure caused by a sound wave. Also called overpressure. Unit: pascal (Pa). Symbol: p.

pressure, hydrostatic
The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

rms
root-mean-square.

shear wave
A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called secondary wave or S-wave. Shear waves propagate only in solid media, such as sediments or rock. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

signature
Pressure signal generated by a source.

sound
A time-varying pressure disturbance generated by mechanical vibration waves travelling through a fluid medium such as air or water.

sound exposure
Time integral of squared, instantaneous frequency-weighted sound pressure over a stated time interval or event. Unit: pascal-squared second (Pa^2·s) (ANSI S1.1-1994 R2004).

sound exposure level (SEL)
A cumulative measure related to the sound energy in one or more pulses. Unit: dB re 1 µPa^2·s. SEL is expressed over the summation period (e.g., per-pulse SEL [for airguns], single-strike SEL [for pile drivers], 24-hour SEL).

sound exposure spectral density
Distribution as a function of frequency of the time-integrated squared sound pressure per unit bandwidth of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: µPa^2·s/Hz.

sound field
Region containing sound waves (ANSI S1.1-1994 R2004).

sound intensity
Sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound pressure level (SPL)
The decibel ratio of the time-mean-square sound pressure, in a stated frequency band, to the square of the reference sound pressure (ANSI S1.1-1994 R2004).

For sound in water, the reference sound pressure is one micropascal (p_0 = 1 µPa) and the unit for SPL is dB re 1 µPa^2:

$$L_p = 10\log_{10}(p^2/p_0^2) = 20\log_{10}(p/p_0)$$

Unless otherwise stated, SPL refers to the root-mean-square (rms) pressure level. See also 90% sound pressure level and fast-average sound pressure level. Non-rectangular time window functions may be applied during calculation of the rms value, in which case the SPL unit should identify the window type.

sound speed profile
The speed of sound in the water column as a function of depth below the water surface.

source level (SL)
The sound level measured in the far-field and scaled back to a standard reference distance of 1 metre from the acoustic centre of the source. Unit: dB re 1 µPa·m (pressure level) or dB re 1 µPa^2·s·m (exposure level).

spectrum
An acoustic signal represented in terms of its power, energy, mean-square sound pressure, or sound exposure distribution with frequency.

temporary threshold shift (TTS)
Temporary loss of hearing sensitivity caused by excessive noise exposure.

transmission loss (TL)
The decibel reduction in sound level between two stated points that results from sound spreading away from an acoustic source subject to the influence of the surrounding environment. Also referred to as propagation loss.

wavelength
Distance over which a wave completes one cycle of oscillation. Unit: metre (m). Symbol: λ.

Literature Cited

[DEWHA] Department of the Environment Water Heritage and the Arts. 2008. *EPBC Act Policy Statement 2.1 - Interaction Between Offshore Seismic Exploration and Whales*. *In*: Australian Government - Department of the Environment, Water, Heritage and the Arts. 14 p. http://www.environment.gov.au/resource/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales.

[HESS] High Energy Seismic Survey. 1999. *High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California*. Prepared for the California State Lands Commission and the United States Minerals Management Service Pacific Outer Continental Shelf Region by the High Energy Seismic Survey Team, Camarillo, CA, USA. 98 p. https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2001100103.xhtml.

[ISO] International Organization for Standardization. 2006. *ISO 80000-3:2006. Quantities and Units – Part 3: Space and time*. https://www.iso.org/standard/31888.html.

[ISO] International Organization for Standardization. 2017. *ISO 18405:2017. Underwater acoustics – Terminology*. Geneva. https://www.iso.org/standard/62406.html.

[NIOSH] National Institute for Occupational Safety and Health. 1998. *Criteria for a recommended standard: Occupational noise exposure. Revised Criteria*. Document Number 98-126. US Department of Health and Human Services, NIOSH, Cincinnati, OH, USA. 122 p. https://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf.

[NMFS] National Marine Fisheries Service (US). 1998. *Acoustic Criteria Workshop*. Dr. Roger Gentry and Dr. Jeanette Thomas Co-Chairs.

[NMFS] National Marine Fisheries Service (US). 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178 p.

[NMFS] National Marine Fisheries Service (US). 2018a. *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://www.fisheries.noaa.gov/webdam/download/75962998.

[NMFS] National Marine Fisheries Service (US). 2018b. Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Marine Site Characterization Surveys off of Delaware. *Federal Register* 83(65): 14417-14443. https://www.federalregister.gov/d/2018-12225.

[NOAA] National Oceanic and Atmospheric Administration (US). 2013. *Draft guidance for assessing the effects of anthropogenic sound on marine mammals: Acoustic threshold levels for onset of permanent and temporary threshold shifts*. National Oceanic and Atmospheric Administration, US Department of Commerce, and NMFS Office of Protected Resources, Silver Spring, MD, USA. 76 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2015. *Draft guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic threshold levels for onset of permanent and temporary threshold shifts*. NMFS Office of Protected Resources, Silver Spring, MD, USA. 180 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2019. *ESA Section 7 Consultation Tools for Marine Mammals on the West Coast* (webpage), 27 Sep 2019.

https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/esa-section-7-consultation-tools-marine-mammals-west. (Accessed 10 Mar 2020).

[NSF] National Science Foundation (US), Geological Survey (US), and [NOAA] National Oceanic and Atmospheric Administration (US). 2011. *Final Programmatic Environmental Impact Statement/Overseas. Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the US Geological Survey*. National Science Foundation, Arlington, VA, USA. https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf.

[ONR] Office of Naval Research. 1998. *ONR Workshop on the Effect of Anthropogenic Noise in the Marine Environment*. Dr. R. Gisiner Chair.

Aerts, L.A.M., M. Blees, S.B. Blackwell, C.R. Greene, Jr., K.H. Kim, D.E. Hannay, and M.E. Austin. 2008. *Marine mammal monitoring and mitigation during BP Liberty OBC seismic survey in Foggy Island Bay, Beaufort Sea, July-August 2008: 90-day report*. Document Number P1011-1. Report by LGL Alaska Research Associates Inc., LGL Ltd., Greeneridge Sciences Inc., and JASCO Applied Sciences for BP Exploration Alaska. 199 p. ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/Auke%20Bay/AukeBayScans/Removable%20Disk/P1011-1.pdf.

Ainslie, M.A. 2008. *Review of Published Safety Thresholds for Human Divers Exposed to Underwater Sound (Veilige maximale geluidsniveaus voor duikers-beoordeling van publicaties)*. Report Number TNO-DV-2007-A598. DTIC Document, TNO Defence Security and Safety, The Hague (Netherlands). 17 p. http://www.dtic.mil/dtic/tr/fulltext/u2/a485758.pdf

ANSI S12.7-1986. R2006. *American National Standard Methods for Measurements of Impulsive Noise*. American National Standards Institute, NY, USA.

ANSI S1.1-1994. R2004. *American National Standard Acoustical Terminology*. American National Standards Institute, NY, USA.

ANSI S1.1-2013. 2013. *American National Standard Acoustical Terminology*. American National Standards Institute, NY, USA.

ANSI/ASA S1.13-2005. R2010. *American National Standard Measurement of Sound Pressure Levels in Air*. American National Standards Institute and Acoustical Society of America, NY, USA.

ANSI/ASA S3.20-1995. R2008. *American National Standard Bioacoustical Terminology*. American National Standards Institute and Acoustical Society of America, NY, USA.

Austin, M.E. and G.A. Warner. 2012. *Sound Source Acoustic Measurements for Apache's 2012 Cook Inlet Seismic Survey*. Version 2.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation.

Austin, M.E. and L. Bailey. 2013. *Sound Source Verification: TGS Chukchi Sea Seismic Survey Program 2013*. Document Number 00706, Version 1.0. Technical report by JASCO Applied Sciences for TGS-NOPEC Geophysical Company.

Austin, M.E., A. McCrodan, C. O'Neill, Z. Li, and A.O. MacGillivray. 2013. *Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort Seas, July–November 2012: 90-Day Report*. *In*: Funk, D.W., C.M. Reiser, and W.R. Koski (eds.). Underwater Sound Measurements. LGL Rep. P1272D–1. Report from LGL Alaska Research Associates Inc. and JASCO Applied Sciences, for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 266 pp plus appendices.

Austin, M.E. 2014. Underwater noise emissions from drillships in the Arctic. *In*: Papadakis, J.S. and L. Bjørnø (eds.). *UA2014 - 2nd International Conference and Exhibition on Underwater Acoustics*. 22-27 Jun 2014, Rhodes, Greece. pp. 257-263.

Austin, M.E., H. Yurk, and R. Mills. 2015. *Acoustic Measurements and Animal Exclusion Zone Distance Verification for Furie's 2015 Kitchen Light Pile Driving Operations in Cook Inlet*. Version 2.0. Technical report by JASCO Applied Sciences for Jacobs LLC and Furie Alaska.

Austin, M.E. and Z. Li. 2016. *Marine Mammal Monitoring and Mitigation During Exploratory Drilling by Shell in the Alaskan Chukchi Sea, July–October 2015: Draft 90-day report*. *In*: Ireland, D.S. and L.N. Bisson (eds.). Underwater Sound Measurements. LGL Rep. P1363D. Report from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. For Shell Gulf of Mexico Inc, National Marine Fisheries Service, and US Fish and Wildlife Service. 188 pp + appendices.

Bartol, S.M. and D.R. Ketten. 2006. *Turtle and tuna hearing*. *In*: Swimmer, Y. and R. Brill. Volume December 2006. NOAA Technical Memorandum NMFS-PIFSC-7. 98-103 p. http://www.sefsc.noaa.gov/turtles/TM_NMFS_PIFSC_7_Swimmer_Brill.pdf#page=108.

Bradshaw, B.E. 2002. *Australian Geological Provinces: Duntroon Sub-basin* (webpage). © Commonwealth of Australia (Geoscience Australia), Creative Commons Attribution 4.0 International Licence. http://www.ga.gov.au/provexplorer/provinceDetails.do?eno=27358.

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137-152. https://doi.org/10.1121/1.1810231.

Carnes, M.R. 2009. *Description and Evaluation of GDEM-V 3.0*. US Naval Research Laboratory, Stennis Space Center, MS. NRL Memorandum Report 7330-09-9165. 21 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/a494306.pdf.

Collins, M.D. 1993. A split-step Padé solution for the parabolic equation method. *Journal of the Acoustical Society of America* 93(4): 1736-1742. https://doi.org/10.1121/1.406739.

Collins, M.D., R.J. Cederberg, D.B. King, and S. Chin-Bing. 1996. Comparison of algorithms for solving parabolic wave equations. *Journal of the Acoustical Society of America* 100(1): 178-182. https://doi.org/10.1121/1.415921.

Coppens, A.B. 1981. Simple equations for the speed of sound in Neptunian waters. *Journal of the Acoustical Society of America* 69(3): 862-863. https://doi.org/10.1121/1.382038.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, K. Hartmann, J.M. Semmens, and Institute for Marine and Antarctic Studies. 2016a. *Assessing the Impact of Marine Seismic Surveys on Southeast Australian Scallop and Lobster Fisheries*. Impacts of Marine Seismic Surveys on Scallop and Lobster Fisheries. Fisheries Ressearch & Development Corporation. FRDC Project No 2012/008, University of Tasmania, Hobart. 159 p.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, and J.M. Semmens. 2016b. Seismic air gun exposure during early-stage embryonic development does not negatively affect spiny lobster *Jasus edwardsii larvae* (Decapoda:Palinuridae). *Scientific Reports* 6: 1-9. https://doi.org/10.1038/srep22723.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, K. Hartmann, and J.M. Semmens. 2017. Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*. *Proceedings of the National Academy of Sciences* 114(40): E8537-E8546. https://doi.org/10.1073/pnas.1700564114.

Day, R.D., R.D. McCauley, Q.P. Fitzgibbon, K. Hartmann, and J.M. Semmens. 2019. Seismic air guns damage rock lobster mechanosensory organs and impair righting reflex. *Proceedings of the Royal Society B* 286(1907). https://doi.org/10.1098/rspb.2019.1424.

Department of the Environment and Energy, NSW Government, and Queensland Government. 2017. *Recovery Plan for Marine Turtles in Australia*.

https://www.environment.gov.au/marine/publications/recovery-plan-marine-turtles-australia-2017.

Dow Piniak, W.E., S.A. Eckert, C.A. Harms, and E.M. Stringer. 2012. *Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise*. Document Number 2012-01156. US Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters. 35 p.

Dragoset, W.H. 1984. A comprehensive method for evaluating the design of airguns and airgun arrays. *16th Annual Offshore Technology Conference* Volume 3, 7-9 May 1984. OTC 4747, Houston, TX, USA. pp. 75–84.

Duncan, A.J., A.N. Gavrilov, N. Alexander, R.D. McCauley, I.M. Parnum, and J.M. Collis. 2013. Characteristics of sound propagation in shallow water over an elastic seabed with a thin cap-rock layer. *Journal of the Acoustical Society of America* 134(1): 207-215. https://doi.org/10.1121/1.4809723.

Ellison, W.T. and P.J. Stein. 1999. *SURTASS LFA High Frequency Marine Mammal Monitoring (HF/M3) Sonar: Sustem Description and Test & Evaluation*. Under US Navy Contract N66604-98-D-5725. http://www.surtass-lfa-eis.com/wp-content/uploads/2018/02/HF-M3-Ellison-Report-2-4a.pdf.

Ellison, W.T. and A.S. Frankel. 2012. A common sense approach to source metrics. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life*. Volume 730. Springer, New York. pp. 433-438. https://doi.org/10.1007/978-1-4419-7311-5_98.

Fewtrell, J.L. and R.D. McCauley. 2012. Impact of air gun noise on the behaviour of marine fish and squid. *Marine Pollution Bulletin* 64(5): 984-993. https://doi.org/10.1016/j.marpolbul.2012.02.009.

Fields, D.M., N.O. Handegard, J. Dalen, C. Eichner, K. Malde, Ø. Karlsen, A.B. Skiftesvik, C.M.F. Durif, and H.I. Browman. 2019. Airgun blasts used in marine seismic surveys have limited effects on mortality, and no sublethal effects on behaviour or gene expression, in the copepod *Calanus finmarchicus*. *ICES Journal of Marine Science*. https://doi.org/10.1093/icesjms/fsz126.

Finneran, J.J. and A.K. Jenkins. 2012. *Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis*. SPAWAR Systems Center Pacific, San Diego, CA, USA. 64 p.

Finneran, J.J. 2015. *Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores*. Technical report by SSC Pacific, San Diego, CA, USA.

Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report for Space and Naval Warfare Systems Center Pacific, San Diego, CA, USA. 49 p. http://www.dtic.mil/dtic/tr/fulltext/u2/1026445.pdf.

Finneran, J.J., E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p.

Fothergill, D.M., J.R. Sims, and M.D. Curley. 2001. Recreational SCUBA divers' aversion to low frequency underwater sound. *Undersea and Hyperbaric Medicine* 28(1): 9-18.

Funk, D., D.E. Hannay, D.S. Ireland, R. Rodrigues, and W.R. Koski (eds.). 2008. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–November 2007: 90-day report*. LGL Report P969-1. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 218 p.

Gedamke, J., N. Gales, and S. Frydman. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: The effect of uncertainty and individual variation. *Journal of the Acoustical Society of America* 129(1): 496-506. https://doi.org/10.1121/1.3493445.

Hannay, D.E. and R.G. Racca. 2005. *Acoustic Model Validation*. Document Number 0000-S-90-04-T-7006-00-E, Revision 02. Technical report by JASCO Research Ltd. for Sakhalin Energy Investment Company Ltd. 34 p.

Heap, A.D. 2009. *Marine Sediments (MARS) Database* (webpage). Commonwealth of Australia (Geoscience Australia), Creative Commons Attribution 4.0 International Licence. http://www.ga.gov.au/metadata-gateway/metadata/record/gcat_69869.

Heyward, A., J. Colquhoun, E. Cripps, D. McCorry, M. Stowar, B. Radford, K. Miller, I. Miller, and C. Battershill. 2018. No evidence of damage to the soft tissue or skeletal integrity of mesophotic corals exposed to a 3D marine seismic survey. *Marine Pollution Bulletin* 129(1): 8-13. https://doi.org/10.1016/j.marpolbul.2018.01.057.

Ireland, D.S., R. Rodrigues, D. Funk, W.R. Koski, and D.E. Hannay. 2009. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–October 2008: 90-Day Report*. Document Number P1049-1. 277 p.

Jensen, F.B., W.A. Kuperman, M.B. Porter, and H. Schmidt. 2011. *Computational Ocean Acoustics*. 2nd edition. AIP Series in Modern Acourics and Signal Processing. AIP Press - Springer, New York. 794 p.

Jones, I.T., J.A. Stanley, and T.A. Mooney. 2020. Impulsive pile driving noise elicits alarm responses in squid (Doryteuthis pealeii). *Marine Pollution Bulletin* 150: 110792. http://www.sciencedirect.com/science/article/pii/S0025326X19309488.

Kujawa, S.G. and M.C. Liberman. 2006. Acceleration of age-related hearing loss by early noise exposure: Evidence of a misspent youth. *Journal of Neuroscience* 26(7): 2115-2123. https://doi.org/10.1523/JNEUROSCI.4985-05.2006.

Kujawa, S.G. and M.C. Liberman. 2009. Adding insult to injury: Cochlear nerve degeneration after 'temporary' noise induced hearing loss. *Journal of Neuroscience* 29(45): 14077-14086. https://doi.org/10.1523/JNEUROSCI.2845-09.2009.

Kujawa, S.G. and M.C. Liberman. 2015. Synaptopathy in the noise-exposed and aging cochlea: Primary neural degeneration in acquired sensorineural hearing loss. *Hearing Research* 330: 191-199. http://www.sciencedirect.com/science/article/pii/S037859551500057X.

Landro, M. 1992. Modeling of GI gun signatures. *Geophysical Prospecting* 40: 721–747. https://doi.org/10.1111/j.1365-2478.1992.tb00549.x

Laws, R.M., L. Hatton, and M. Haartsen. 1990. Computer modeling of clustered airguns. *First Break* 8(9): 331–338.

Long, T.M., R.T. Hanlon, A. Ter Maat, and H.M. Pinsker. 1989. Non-associative learning in the squid Lolliguncula brevis (Mollusca, Cephalopoda). *Marine Behaviour and Physiology* 16: 1-9.

Lurton, X. 2002. *An Introduction to Underwater Acoustics: Principles and Applications*. Springer, Chichester, UK. 347 p.

MacGillivray, A.O. and N.R. Chapman. 2012. Modeling underwater sound propagation from an airgun array using the parabolic equation method. *Canadian Acoustics* 40(1): 19-25. https://jcaa.caa-aca.ca/index.php/jcaa/article/view/2502/2251.

MacGillivray, A.O. 2018. Underwater noise from pile driving of conductor casing at a deep-water oil platform. *Journal of the Acoustical Society of America* 143(1): 450-459. https://doi.org/10.1121/1.5021554.

Maison, S.F., H. Usubuchi, and M.C. Liberman. 2013. Efferent Feedback Minimizes Cochlear Neuropathy from Moderate Noise Exposure. *Journal of Neuroscience* 33(13): 5542-5552. https://www.jneurosci.org/content/jneuro/33/13/5542.full.pdf.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1984. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Phase II: January 1984 migration*. Report Number 5586. Report prepared by Bolt, Beranek and Newman Inc. for the US Department of the Interior, Minerals Management Service, Cambridge, MA, USA. 357 p. https://www.boem.gov/BOEM-Newsroom/Library/Publications/1983/rpt5586.aspx.

Martin, B., K. Bröker, M.-N.R. Matthews, J.T. MacDonnell, and L. Bailey. 2015. Comparison of measured and modeled air-gun array sound levels in Baffin Bay, West Greenland. *OceanNoise 2015*. 11-15 May 2015, Barcelona, Spain.

Martin, B., J.T. MacDonnell, and K. Bröker. 2017a. Cumulative sound exposure levels—Insights from seismic survey measurements. *Journal of the Acoustical Society of America* 141(5): 3603-3603. https://doi.org/10.1121/1.4987709.

Martin, S.B. and A.N. Popper. 2016. Short- and long-term monitoring of underwater sound levels in the Hudson River (New York, USA). *Journal of the Acoustical Society of America* 139(4): 1886-1897. https://doi.org/10.1121/1.4944876.

Martin, S.B., M.-N.R. Matthews, J.T. MacDonnell, and K. Bröker. 2017b. Characteristics of seismic survey pulses and the ambient soundscape in Baffin Bay and Melville Bay, West Greenland. *Journal of the Acoustical Society of America* 142(6): 3331-3346. https://doi.org/10.1121/1.5014049.

Matthews, M.-N.R. and A.O. MacGillivray. 2013. Comparing modeled and measured sound levels from a seismic survey in the Canadian Beaufort Sea. *Proceedings of Meetings on Acoustics* 19(1): 1-8. https://doi.org/10.1121/1.4800553

Mattsson, A. and M. Jenkerson. 2008. Single Airgun and Cluster Measurement Project. *Joint Industry Programme (JIP) on Exploration and Production Sound and Marine Life Proramme Review*. 28-30 Oct. International Association of Oil and Gas Producers, Houston, TX, USA.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000a. *Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid*. Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia. 198 p. https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/McCauley-et-al-Seismic-effects-2000.pdf.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000b. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40(1): 692-708. https://doi.org/10.1071/AJ99048.

McCauley, R.D., R.D. Day, K.M. Swadling, Q.P. Fitzgibbon, R.A. Watson, and J.M. Semmens. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nature Ecology & Evolution* 1(7): 1-8. https://doi.org/10.1038/s41559-017-0195.

McCrodan, A., C.R. McPherson, and D.E. Hannay. 2011. *Sound Source Characterization (SSC) Measurements for Apache's 2011 Cook Inlet 2D Technology Test*. Version 3.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation. 51 p.

McPherson, C.R. and G.A. Warner. 2012. *Sound Sources Characterization for the 2012 Simpson Lagoon OBC Seismic Survey 90-Day Report*. Document Number 00443, Version 2.0.

Technical report by JASCO Applied Sciences for BP Exploration (Alaska) Inc. http://www.nmfs.noaa.gov/pr/pdfs/permits/bp_openwater_90dayreport_appendices.pdf.

McPherson, C.R., K. Lucke, B.J. Gaudet, B.S. Martin, and C.J. Whitt. 2018. *Pelican 3-D Seismic Survey Sound Source Characterisation*. Document Number 001583. Version 1.0. Technical report by JASCO Applied Sciences for RPS Energy Services Pty Ltd.

McPherson, C.R. and B. Martin. 2018. *Characterisation of Polarcus 2380 in^3 Airgun Array*. Document Number 001599, Version 1.0. Technical report by JASCO Applied Sciences for Polarcus Asia Pacific Pte Ltd.

Morris, C.J., D. Cote, B. Martin, and D. Kehler. 2018. Effects of 2D seismic on the snow crab fishery. *Fisheries Research* 197: 67–77. https://doi.org/10.1016/j.fishres.2017.09.012.

Nedwell, J.R. and A.W. Turnpenny. 1998. The use of a generic frequency weighting scale in estimating environmental effect. *Workshop on Seismics and Marine Mammals*. 23–25 Jun 1998, London, UK.

Nedwell, J.R., A.W. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, J.A.L. Spinks, and D. Howell. 2007. *A validation of the dB$_{ht}$ as a measure of the behavioural and auditory effects of underwater noise*. Document Number 534R1231 Report prepared by Subacoustech Ltd. for the UK Department of Business, Enterprise and Regulatory Reform under Project No. RDCZ/011/0004. 74 p. https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-et-al-2007.pdf.

O'Neill, C., D. Leary, and A. McCrodan. 2010. Sound Source Verification. (Chapter 3) *In* Blees, M.K., K.G. Hartin, D.S. Ireland, and D.E. Hannay (eds.). *Marine mammal monitoring and mitigation during open water seismic exploration by Statoil USA E&P Inc. in the Chukchi Sea, August-October 2010: 90-day report*. LGL Report P1119. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. for Statoil USA E&P Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. pp. 1-34.

Parvin, S. 2005. *Limits for underwater noise exposure of human divers and swimmers*. Subacoustech. Presented at the National Physics Laboratory Seminar on Underwater Acoustics, Teddington, UK. http://www.subacoustech.com/wp-content/uploads/NPLDiverNoisePresentation.pdf.

Parvin, S.J. 1998. The effects of low frequency underwater sound on divers. *Undersea Defence Technology*. Wembley, UK. pp. 227-232.

Payne, J.F., C. Andrews, L. Fancey, D. White, and J. Christian. 2008. *Potential Effects of Seismic Energy on Fish and Shellfish: An Update since 2003*. Report Number 2008/060. Canadian Science Advisory Secretariat. 22 p.

Payne, R. and D. Webb. 1971. Orientation by means of long range acoustic signaling in baleen whales. *Annals of the New York Academy of Sciences* 188: 110-141. https://doi.org/10.1111/j.1749-6632.1971.tb13093.x.

Pestorius, F.M., E.A. Cudahy, and D.M. Fothergill. 2009. Evolution of navy diver exposure standards for deterministic underwater sound in the 100-500 Hz band. *Meetings on Acoustics*. Volume 8(070002), 26-30 Oct 2009. Journal of the Acoustical Society of America, San Antonio, Texas. https://doi.org/10.1121/1.3280165.

Plomp, R. and M.A. Bouman. 1959. Relation between Hearing Threshold and Duration for Tone Pulses. *Journal of the Acoustical Society of America* 31(6): 749-758. https://doi.org/10.1121/1.1907781.

Popper, A.N., M.E. Smith, P.A. Cott, B.W. Hanna, A.O. MacGillivray, M.E. Austin, and D.A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. *Journal of the Acoustical Society of America* 117(6): 3958-3971. https://doi.org/10.1121/1.1904386

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Popper, A.N., T.J. Carlson, J.A. Gross, A.D. Hawkins, D.G. Zeddies, L. Powell, and J. Young. 2016. Effects of seismic air guns on pallid sturgeon and paddlefish. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, New York. pp. 871-878. https://doi.org/10.1007/978-1-4939-2981-8_107.

Popper, A.N. 2018. *Potential for impact of cumulative sound exposure on fishes during a seismic survey*. Environmental BioAcoustics, LLC, Maryland, USA. https://www.nopsema.gov.au/assets/epdocuments/A601445-EP-Summary-redacted.pdf.

Porter, M.B. and Y.-C. Liu. 1994. Finite-element ray tracing. *In*: Lee, D. and M.H. Schultz (eds.). *International Conference on Theoretical and Computational Acoustics*. Volume 2. World Scientific Publishing Co. pp. 947-956.

Racca, R.G., A.N. Rutenko, K. Bröker, and M.E. Austin. 2012a. A line in the water - design and enactment of a closed loop, model based sound level boundary estimation strategy for mitigation of behavioural impacts from a seismic survey. *11th European Conference on Underwater Acoustics*. Volume 34(3), Edinburgh, UK.

Racca, R.G., A.N. Rutenko, K. Bröker, and G. Gailey. 2012b. Model based sound level estimation and in-field adjustment for real-time mitigation of behavioural impacts from a seismic survey and post-event evaluation of sound exposure for individual whales. *In*: McMinn, T. (ed.). *Acoustics 2012*. Fremantle, Australia. http://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p92.pdf.

Racca, R.G., M.E. Austin, A.N. Rutenko, and K. Bröker. 2015. Monitoring the gray whale sound exposure mitigation zone and estimating acoustic transmission during a 4-D seismic survey, Sakhalin Island, Russia. *Endangered Species Research* 29(2): 131-146. https://doi.org/10.3354/esr00703.

Sims, J.R., D.M. Fothergill, and M.D. Curley. 1999. *Effects of a neoprene wetsuit hood on low-frequency underwater hearing thresholds*. *The Journal of the Acoustical Society of America*. Volume 105(2). 2, pp. 1298-1298. https://asa.scitation.org/doi/abs/10.1121/1.426183.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4): 411-521. https://doi.org/10.1080/09524622.2008.9753846.

Southall, B.L., D.P. Nowaceck, P.J.O. Miller, and P.L. Tyack. 2016. Experimental field studies to measure behavioral responses of cetaceans to sonar. *Endangered Species Research* 31: 293-315. https://doi.org/10.3354/esr00764.

Southall, B.L., J.J. Finneran, C. Reichmuth, P.E. Nachtigall, D.R. Ketten, A.E. Bowles, W.T. Ellison, D.P. Nowacek, and P.L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals* 45(2): 125-232. https://doi.org/10.1578/AM.45.2.2019.125.

Teague, W.J., M.J. Carron, and P.J. Hogan. 1990. A comparison between the Generalized Digital Environmental Model and Levitus climatologies. *Journal of Geophysical Research* 95(C5): 7167-7183. https://doi.org/10.1029/JC095iC05p07167.

Warner, G.A., C. Erbe, and D.E. Hannay. 2010. Underwater Sound Measurements. (Chapter 3) *In* Reiser, C.M., D. Funk, R. Rodrigues, and D.E. Hannay (eds.). *Marine Mammal Monitoring and Mitigation during Open Water Shallow Hazards and Site Clearance Surveys by Shell*

Offshore Inc. in the Alaskan Chukchi Sea, July-October 2009: 90-Day Report. LGL Report P1112-1. Report by LGL Alaska Research Associates Inc. and JASCO Applied Sciences for Shell Offshore Inc., National Marine Fisheries Service (US), and Fish and Wildlife Service (US). pp. 1-54.

Warner, G.A., M.E. Austin, and A.O. MacGillivray. 2017. Hydroacoustic measurements and modeling of pile driving operations in Ketchikan, Alaska [Abstract]. *Journal of the Acoustical Society of America* 141(5): 3992. https://doi.org/10.1121/1.4989141.

Whiteway, T. 2009. *Australian Bathymetry and Topography Grid, June 2009*. GeoScience Australia, Canberra. http://pid.geoscience.gov.au/dataset/ga/67703.

Zhang, Z.Y. and C.T. Tindle. 1995. Improved equivalent fluid approximations for a low shear speed ocean bottom. *Journal of the Acoustical Society of America* 98(6): 3391-3396. https://doi.org/10.1121/1.413789.

Ziolkowski, A. 1970. A method for calculating the output pressure waveform from an air gun. *Geophysical Journal of the Royal Astronomical Society* 21(2): 137-161. https://doi.org/10.1111/j.1365-246X.1970.tb01773.x.

Zykov, M.M. and J.T. MacDonnell. 2013. *Sound Source Characterizations for the Collaborative Baseline Survey Offshore Massachusetts Final Report: Side Scan Sonar, Sub-Bottom Profiler, and the R/V Small Research Vessel experimental*. Document Number 00413, Version 2.0. Technical report by JASCO Applied Sciences for Fugro GeoServices, Inc. and the (US) Bureau of Ocean Energy Management.

Appendix A. Acoustic Metrics

A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 µPa. Because the perceived loudness of sound, especially pulsed sound such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate sound and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow the American National Standard Institute and International Organization for Standardization definitions and symbols for sound metrics (ANSI 2013, e.g., ISO 2017), but these standards are not always consistent.

The zero-to-peak sound pressure, or peak sound pressure (PK or $L_{p,pk}$; dB re 1 µPa), is the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,\mathrm{pk}} = 10\log_{10}\left(\frac{\max|p^2(t)|}{p_0^2}\right) = 20\log_{10}\left(\frac{\max|p(t)|}{p_0}\right) \tag{A-1}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of an acoustic event, it is generally a poor indicator of perceived loudness.

The peak-to-peak sound pressure (PK-PK or $L_{p,pk\text{-}pk}$; dB re 1 µPa) is the difference between the maximum and minimum instantaneous sound pressure, possibly filtered in a stated frequency band, attained by an impulsive sound, $p(t)$:

$$L_{p,\mathrm{pk\text{-}pk}} = 10\log_{10}\left(\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2}\right) \tag{A-2}$$

The sound pressure level (SPL or L_p; dB re 1 µPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window (T; s). It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T g(t)\,p^2(t)\,dt\Big/p_0^2\right) \tag{A-3}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying SPL function. For short acoustic events, such as sonar pulses and marine mammal vocalizations, it is important to choose an appropriate time window that matches the duration of the signal. For in-air studies, when evaluating the perceived loudness of sounds with rapid amplitude variations in time, the time weighting function $g(t)$ is often set to a decaying exponential function that emphasizes more recent pressure signals. This function mimics the leaky integration nature of mammalian hearing. For example, human-based fast time-weighted SPL ($L_{p,fast}$) applies an exponential function with time constant 125 ms. A related simpler approach used in underwater acoustics sets $g(t)$ to a boxcar (unity amplitude) function of width 125 ms; the results can be referred to as $L_{p,boxcar\ 125ms}$. Another approach, historically used to evaluate SPL of impulsive signals underwater, defines $g(t)$ as a boxcar function with edges set to the times corresponding to 5% and 95% of the cumulative square pressure function encompassing the duration of an impulsive acoustic event. This calculation is applied individually to each impulse signal, and the results have been referred to as 90% SPL ($L_{p,90\%}$). In this report, SPL refers to $L_{p,boxcar\ 125ms}$.

The sound exposure level (SEL or L_E; dB re 1 µPa^2·s) is the time-integral of the squared acoustic pressure over a duration (T):

$$L_E = 10\log_{10}\left(\int_T p^2(t)\,dt \Big/ T_0 p_0^2\right) \quad \text{(A-4)}$$

where T_0 is a reference time interval of 1 s. SEL continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered for its relevance to impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to pulsed sounds, SEL can be calculated by summing the SEL of the N individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the N individual events:

$$L_{E,N} = 10\log_{10}\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \quad \text{(A-5)}$$

Because the SPL and SEL are both computed from the integral of square pressure, these metrics are related numerically by the following expression, which depends only on the duration of the time window T:

$$L_p = L_E - 10\log_{10}(T) \quad \text{(A-6)}$$

When applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LF,24h}$; see Appendix A.5).

A.2. Particle Acceleration and Velocity Metrics

Since sound is a mechanical wave, it can also be measured in terms of the vibratory motion of fluid particles. Particle motion can be measured in terms of three different (but related) quantities: displacement, velocity, or acceleration. Acoustic particle velocity is the time derivative of particle displacement, and likewise acceleration is the time derivative of velocity. For the present study, acoustic particle motion has been reported in terms of acceleration and velocity.

The particle velocity (v) is the physical speed of a particle in a material moving back and forth in the direction of the pressure wave. It can be derived from the pressure gradient and Euler's linearised momentum equation where ρ_0 is the density of the medium:

$$v = -\int \nabla p(t)dt/\rho_0 \quad \text{(A-7)}$$

The particle acceleration (a) is the rate of change of the velocity with respect to time, and it can be obtained from equation A-7 as:

$$a = \frac{dv}{dt} = -\frac{\nabla p(t)}{\rho_0} \quad \text{(A-8)}$$

Unlike sound pressure, particle motion is a vector quantity, meaning that it has both magnitude and direction: at any given point in space, acoustic particle motion has three different time-varying components (x, y, and z). Given the particle velocity in the x, y, and z, directions, v_x, v_y, and v_z, the particle velocity magnitude $|v|$ is computed per the Pythagorean equation:

$$|v| = \sqrt{v_x + v_y + v_z} \quad \text{(A-9)}$$

The magnitude of particle acceleration is calculated similarly from the particle acceleration in the x, y, and z directions.

A.3. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analysing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. They are approximately one third of an octave (base 2) wide and are therefore often referred to as 1/3-octave-bands. Each octave represents a doubling in sound frequency. The centre frequency of the ith band, $f_{\mathrm{c}}(i)$, is defined as:

$$f_{\mathrm{c}}(i) = 10^{\frac{i}{10}}\,\mathrm{kHz} \tag{A-10}$$

and the low (f_{lo}) and high (f_{hi}) frequency limits of the ith decade band are defined as:

$$f_{\mathrm{lo},i} = 10^{\frac{-1}{20}} f_{\mathrm{c}}(i) \quad \text{and} \quad f_{\mathrm{hi},i} = 10^{\frac{1}{20}} f_{\mathrm{c}}(i) \tag{A-11}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1). The acoustic modelling spans from band 7 (f_c (7) = 5 Hz) to band 44 ($f_{\mathrm{c}}(44)$ = 25 kHz).

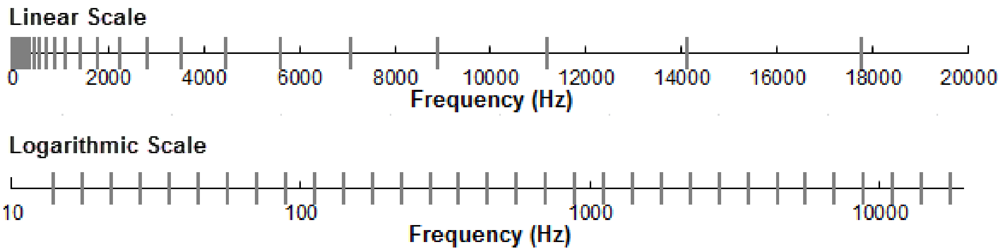


Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the ith band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{\mathrm{lo},i}$ and $f_{\mathrm{hi},i}$:

$$L_{p,i} = 10\log_{10}\int_{f_{\mathrm{lo},i}}^{f_{\mathrm{hi},i}} S(f)\,df \tag{A-12}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10\log_{10}\sum_{i} 10^{\frac{L_{p,i}}{10}} \tag{A-13}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient noise signal. Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the spectral levels at higher frequencies. Acoustic modelling of decidecade bands requires less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

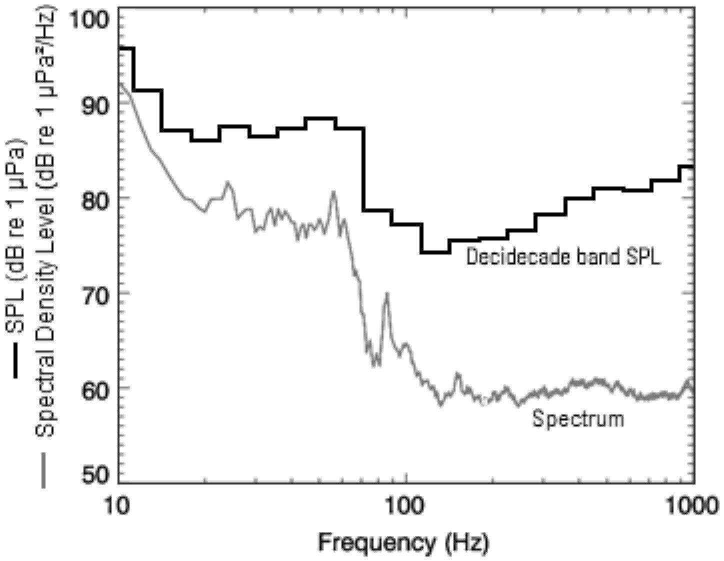


Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.

A.4. Marine Mammal Impact Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggested that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources–primarily airguns used in seismic surveys–could cause auditory injury. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for both injury and disturbance. The following sections summarise the recent development of thresholds; however, this field remains an active research topic.

A.4.1. Auditory Impairment

There are two categories of auditory threshold shifts (also termed Noise Induced Threshold Shift, NITS): Permanent Threshold Shift (PTS), a physical injury to an animal's hearing system; and Temporary Threshold Shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of physiological and mechanical processes in the inner ear. While PTS undoubtedly constitutes an injury, TTS (as a temporary effect) was not considered in the same way. However, recent research clearly indicates that already moderate levels (<12 dB) of TTS produced an accelerated hearing loss (PTS) resulting from progressive neural degeneration with age (Kujawa and Liberman 2006, 2009, Maison et al. 2013, Kujawa and Liberman 2015).

The criteria for assessing possible effects of impulsive noise (such as pile driving or seismic impulses) on marine mammals, NMFS (2018a), was applied in this study.

A.4.2. Behavioural response

Numerous studies on marine mammal behavioural responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioural reactions. However, it is recognised that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al. 2007, Ellison and Frankel 2012, Southall et al. 2016).

For impulsive noise, NMFS currently uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA

2018b, NOAA 2019). The threshold for impulsive sound is derived from the High-Energy Seismic Survey (HESS) panel (HESS 1999) report that, in turn, is based on the responses of migrating mysticete whales to airgun sounds (Malme et al. 1984). The HESS team recognised that behavioural responses to sound may occur at lower levels, but significant responses were only likely to occur above a SPL of 140 dB re 1 µPa. Southall et al. (2007) found varying responses for most marine mammals between a SPL of 140 and 180 dB re 1 µPa, consistent with the HESS (1999) report, but lack of convergence in the data prevented them from suggesting explicit step functions.

A.5. Marine Mammal Frequency Weighting

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

A.5.1. Marine mammal frequency weighting functions

In 2015, a U.S. Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a \left[1+(f/f_{hi})^2\right]^b}\right)\right] \qquad \text{(A-14)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid-, and high-frequency cetaceans, phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses noise impacts on marine mammals (NMFS 2016, NMFS 2018a). Table A-1 lists the frequency-weighting parameters for each hearing group; Figure A-3 shows the resulting frequency-weighting curves.

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2018a).

Hearing group	**a**	**b**	**f_{lo} (Hz)**	**f_{hi} (kHz)**	**K (dB)**
Low-frequency cetaceans (baleen whales)	1.0	2	200	19 000	0.13
Mid-frequency cetaceans (dolphins, plus toothed, beaked, and bottlenose whales)	1.6	2	8800	110 000	1.20
High-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	1.8	2	12 000	140 000	1.36
Phocid seals in water	1.0	2	1900	30 000	0.75
Otariid seals in water	2.0	2	940	25 000	0.64

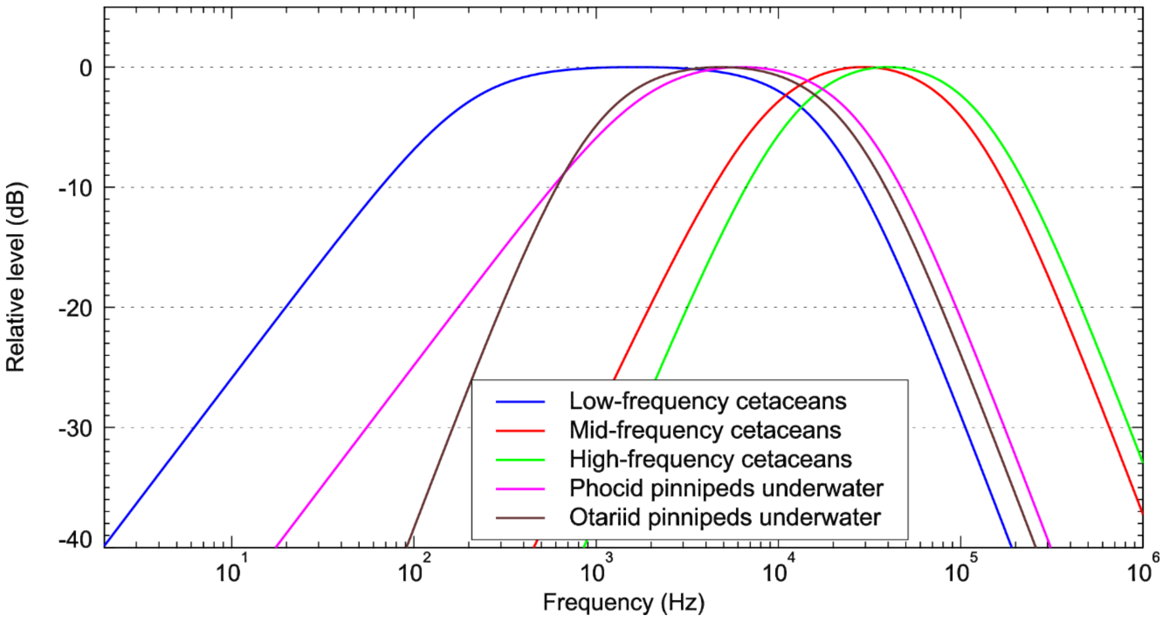


Figure A-3. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2018a).

A.6. Fish, Fish Eggs, and Fish Larvae Impact Criteria

In general, any adverse effects of seismic sound on fish behaviour depends on the species, the state of the individuals exposed, and other factors. We note that, despite mortality being a possibility for fish exposed to airgun sounds, Popper et al. (2014) do not reference an actual occurrence of this effect. Since the publication of that work, newer studies have further examined the question of possible mortality. Popper et al. (2016) adds further information to the possible levels of impulsive seismic airgun sound to which adult fish can be exposed without immediate mortality. They found that the two fish species in their study, with body masses in the range 200–400 g, exposed to a single-impulse of a maximum received level of either 231 dB re 1 µPa (PK) or 205 dB re 1 µPa^2·s (SEL), remained alive for 7 days after exposure and that the probability of mortal injury did not differ between exposed and control fish.

In the discussion of the criteria, Popper et al. (2014) discuss the complications in determining a relevant period of mobile seismic surveys, as the received levels at the fish change between impulses because the source is moving, and that in reality a revised guideline based on the closest PK or the per-pulse SEL might be more useful than one based on accumulated SEL. This is because exposures at the closest point of approach (CPA) are the primary exposures contributing to a receiver's accumulated level (Gedamke et al. 2011). Additionally, several important factors determine the likelihood and duration a receiver is expected to be in close proximity to a sound source (i.e., overlap in space and time between the source and receiver). For example, accumulation time for fast moving (relative to the receiver) mobile sources is driven primarily by the characteristics of the source (i.e., speed, duty cycle; NMFS 2016, 2018a).

As discussed in Popper (2018), many fish species move around, some over large distances. The author suggests that it is reasonable to think that if the sound of a seismic source becomes too loud, the fish will move away from the source because they are able to determine the direction of a sound source. If the fish moves away, the amount of energy to which it is exposed is likely to be one or a few seismic pulses, and these would not likely be loud enough to result in any effect because the fish would move away at a much lower level signal than could cause harm. Data on TTS for fish are very limited, with the only study that examined recovery from seismic impulses being Popper et al. (2005). Popper (2018) states that if this study had been conducted on wild, free-swimming fish instead of caged ones, there would have been no effect whatsoever because they were likely to have moved away from the source as it approached them, as would happen with normally free-moving demersal and pelagic fish species associated with a 3-D seismic survey in northern Australian waters, extrapolating from the Bethany 3-D assessed in Popper (2018).

Therefore, the time over which energy should be accumulated in each individual fish in the survey area should be limited to the time over which fish receives the maximum exposure, and 24 h is likely too long a period for calculating the accumulation of energy in determining potential harm (e.g., damage or TTS) (Popper 2018). 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 h (or less) is very likely. If TTS does occur, the duration of exposure to the most intense sounds that could result in TTS will be over just a few hours. Thus, energy accumulating over longer periods than a few hours is probably inappropriate (Popper 2018).

Appendix B. Models

B.1. Acoustic Source Model

The source levels and directivity of the seismic source were predicted with JASCO's Airgun Array Source Model (AASM). AASM includes low- and high-frequency modules for predicting different components of the seismic source spectrum. The low-frequency module is based on the physics of oscillation and radiation of airgun bubbles, as originally described by Ziolkowski (1970), that solves the set of parallel differential equations that govern bubble oscillations. Physical effects accounted for in the simulation include pressure interactions between airguns, port throttling, bubble damping, and generator-injector (GI) gun behaviour discussed by Dragoset (1984), Laws et al. (1990), and Landro (1992). A global optimisation algorithm tunes free parameters in the model to a large library of airgun source signatures.

While airgun signatures are highly repeatable at the low frequencies, which are used for seismic imaging, their sound emissions have a large random component at higher frequencies that cannot be predicted using a deterministic model. Therefore, AASM uses a stochastic simulation to predict the high-frequency (800−25,000 Hz) sound emissions of individual airguns, using a data-driven multiple-regression model. The multiple-regression model is based on a statistical analysis of a large collection of high quality seismic source signature data recently obtained from the Joint Industry Program (JIP) on Sound and Marine Life (Mattsson and Jenkerson 2008). The stochastic model uses a Monte-Carlo simulation to simulate the random component of the high-frequency spectrum of each airgun in an array. The mean high-frequency spectra from the stochastic model augment the low-frequency signatures from the physical model, allowing AASM to predict airgun source levels at frequencies up to 25,000 Hz.

AASM produces a set of “notional” signatures for each array element based on:

- Array layout
- Volume, tow depth, and firing pressure of each airgun
- Interactions between different airguns in the array

These notional signatures are the pressure waveforms of the individual airguns at a standard reference distance of 1 m; they account for the interactions with the other airguns in the array. The signatures are summed with the appropriate phase delays to obtain the far-field source signature of the entire array in all directions. This far-field array signature is filtered into decidecade frequency bands to compute the source levels of the array as a function of frequency band and azimuthal angle in the horizontal plane (at the source depth), after which it is considered a directional point source in the far field.

A seismic array consists of many sources and the point source assumption is invalid in the near field where the array elements add incoherently. The maximum extent of the near field of an array (R_{nf}) is:

$$R_{\mathrm{nf}} < \frac{l^2}{4\lambda} \tag{B-1}$$

where λ is the sound wavelength and l is the longest dimension of the array (Lurton 2002, §5.2.4). For example, a seismic source length of l = 21 m yields a near-field range of 147 m at 2 kHz and 7 m at 100 Hz. Beyond this R_{nf} range, the array is assumed to radiate like a directional point source and is treated as such for propagation modelling.

The interactions between individual elements of the array create directionality in the overall acoustic emission. Generally, this directionality is prominent mainly at frequencies in the mid-range between tens of hertz to several hundred hertz. At lower frequencies, with acoustic wavelengths much larger than the inter-airgun separation distances, the directionality is small. At higher frequencies, the pattern of lobes is too finely spaced to be resolved and the effective directivity is less.

B.2. Sound Propagation Models

B.2.1. MONM-BELLHOP

Long-range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). Compared to VSTACK, MONM less accurately predicts steep-angle propagation for environments with higher shear speed but is well suited for effective longer-range estimation. This model computes sound propagation at frequencies of 5 Hz to 2 kHz via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). MONM computes sound propagation at frequencies > 1 kHz via the BELLHOP Gaussian beam acoustic ray-trace model (Porter and Liu 1994).

The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM accounts for the additional reflection loss at the seabed, which results from partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

MONM computes acoustic fields in three dimensions by modelling transmission loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ number of planes (Figure B-1).

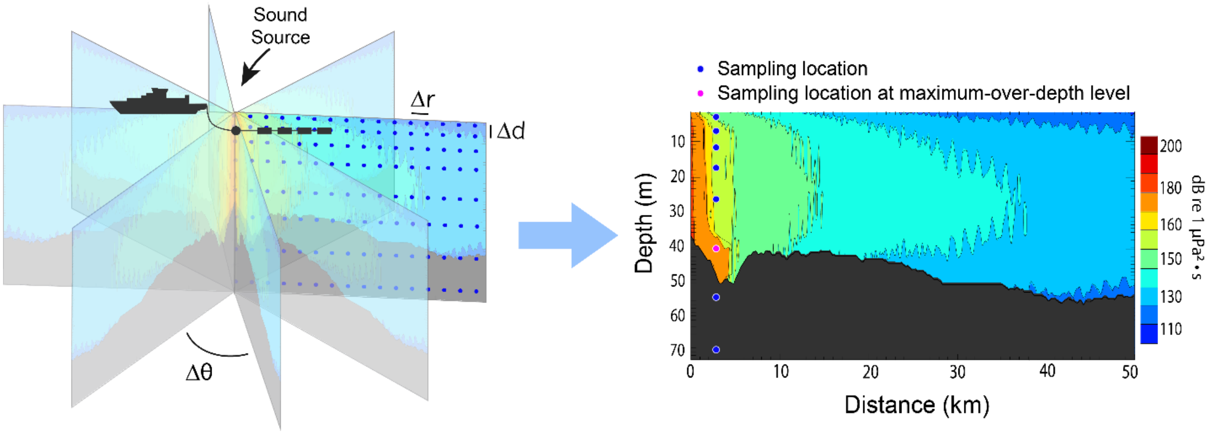


Figure B-1. The N×2-D and maximum-over-depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic transmission loss at the centre frequencies of decidecade bands. Sufficiently many frequency bands, starting at 5 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the transmission loss is modelled within each of the N vertical planes as a function of depth and range from the source. The decidecade-band received per-pulse SEL are computed by subtracting the band transmission loss values from the directional source level in that frequency band. Composite broadband received per-pulse SEL are then computed by summing the received decidecade-band levels.

The received per-pulse SEL sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size. At each sampling range along the surface, the sound field is sampled at various depths, with the step size between samples increasing with depth below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. For areas with deep water, sampling is not performed at depths beyond those reachable by marine mammals. The received per-pulse SEL at a surface sampling location is taken as the maximum value that occurs over all samples within the water column, i.e., the maximum-over-depth received per-pulse SEL. These maximum-over-depth per-pulse SEL are presented as colour contours around the source.

B.2.2. Full Waveform Range-dependent Acoustic Model: FWRAM

For impulsive sounds from the seismic source, time-domain representations of the pressure waves generated in the water are required to calculate SPL and PK. Furthermore, the seismic source must be represented as a distributed source to accurately characterise vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on the same wide-angle parabolic equation (PE) algorithm as MONM. FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments, and it takes the same environmental inputs as MONM (bathymetry, water sound speed profile, and seafloor geoacoustic profile). Unlike MONM, FWRAM computes pressure waveforms via Fourier synthesis of the modelled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Besides providing direct calculations of the PK and SPL, the synthetic waveforms from FWRAM can also be used to convert the SEL values from MONM to SPL.

B.2.3. Wavenumber Integration Model

Sound pressure levels near the seismic source were modelled using JASCO’s VSTACK wavenumber integration model. VSTACK computes synthetic pressure waveforms versus depth and range for arbitrarily layered, range-independent acoustic environments using the wavenumber integration approach to solve the exact (range-independent) acoustic wave equation. This model is valid over the full angular range of the wave equation and can fully account for the elasto-acoustic properties of the sub-bottom. Wavenumber integration methods are extensively used in the field of underwater acoustics and seismology where they are often referred to as reflectivity methods or discrete wavenumber methods. VSTACK computes sound propagation in arbitrarily stratified water and seabed layers by decomposing the outgoing field into a continuum of outward-propagating plane cylindrical waves. Seabed reflectivity in the model is dependent on the seabed layer properties: compressional and shear wave speeds, attenuation coefficients, and layer densities. The output of the model can be post-processed to yield estimates of the SEL, SPL, and PK.

VSTACK accurately predicts steep-angle propagation in the proximity of the source, but it is computationally slow at predicting sound pressures at large distances due to the need for smaller wavenumber steps with increasing distance. Additionally, VSTACK assumes range-invariant bathymetry with a horizontally stratified medium (i.e., a range-independent environment) which is azimuthally symmetric about the source. VSTACK is thus best suited to modelling the sound field near the source.

B.2.3.1. Particle Motion

VSTACK was also used to compute estimates of particle acceleration for two modelled sites (Sites A and 1) for the 3480 in^3 airgun array. Particle motion waveforms were modelled and pulse metrics were computed from the time-domain traces. VSTACK uses the wavenumber integration approach to solve the exact acoustic wave equation for arbitrarily layered range-independent acoustic environments.

The VSTACK model setup for the particle velocity scenarios was identical to that for the peak pressure scenarios in terms of source treatment, frequency range and environmental model. The particle acceleration and velocity waveforms were computed to a maximum distance of 1000 m in the broadside and endfire directions from the centre of the airgun array for a receiver 5 cm above the seafloor.

As discussed above in Appendix A.2, particle velocity (v) is the physical speed of a particle in a material. It can be derived from the pressure gradient and Euler’s linearised momentum equation where ρ_0 is the density of the medium (Appendix A.2). Since the wavenumber integration kernel is a product of analytic expressions in terms of range and depth, VSTACK computes particle velocity by computing the spatial gradient of the pressure field analytically in the frequency domain. Fourier synthesis is applied to compute time series synthetic pressure and/or velocity waveforms at depth and range receivers by convolving the source waveforms with the impulse response of the waveguide. Particle velocity metrics at each receiver location were calculated from the modelled particle motion along three perpendicular axes (horizontal and along the source-receiver path, horizontal and perpendicular to the source-receiver path, and vertical).

The particle velocity results were converted to acceleration by time differentiation. The peak particle acceleration and velocity were calculated from the maximum of the predicted acceleration and velocity magnitude, defined as “peak magnitude” and are presented as plots of peak value versus range (Appendix A.2).

B.3. Model Validation Information

Predictions from JASCO’s Airgun Array Source Model (AASM) and propagation models (MONM, FWRAM and VSTACK) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Artic, Canadian and southern United States waters, Greenland, Russia and Australia (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities which have included internal validation of the modelling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016).

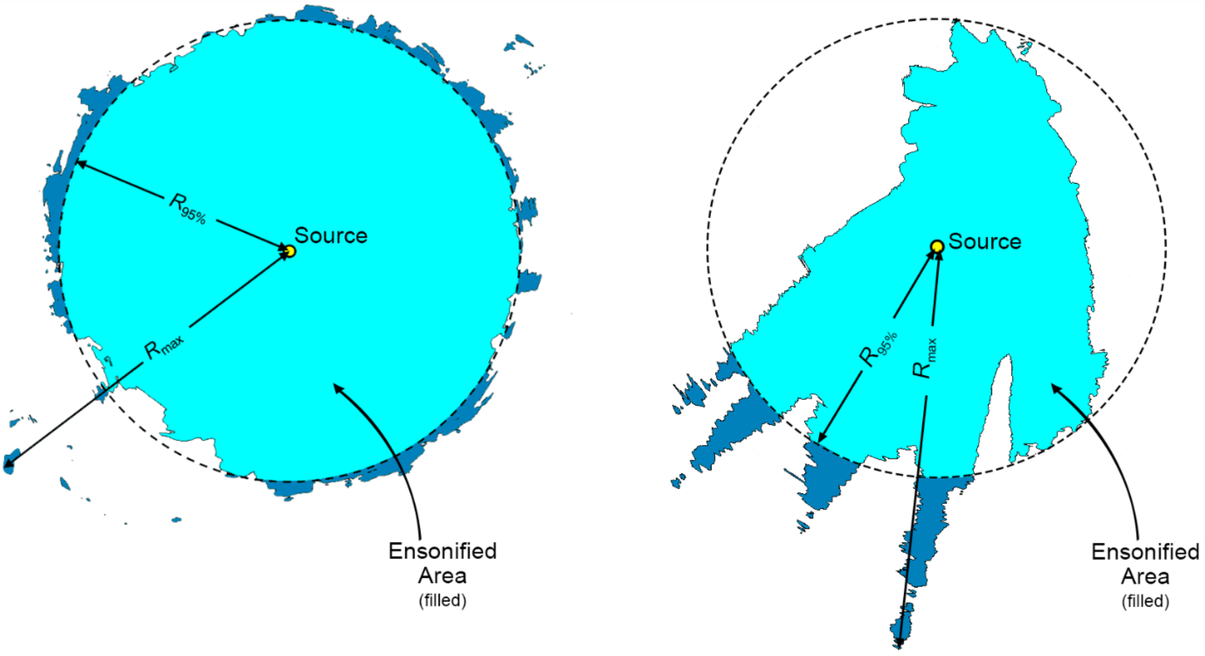
Appendix C. Methods and Parameters

This section describes the specifications of the seismic source that was used at all sites and the environmental parameters used in the propagation models.

C.1. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) R_{max}, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure C-1).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure C-1(a). In cases such as this, where relatively few points are excluded in any given direction, R_{max} can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure C-1(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases R_{max} might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.



(a) (b)

Figure C-1. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two different scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine R_{max}.

C.2. Estimating SPL from Modelled SEL Results

The per-pulse SEL of sound pulses is an energy-like metric related to the dose of sound received over a pulse's entire duration. The pulse SPL on the other hand, is related to its intensity over a specified time interval. Seismic pulses typically lengthen in duration as they propagate away from their source, due to seafloor and surface reflections, and other waveguide dispersion effects. The changes in pulse length, and therefore the time window considered, affect the numeric relationship between SPL and SEL. This study has applied a fixed window duration to calculate SPL (T_{fix} = 125 ms; see Appendix A.1), as implemented in Martin et al. (2017b). Full-waveform modelling was used to estimate SPL, but this type of modelling is computationally intensive, and can be prohibitively time consuming when run at high spatial resolution over large areas.

For the current study, FWRAM (Appendix B.2.2) was used to model synthetic seismic pulses over the frequency range 5–1024 Hz. This was performed along all broadside and endfire radials at three sites. FWRAM uses Fourier synthesis to recreate the signal in the time domain so that both the SEL and SPL from the source can be calculated. The differences between the SEL and SPL were extracted for all ranges and depths that corresponded to those generated from the high spatial-resolution results from MONM. A 125 ms fixed time window positioned to maximize the SPL over the pulse duration was applied. The resulting SEL -to-SPL offsets were averaged in 0.02 km range bins along each modelled radial and depth, and the 90th percentile was selected at each range to generate a generalised range-dependent conversion function for each site. The range- dependent conversion function was averaged between the two sites and applied to predicted per-pulse SEL results from MONM to model SPL values. Figures D-2 to D-4 show the conversion offsets for Sites 3, 6, 7 and 10; the spatial variation is caused by changes in the received airgun pulse as it propagates from the source.

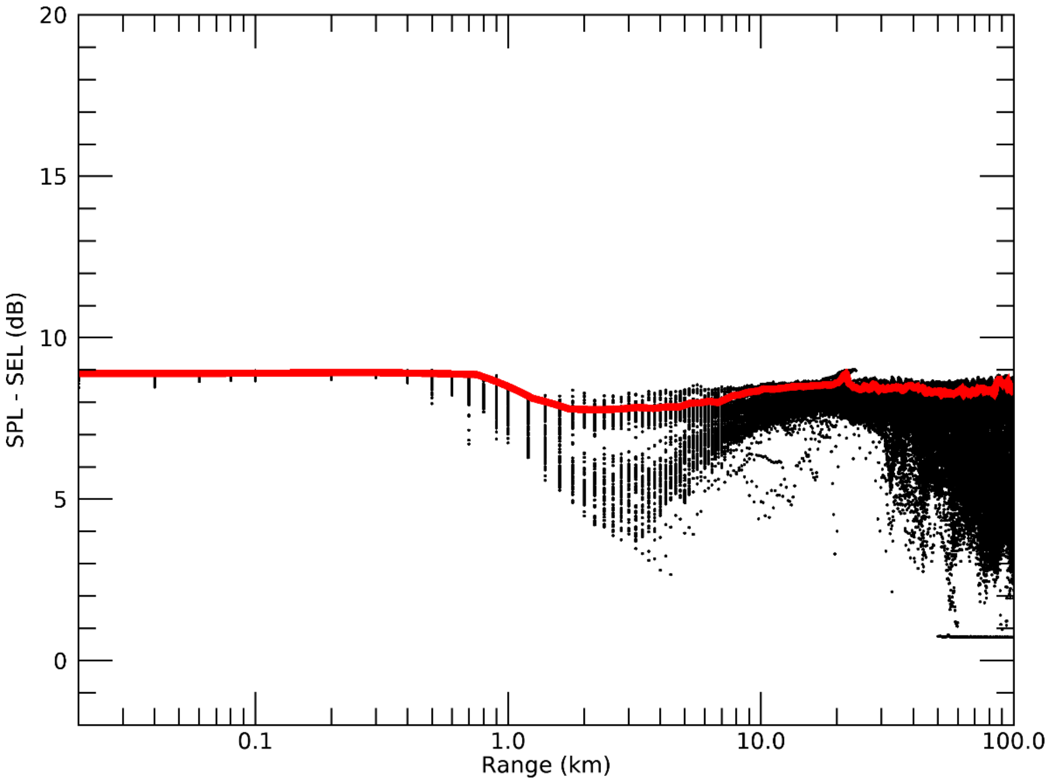


Figure C-2. *Site 3*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 3480 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

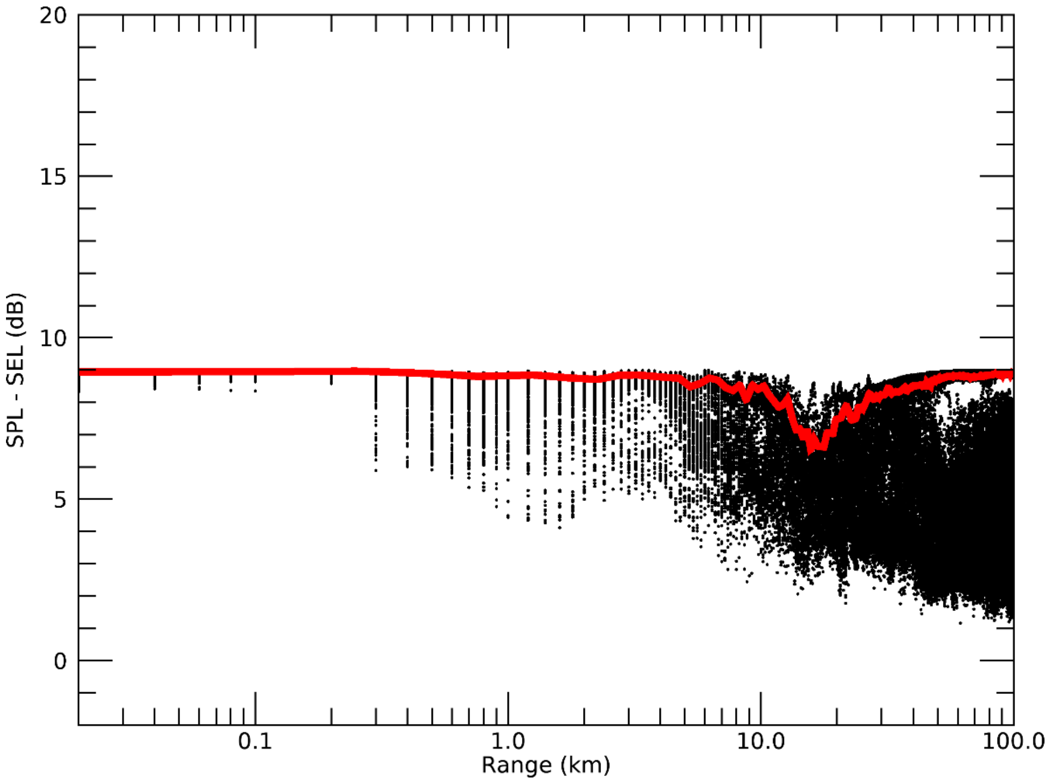


Figure C-3. *Site 6*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 3480 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

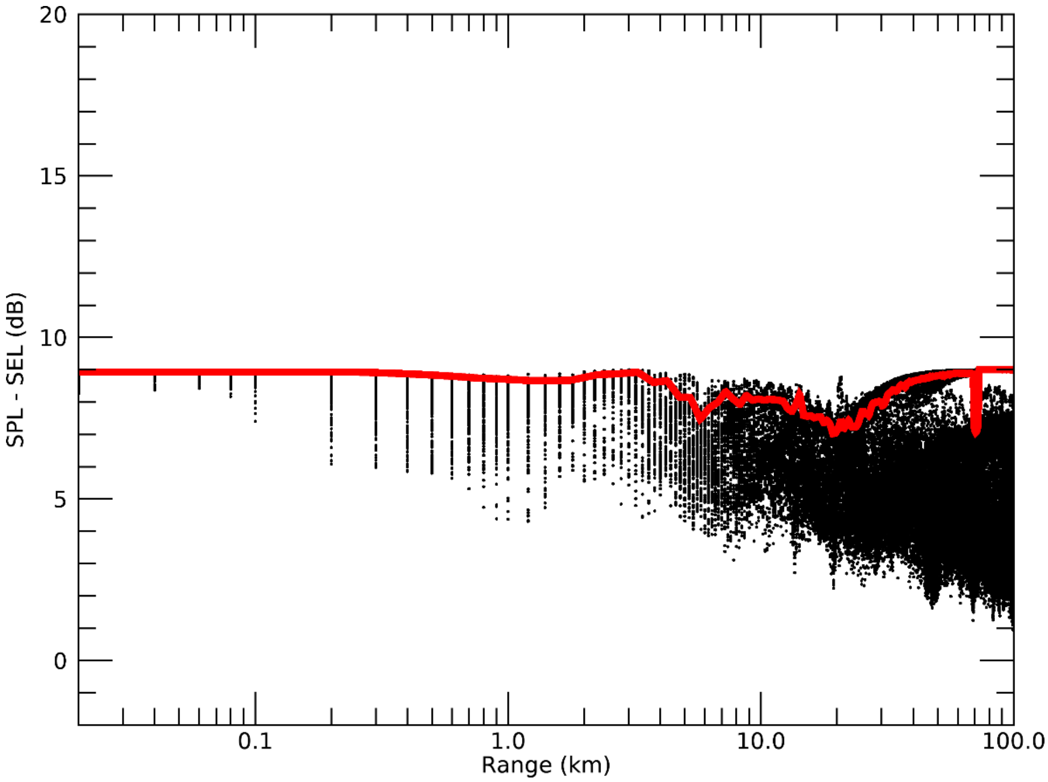


Figure C-4. *Site 7*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 3480 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

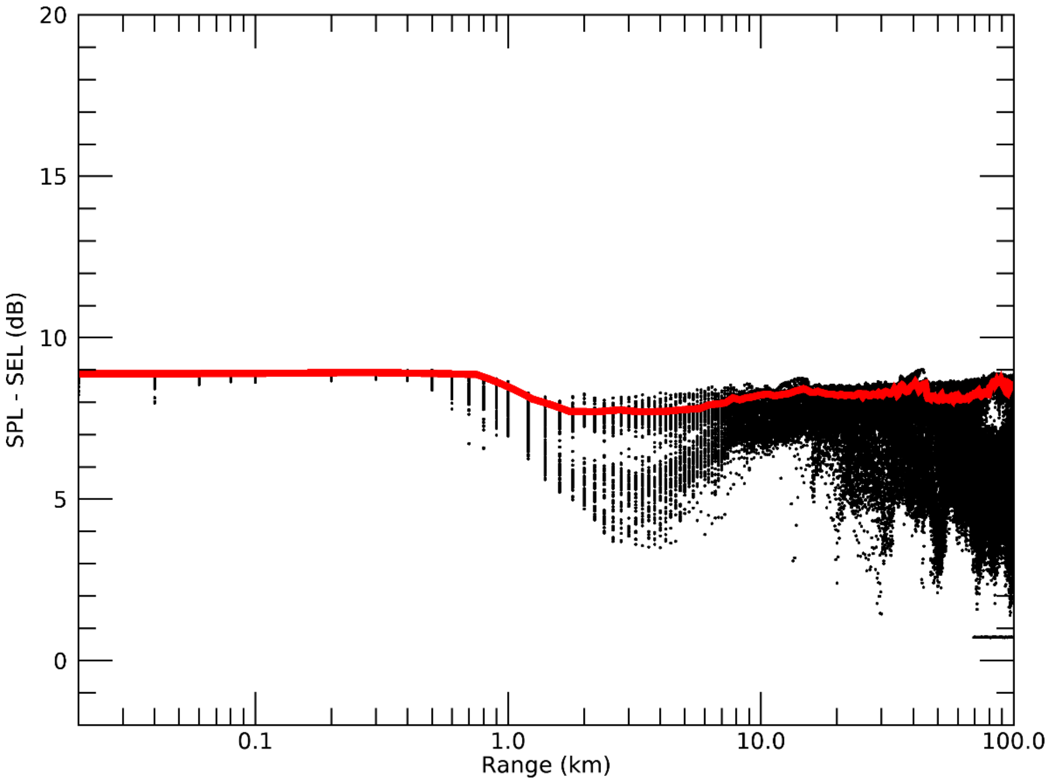


Figure C-5. *Site 10*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 3480 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

C.3. Accumulated SEL Calculation

When there are many seismic pulses, it becomes computationally prohibitive to perform sound propagation modelling for every single event. The distance between the consecutive seismic impulses is small enough, however, that the environmental parameters that influence sound propagation are virtually the same for many impulse points. The acoustic fields can, therefore, be modelled for a subset of seismic pulses and estimated at several adjacent ones. After sound fields from representative impulse locations are calculated, they are adjusted to account for the source position for nearby impulses.

Although estimating the cumulative sound field with the described approach is not as precise as modelling sound propagation at every impulse location, small-scale, site-specific sound propagation features tend to blur and become less relevant when sound fields from adjacent impulses are summed. Larger scale sound propagation features, primarily dependent on water depth, dominate the cumulative field. The accuracy of the present method acceptably reflects those large-scale features, thus providing a meaningful estimate of a wide area SEL field in a computationally feasible framework.

To produce the map of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum-over-depth level was calculated at each sampling point within the modelled region. The radial grids of maximum-over-depth and seafloor sound levels for each impulse were then resampled (by linear triangulation) to produce a regular Cartesian grid. The sound field grids from all impulses were summed (Equation A-5) to produce the cumulative sound field grid with cell sizes of 20 m. The contours and threshold ranges were calculated from these flat Cartesian projections of the modelled acoustic fields. The single-impulse SEL fields were computed over model grids approximately 150 × 150 km in range, which encompasses the full area of the cumulative grid (the entire survey area).

C.4. Environmental Parameters

C.4.1. Bathymetry

Water depths throughout the modelled area were extracted from the Australian Bathymetry and Topography Grid, a 9 arc-second grid rendered for Australian waters (Whiteway 2009) for the region shown in Figure 1. Bathymetry data were extracted and re-gridded onto a Universal Transverse Mercator (UTM) coordinate projection (Zone 54) with a regular grid spacing of 200 ×200 m to generate the bathymetry in Figure C-6 (note the data is re-projected or the display in the Map Grid of Australia (MGA) coordinate system).

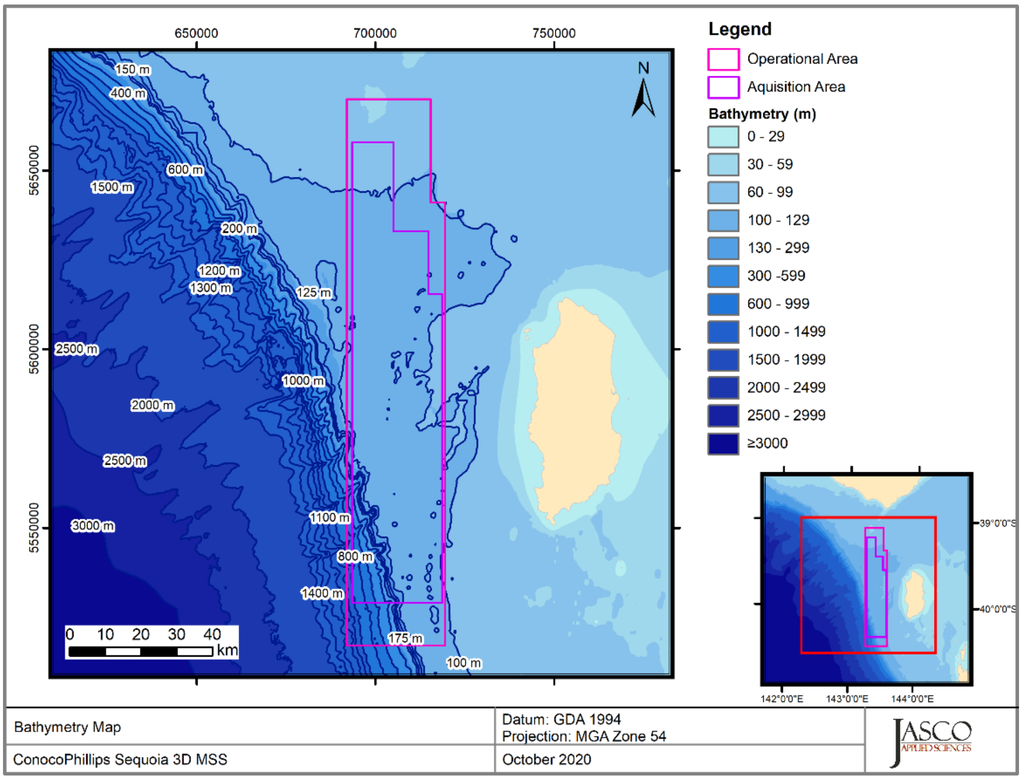


Figure C-6. Map of the modelling area presenting the variation in water depth.

C.4.2. Sound speed profile

The sound speed profiles for the modelled sites were derived from temperature and salinity profiles from the U.S. Naval Oceanographic Office's Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the U.S. Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean sound speed profiles for July to October were derived from the GDEM profiles within a 100 km box radius encompassing all modelling sites. The sound speed profile in July is expected to be most favourable to longer-range sound propagation during the proposed survey time frame due to a slight upward refracting profile section in the upper 40 m. This profile section was also present in August, although to a slightly lesser extent. As such, July was selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure C-7 shows the resulting profile used as input to the sound propagation modelling.

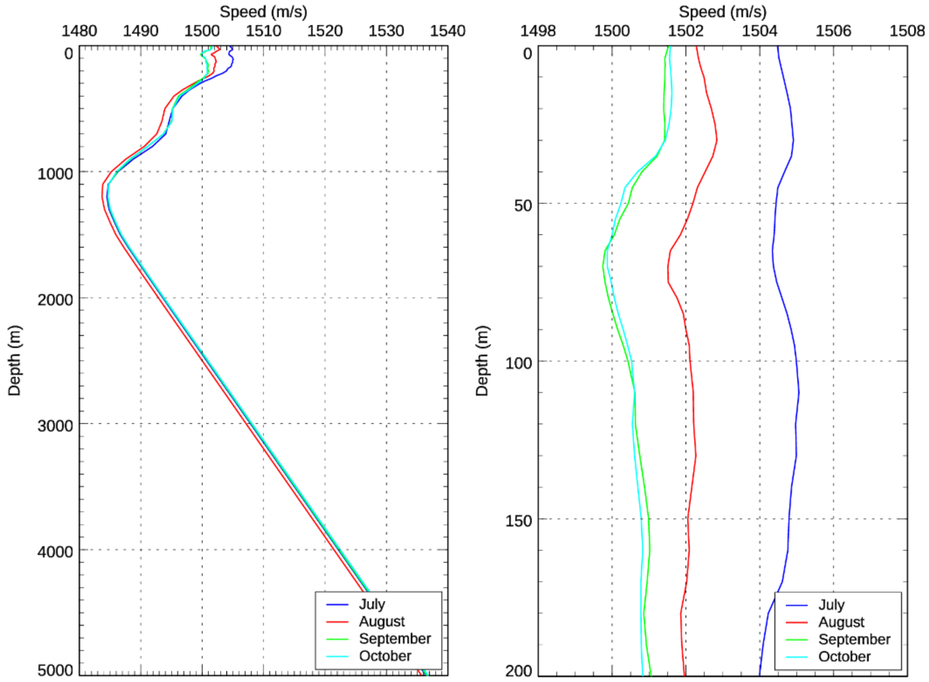


Figure C-7. Monthly averaged sound speed profiles for July to October. The plot on the right shows the top 200 m of water; the plot on the left shows the profiles over the entire water column The profile for July was used in modelling all sound fields. All profiles were calculated from temperature and salinity profiles from GDEM V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

C.4.3. Geoacoustics

Geotechnical data has been acquired from borehole analysis near the modelling Sites 1–5, 9–10 at the western edge of the Bass Strait (Duncan et al. 2013). The sediment is typified by a thin layer of well-cemented calcarenite overlying a softer sand/calcarenite layer that extends for a further 100 m below the sea floor. The sound propagation models use a single value shear speed, which has been set at a value representative of the layers beneath the cemented calcarenite layer. Table C-1 lists the geoacoustic properties used for modelling.

Table C-1. Geoacoustic profile used as the input to the models for Sites 1–5, 9–10.

Depth below seafloor (m)	Material	Density (g/cm^3)	P-wave speed (m/s)	P-wave attenuation (dB/λ)	S-wave speed (m/s)	S-wave attenuation (dB/λ)
0–1	Well-cemented calcarenite	2.2	2600	0.2	500	0.4
1–101	Slightly to semi-cemented sand/calcarenite	1.9	2100	0.12		
101–1000	Semi-cemented sand/calcarenite	1.9	2200	0.12		
>1000	Basement (rock)	3.0	3800	0.1		

Geoacoustic parameters used for modelling at sites in deeper waters (Sites 6–8) were derived from sedimentary grain size measurements from the Australian Government's Marine Sediments (MARS) database (Heap 2009). Most of these samples were taken at the seafloor, although some are from sediment from greater depths in the seabed. On average, the surficial grain size indicates silty sand is present throughout the modelled area. Geotechnical data along the southern Australian shelf typically show sand overlaying calcarenite layers (Bradshaw 2002, Duncan et al. 2013). Representative grain sizes and porosity were used in the grain-shearing model proposed by Buckingham (2005) to estimate the geoacoustic parameters required by the sound propagation models. Table C-2 lists the geoacoustic parameters used for modelling.

Table C-2. Geoacoustic profile used as the input to the models at Sites 6–8.

Depth below seafloor (m)	Material	Density (g/cm³)	P-wave speed (m/s)	P-wave attenuation (dB/λ)	S-wave speed (m/s)	S-wave attenuation (dB/λ)
0–10	Silty carbonate sand to semi-cemented limestone	1.88	1605–1700	0.35–0.70	255	3.65
10–20		1.88–1.89	1700–1755	0.70–0.85		
20–50		1.89–1.90	1755–1850	0.85–1.15		
50–100		1.90–1.92	1850–1950	1.15–1.35		
100–200		1.92–1.96	1950–2100	1.35–1.60		
200–500		1.96–2.05	2100–2355	1.60–1.95		
>500		2.05	2355	1.95		

C.5. Seismic Source

The layout of the 3480 in³ seismic source used for modelling in this study is provided in Figure C-8. Details of the airgun parameters are provided in Table C-3. Additionally the layout details for the 3440 in³ source considered in the array comparison (Appendix D) are provided in Figure C-9 and Table C-4.

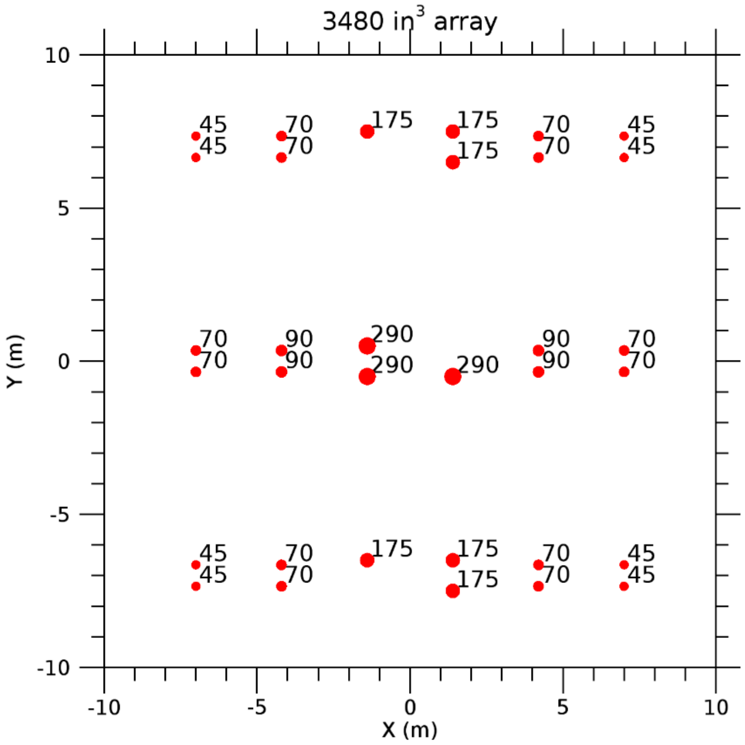


Figure C-8. Layout of the modelled 3480 in³ array. Tow depth is 6 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table C-3.

Table C-3. Layout of the modelled 3480 in^3 array. Tow depth is 6 m. Firing pressure for all guns is 2000 psi. Also see Figure C-8.

String	Gun	*x* (m)	*y* (m)	*z* (m)	Vol (in^3)
1	1	7	−7.35	6	45
	2	7	−6.65	6	45
	3	4.2	−7.35	6	70
	4	4.2	−6.65	6	70
	5	1.4	−7.5	6	175
	6	1.4	−6.5	6	175
	8	−1.4	−6.5	6	175
	9	−4.2	−7.35	6	70
	10	−4.2	−6.65	6	70
	11	−7	−7.35	6	45
	12	−7	−6.65	6	45
2	13	7	−0.35	6	70
	14	7	0.35	6	70
	15	4.2	−0.35	6	90
	16	4.2	0.35	6	90
	17	1.4	−0.5	6	290
	19	−1.4	−0.5	6	290
	20	−1.4	0.5	6	290
	21	−4.2	−0.35	6	90
	22	−4.2	0.35	6	90
	23	−7	−0.35	6	70
	24	−7	0.35	6	70
3	25	7	6.65	6	45
	26	7	7.35	6	45
	27	4.2	6.65	6	70
	28	4.2	7.35	6	70
	29	1.4	6.5	6	175
	30	1.4	7.5	6	175
	32	−1.4	7.5	6	175
	33	−4.2	6.65	6	70
	34	−4.2	7.35	6	70
	35	−7	6.65	6	45
	36	−7	7.35	6	45

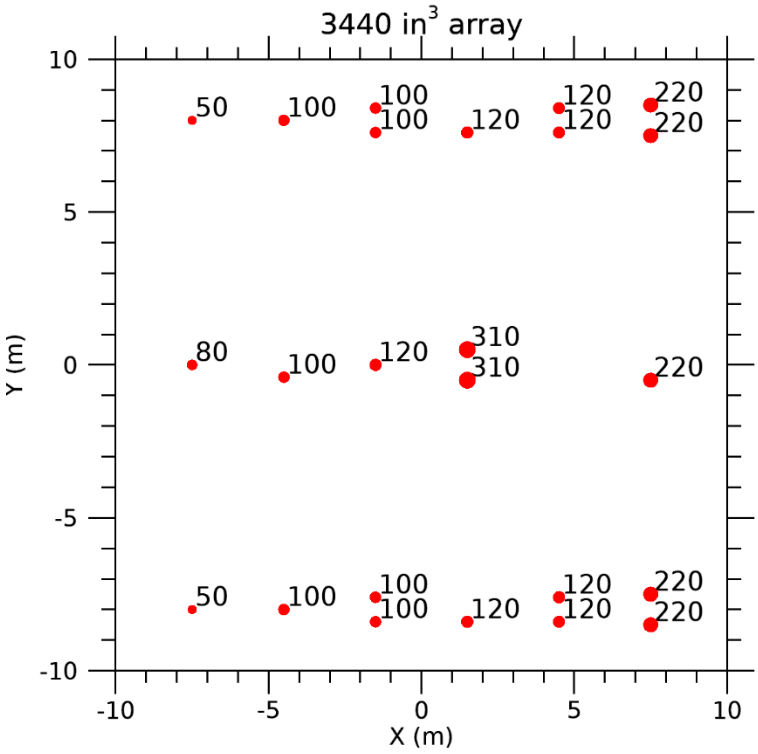


Figure C-9. Layout of the modelled 3440 in^3 array. Tow depth is 6 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table C-4.

Table C-4. Layout of the modelled 3440 in^3 array. Tow depth is 6 m. Firing pressure for all guns is 2000 psi. Also see Figure C-9.

String	Gun	*x* (m)	*y* (m)	*z* (m)	Vol (in^3)
1	1	7.5	-8.5	6	220
	2	7.5	-7.5	6	220
	3	4.5	-8.4	6	120
	4	4.5	-7.6	6	120
	5	1.5	-8.4	6	120
	7	-1.5	-8.4	6	100
	8	-1.5	-7.6	6	100
	9	-4.5	-8	6	100
	10	-7.5	-8	6	50
2	11	7.5	-0.5	6	220
	15	1.5	-0.5	6	310
	16	1.5	0.5	6	310
	17	-1.5	0	6	120
	18	-4.5	-0.4	6	100
	20	-7.5	0	6	80
3	21	7.5	7.5	6	220
	22	7.5	8.5	6	220
	23	4.5	7.6	6	120
	24	4.5	8.4	6	120
	25	1.5	7.6	6	120
	27	-1.5	7.6	6	100
	28	-1.5	8.4	6	100
	29	-4.5	8	6	100
	30	-7.5	8	6	50

C.5.1. Array Source Levels and Directivity

Figure C-10 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction) and vertical overpressure signature and corresponding power spectrum levels for the 3480 in^3 array (Appendix C.5). Horizontal decidecade-band source levels are shown as a function of band centre frequency and azimuth (Figure B-11).

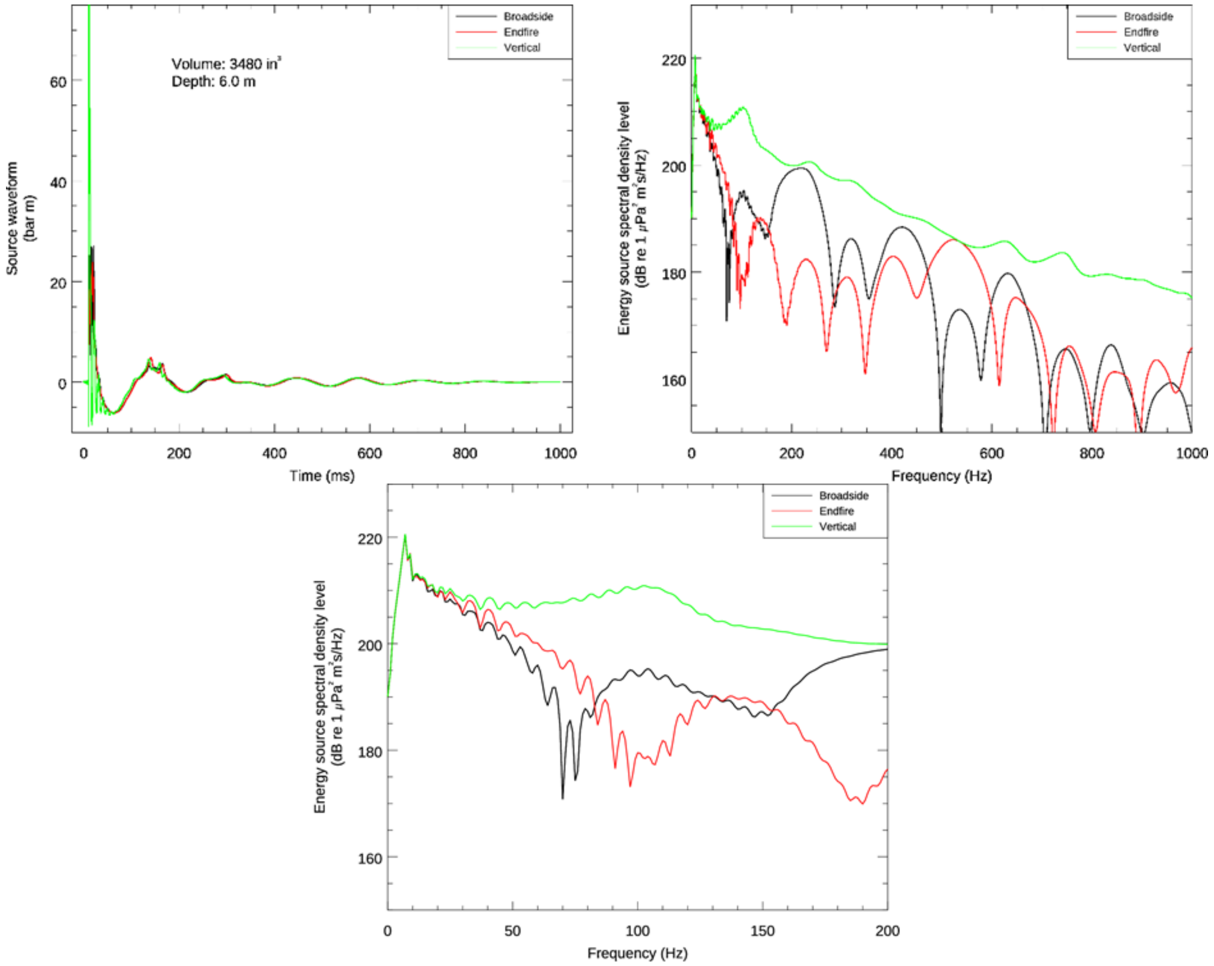


Figure C-10. Predicted source level details for the 3480 in^3 array at 6 m towed depth.(Top left) the overpressure signature and (Top right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost). (Bottom) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost) for low frequencies (0–200 Hz).

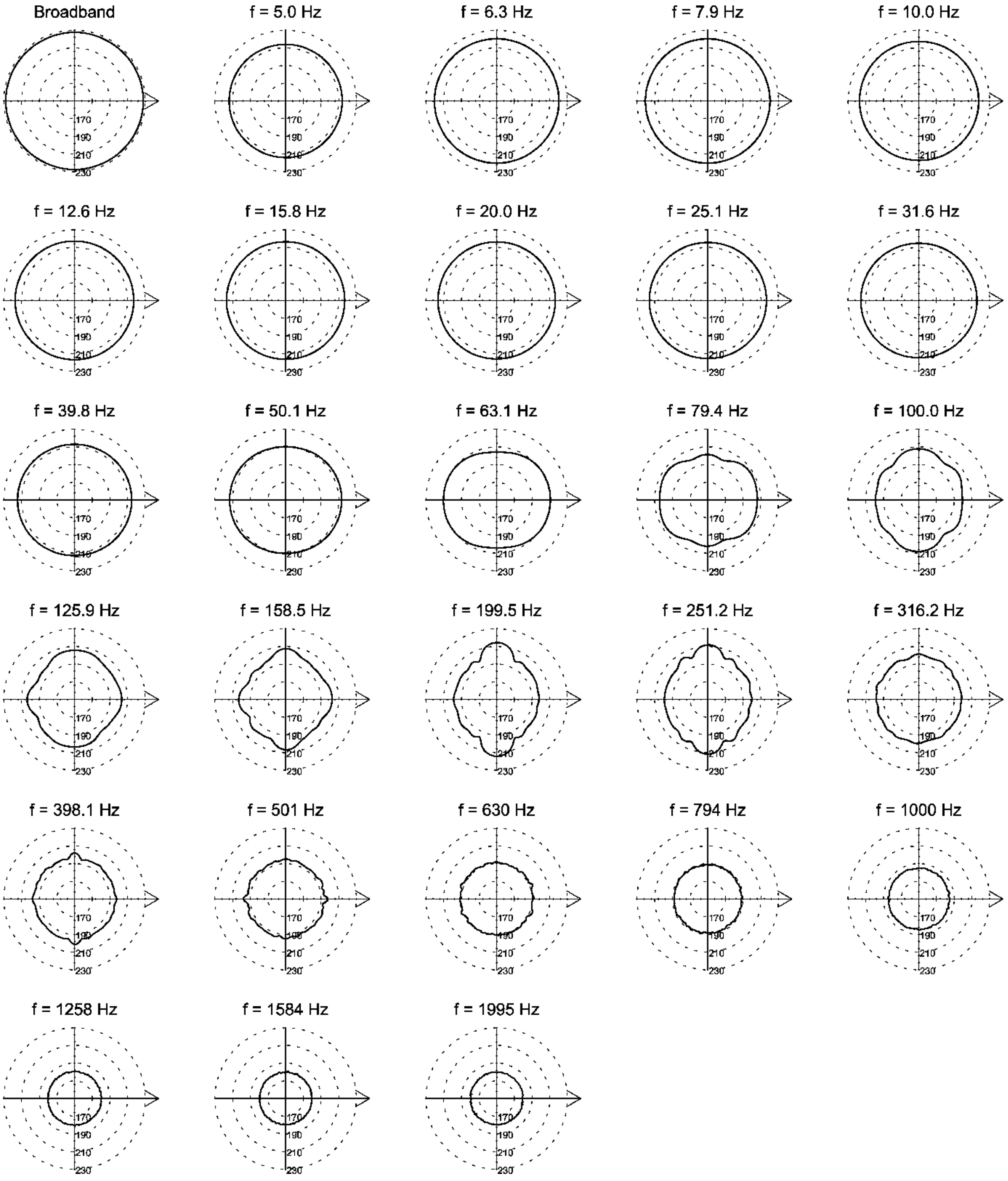


Figure C-11. Directionality of the predicted horizontal source levels for the 3480 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 µPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 6 m (see Figure C-10).

Appendix D. Seismic Source Comparison

D.1. Acoustic Source Levels and Directivity

Four different seismic sources were considered for preliminary source analysis and selecting a worst-case seismic source, the total volumes were 3440 in^3 and 3480 in^3 and the arrays were modelled at a tow depth of 6 m. The results from AASM for these sources are provided in Table D-1.

Table D-1. Far-field source level specifications for the 3440 in^3 and 3480 in^3 sources. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Total volume (in^3)	Direction	Peak source pressure level ($L_{S,pk}$) (dB re 1 µPa m)	Per-pulse source SEL ($L_{S,E}$) (dB 1 $\mu\text{Pa}^2\text{m}^2\text{s}$)
			10–25000 Hz
3440	Broadside	248.3	224.9
3480	Broadside	248.6	225.3
3440	Endfire	247.9	225.8
3480	Endfire	247.5	225.2
3440	Vertical	256.8	229.9
3480	Vertical	258.1	230.9

Appendix E. Per-Pulse SEL Sound Field Maps

Per-pulse SEL maps for all modelled sites are provided in Figures E-1 through E-10.

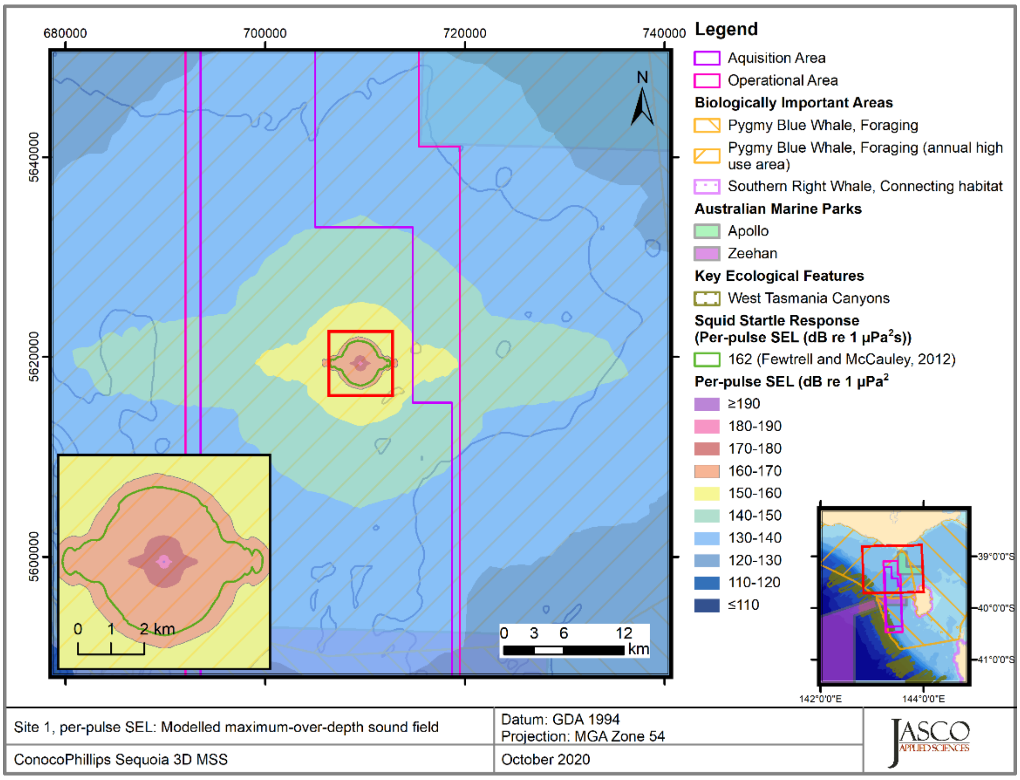


Figure E-1. *Site 1, tow azimuth 0º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

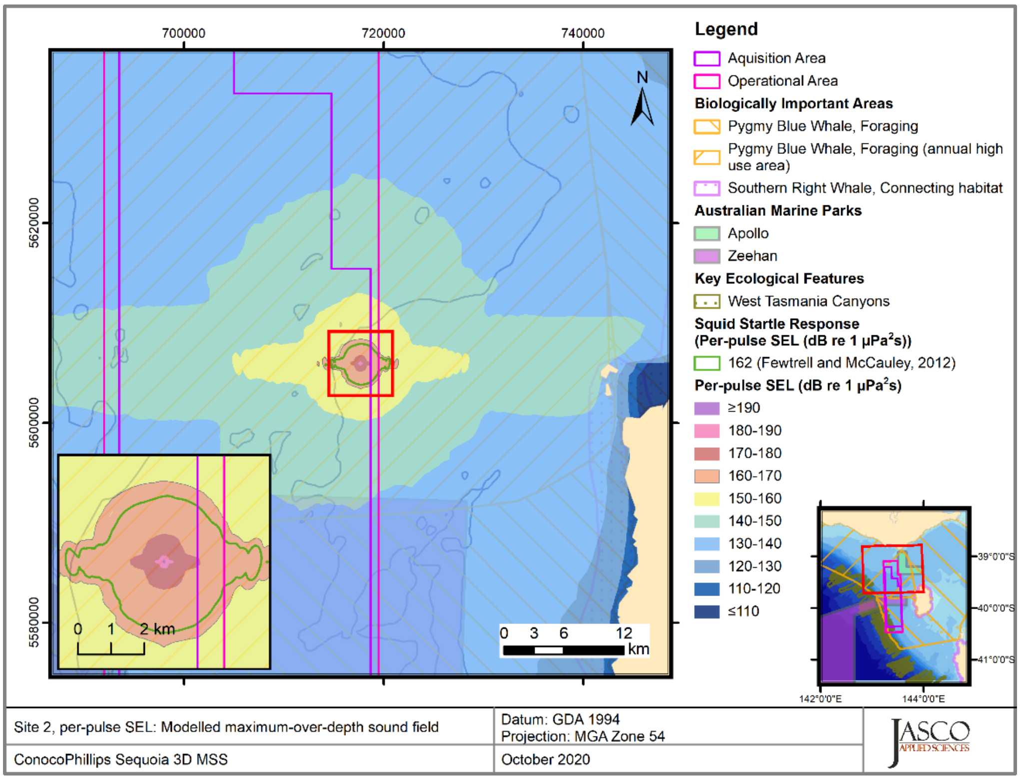


Figure E-2. *Site 2, tow azimuth 180º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

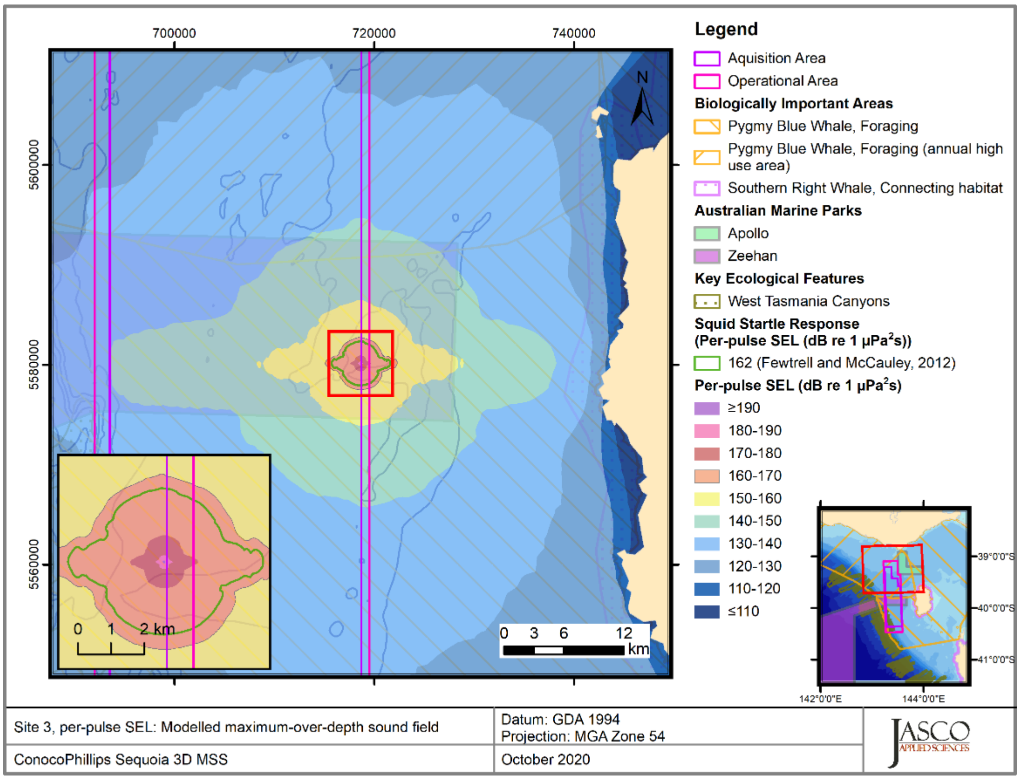
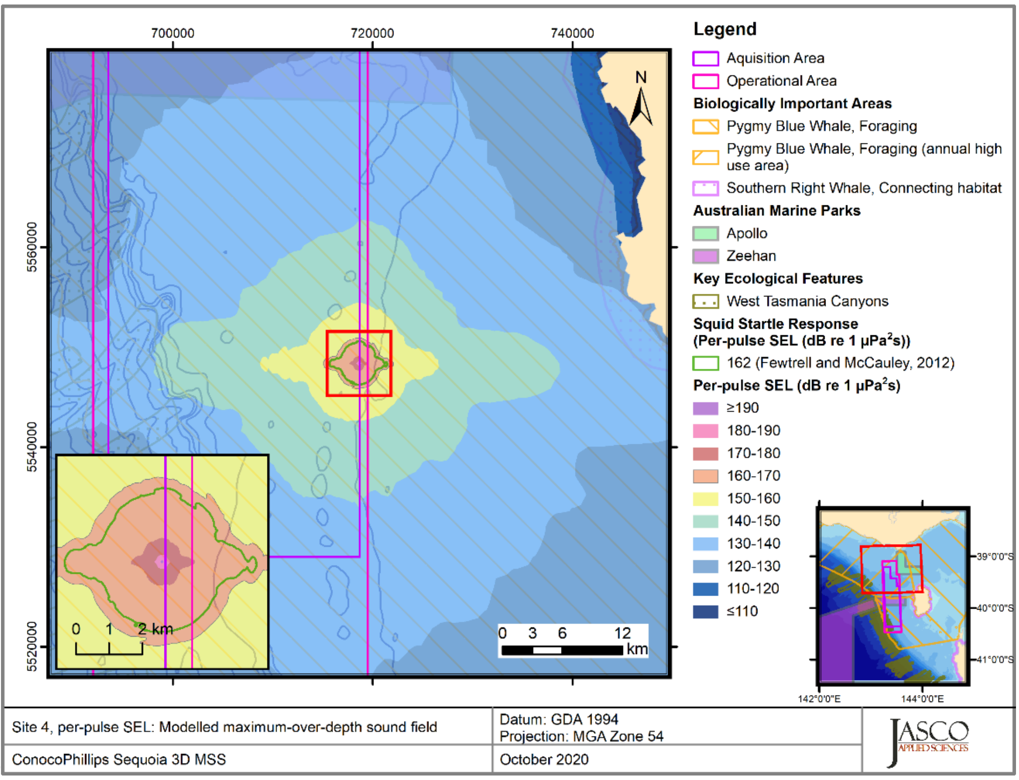


Figure E-3. *Site 3, tow azimuth 180º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.



10

Figure E-4. Site 4, tow azimuth 180º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

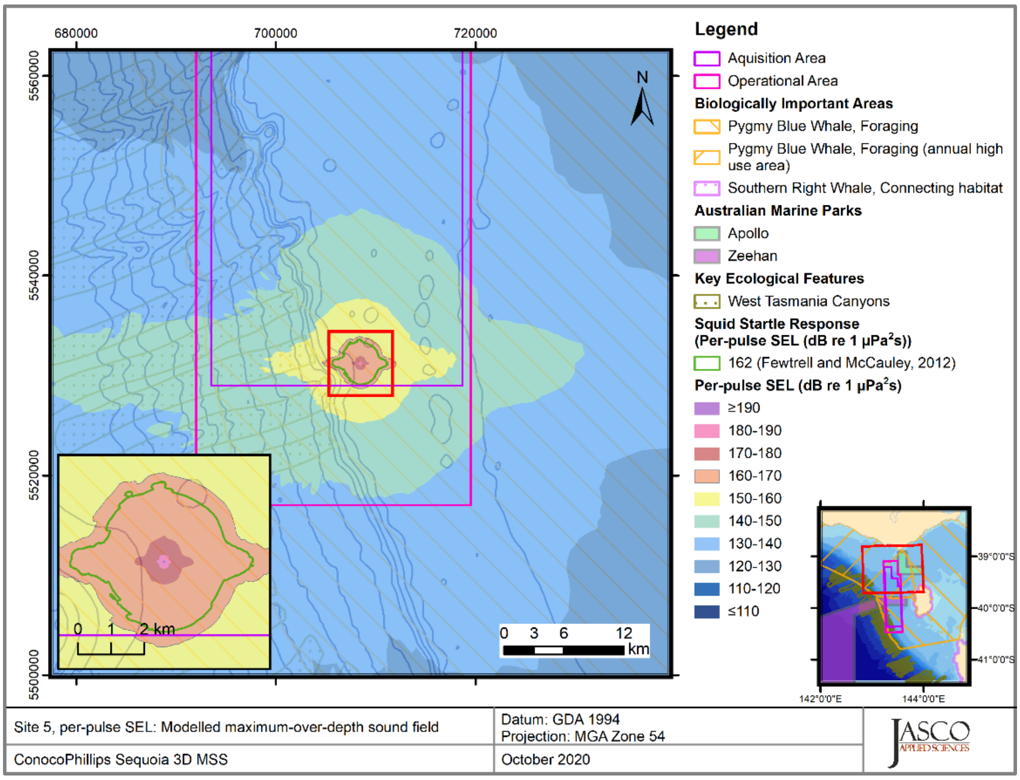


Figure E-5. *Site 5, tow azimuth 0º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

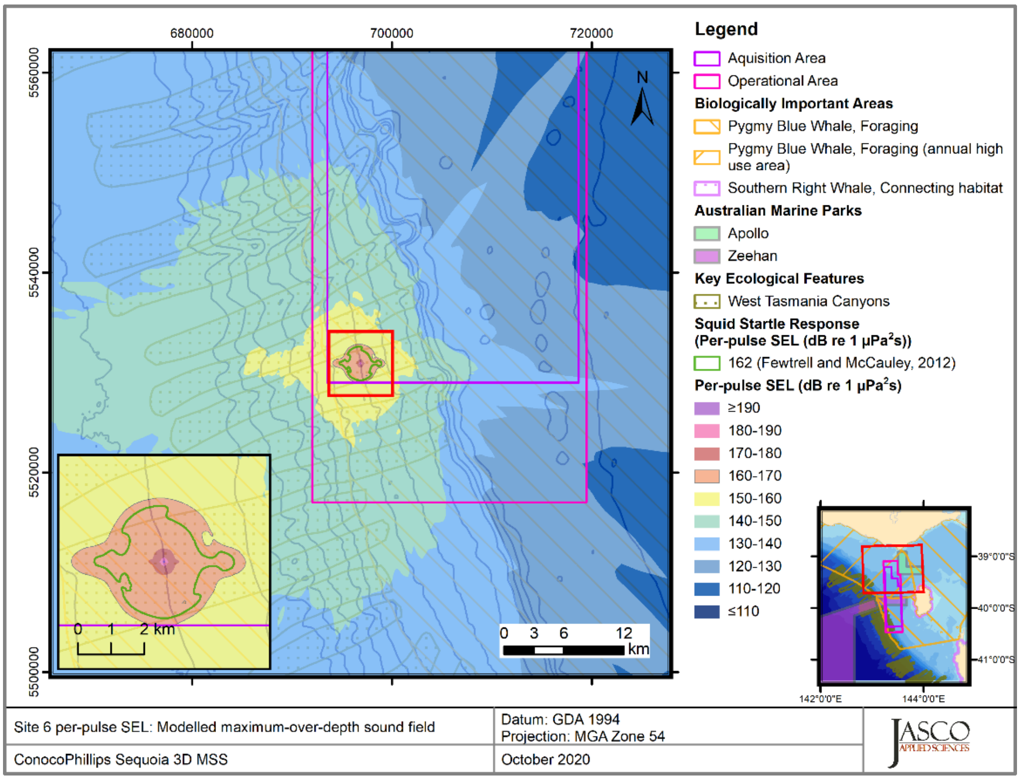


Figure E-6. Site 6, tow azimuth 0º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

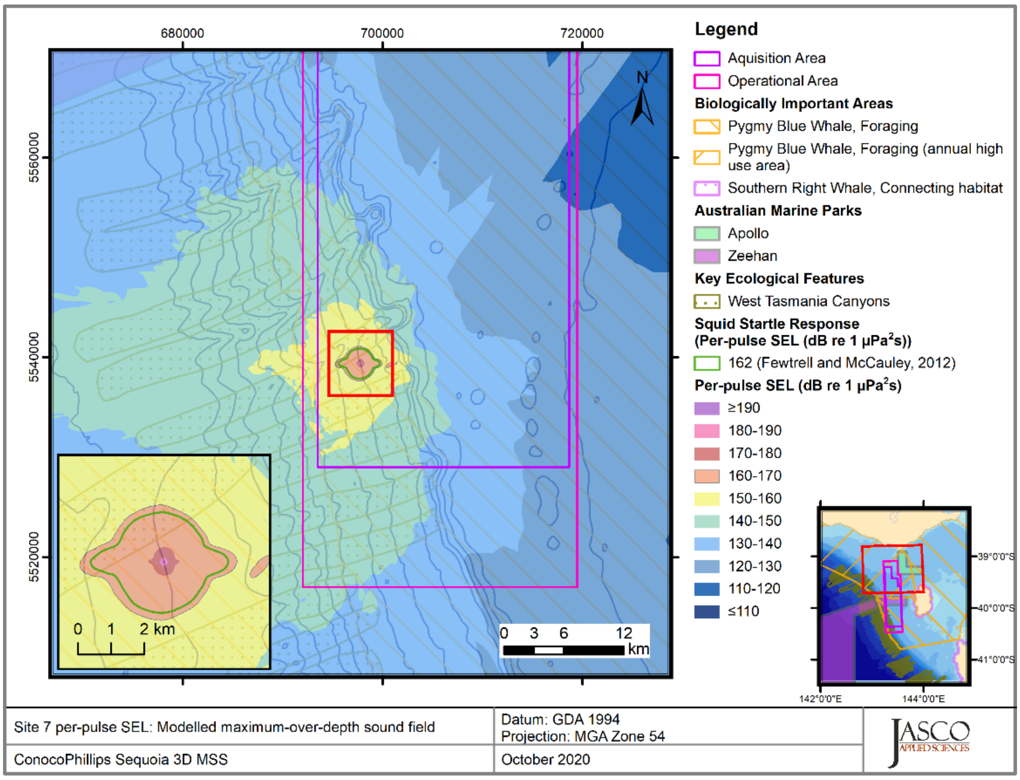


Figure E-7. Site 7, tow azimuth 0º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

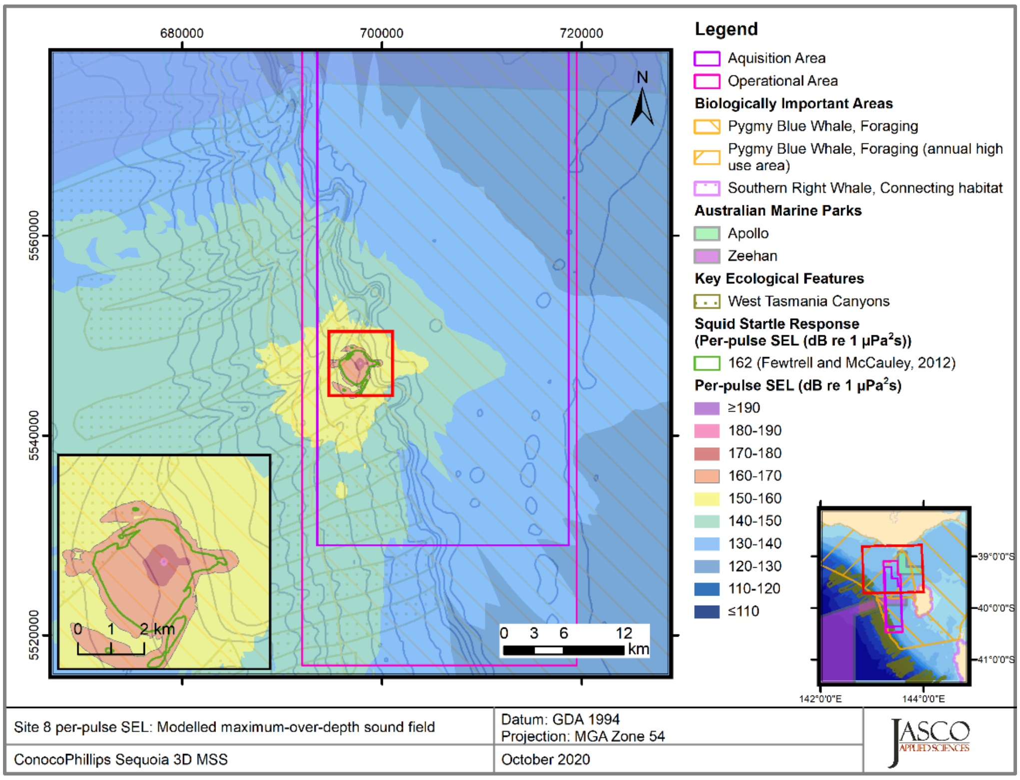


Figure E-8. Site 8, tow azimuth 0º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

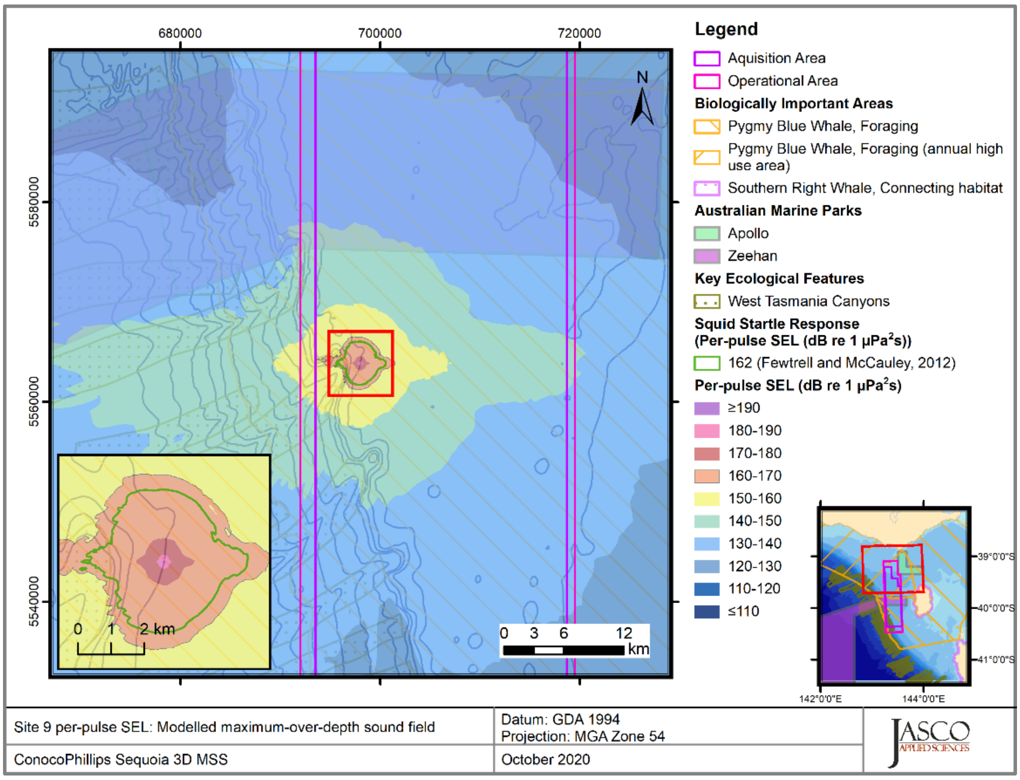


Figure E-9. Site 9, tow azimuth 0º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

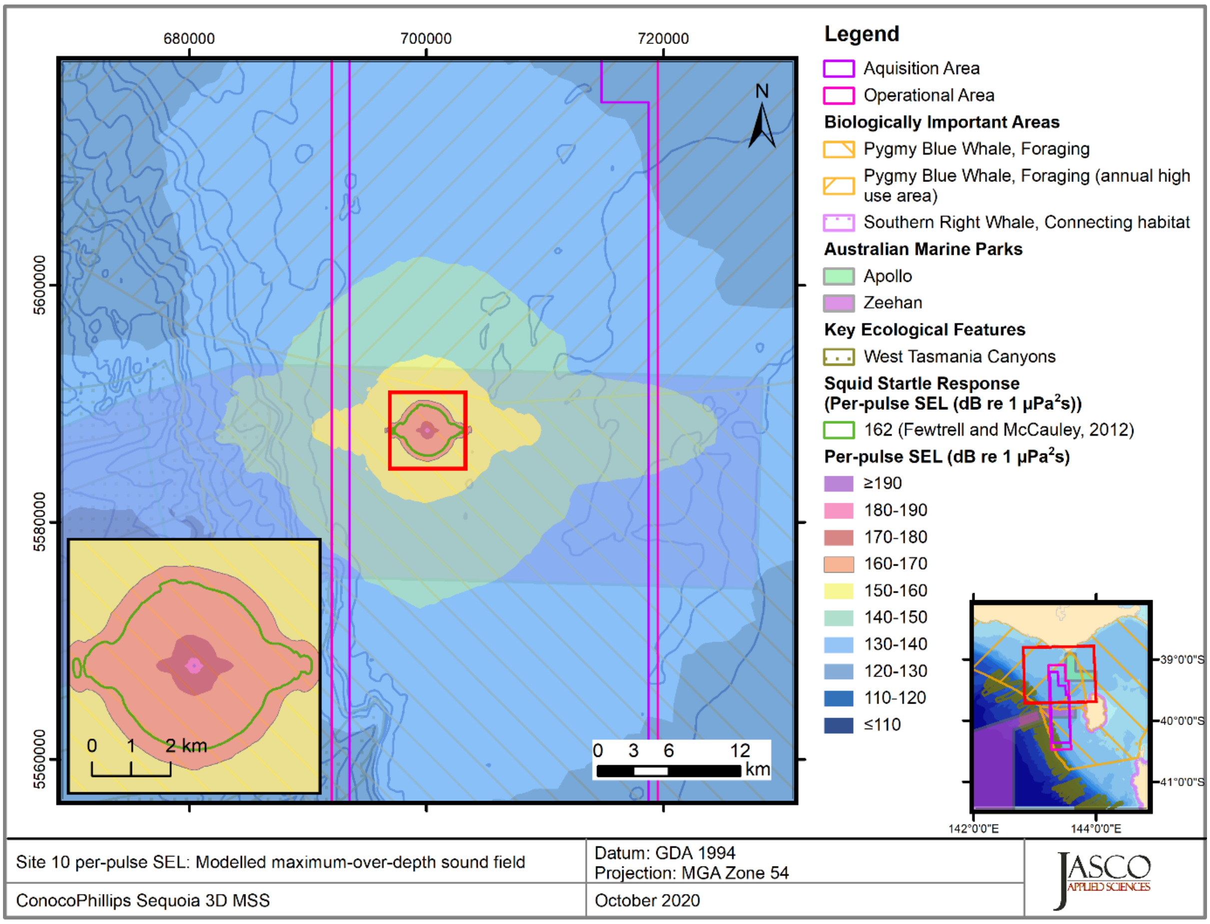


Figure E-10. Site 10, tow azimuth 0º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps.

Unit 1, 14 Hook Street
Capalaba, Queensland, 4157

Tel: +61 7 3823 2620
www.jasco.com

Sequoia 3D MSS Preliminary Results

DATE: 13 July 2021

FROM: Steven Connell, Jorge Quijano, and Craig McPherson (JASCO Applied Sciences (Australia) Pty Ltd)

TO: Rowan Hutson (ConocoPhillips)

Subject: Acoustic modelling preliminary results for the Sequoia 3D MSS

1. Results

1.1. Tabulated Results

Table 1. Maximum (R_{max}) horizontal distances from Site 11 (in km) from the 3480 in^3 array to modelled maximum-over-depth peak pressure level (PK) thresholds based on the NOAA Technical Guidance (NMFS 2018) for marine mammals

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Site 11 (Depth 97 m)	
		Max distance R_{max} (km)	Towards Vic Coast R_{max} (km)
Low-frequency cetaceans (PTS)	219	0.03	0.03
Low-frequency cetaceans (TTS)	213	0.07	0.07

A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

Table 2. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3480 in^3 source to modelled maximum-over-depth SPL isopleths from the modelled single impulse site11, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 11 (Depth 97 m)	
	R_{max}	$R_{95\%}$
200	0.06	0.06
190	0.24	0.22
180	0.70	0.612
170	1.95	1.82
160[A]	5.14	4.57
150	14.2	11.5
140	37.1	26.4
130	58.5	51.4

A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

[A] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).

Table 3. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 3480 in^3 source to modelled maximum-over-depth SPL isopleths from the modelled single impulse site11, with water depth indicated.

SPL- Weighted (L_p; dB re 1 µPa)	Site 11 (Depth 97 m)	
	R_{max}	$R_{95\%}$
200	0.02	0.02
190	0.12	0.12
180	0.46	0.40
170	1.28	1.08
160	3.60	2.97
150	10.6	8.28
140[B]	28.0	21.6
130	56.1	45.6

[B] Marine mammal behavioural threshold for impulsive sound sources (Wood et al. 2012)

Table 4. *Low-frequency cetaceans*: Estimated largest horizontal distances (in km) to stated transects from the survey lines to permanent threshold shift (PTS) and temporary threshold shift (TTS) thresholds considering 24 h of survey activity.

Scenario		**Horizontal Distance (km)**	
	Weighted SEL thresholds ($L_{E,24h}$; dB re 1 µPa²·s)	**North towards Victorian Coastline**	**East towards King Island**
1	168	11.7	25.4
2	168	6.4	25.9

5.2.2. Sound field maps

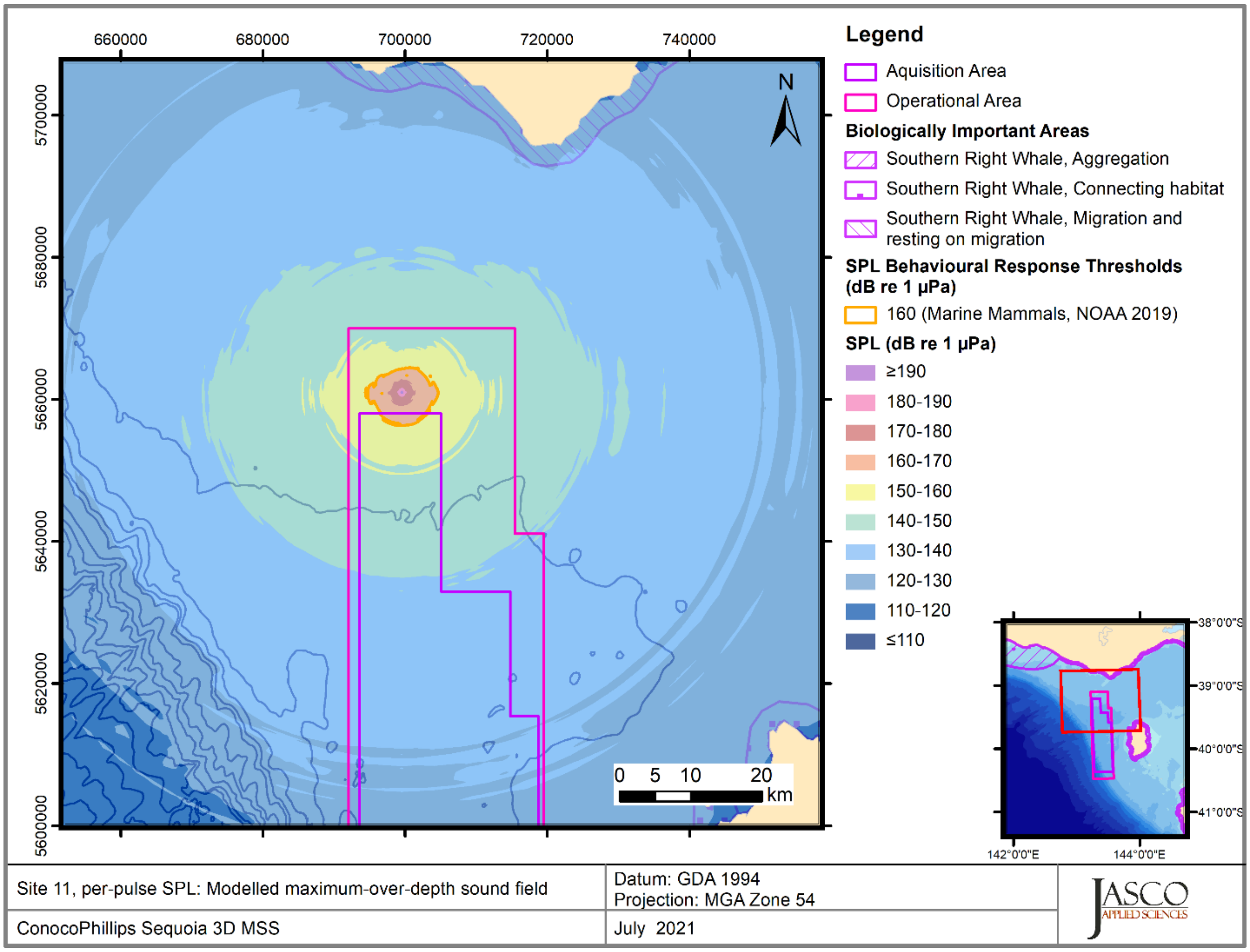


Figure 1. *Site 11, tow azimuth 0º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals.

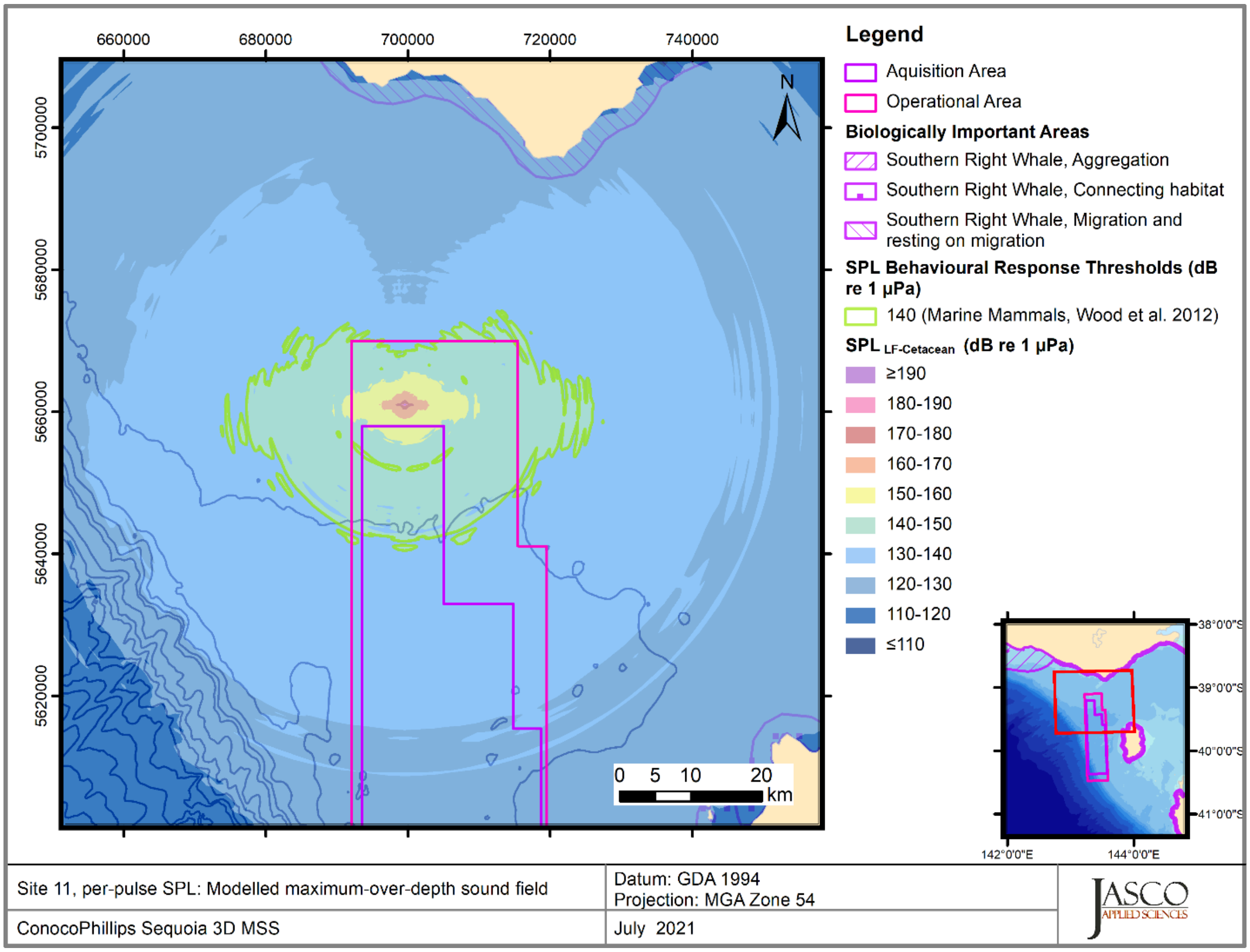


Figure 2. *Site 11, tow azimuth 0º, SPL-Weighted*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals.

Update to ConocoPhillips
on the
Project Sequoia Marine Seismic Survey

Prepared by the

South East Trawl Fishing Industry Association

29 October 2020 Version4.0

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1. EXECUTIVE SUMMARY

Preamble:

1. ConocoPhillips Australia SH1 Pty Ltd (COP Sequoia) proposes to undertake a three-dimensional (3D) Marine Seismic Survey (MSS) west of King Island in exploration permit T/49P called Project *Sequoia* (Figure 1).
2. Access to this permit was previously granted to 3D Oil. 3D Oil engaged SETFIA (the South East Trawl Fishing Industry Association) to prepare a fisheries report for their MSS called Project *Dorrigo* in August 2018, which described the data from fisheries that overlapped with the MSS area using data to end calendar year 2017.
3. COP *Sequoia* has since taken over operations in T/49P from 3D Oil (who remains a joint-venture partner) and have modified (slightly reduced) the proposed MSS area.
4. COP *Sequoia* engaged SETFIA to update the summary table (Table 2) and executive summary of the previous report based on the modified operational area and the most recent (but also historical) fishing catch and effort data.
5. Although now smaller, the Project *Sequoia* operational area extends further north into Victoria's jurisdiction than the proposed Dorrigo MSS did.

Limitations:

The data in this report provides information on the fisheries and sectors that operate in and around the MSS operational area, and an assessment of the overlap of the MSS operational area and these fisheries with respect to catches and value. The collection of fisheries catch and effort data is not necessarily designed to provide information to relatively fine spatial scales. Thus, for the purposes of this report, there are a number of limitations, including:

- The Victorian and Tasmanian fisheries use a system of relatively large "reporting grids" to record the spatial extent of commercial fishing catch and effort. As a result, the methods used to calculate the overlap with Victorian and Tasmanian fisheries may over-estimates the catch and revenue attributed to the MSS operational area.
- The location of otter trawl effort is reported as a start set location and end set (or haul) position. While vessel monitoring systems (VMS) track the actual path of each shot, VMS data are not made publicly available. The only way to "capture" a tow path from the logbook data is to draw a line between the start and end points. From our experience otter trawlers often tow in a straight line along the depth contour. The shelf break in the south-west corner of the area of operation does run in an approximately straight line in a NNW to SSE direction (Figure 4). Given the above, overlap with Commonwealth fishing operations were included if any part of straight line drawn between the start and end points crossed the MSS area.
- Overall, the "*potential impact'* of the MSS operational area is calculated as the overlap of those areas with the landed commercial catch (and estimated revenue) taken within that same area (see Figure 1) by both state and Commonwealth fisheries. Based on the two points above, our estimates of the "potential impact" may not equate to the "actual impact" on catches and revenue, and are likely to be overestimated.
- In the previous report for Project *Dorrigo*, Tasmania issued data in 1-degree blocks rather than their smaller reporting grids, increasing the overestimation of catch and effort, while

for this Project *Sequoia* data request, data was only filtered for the overlapping reporting grids. This adds to the potential to overestimate the reported catch and revenue of MSS overlap with Tasmanian fisheries.

- Inshore species caught by the Tasmanian Scalefish Fishery generally inhabit waters shallower than the MSS area. Thus, most fishing in the Scalefish Fishery is unlikely to overlap with the MSS operational area. The exception is for holders of a Rock Lobster licence that also have a wrasse fishing licence. The two species of wrasse caught, Purple Wrasse (*Notolabrus fucicola*) and Bluethroat Wrasse (*Notolabrus tetricus*), are typically associated with shallow reefs but can inhabit wasters down to 90 m and 160 m respectively. However, this fishery sells live fish, and to reduce the chance of death through barotrauma, the fishery mainly operates in shallow water.
- Fish prices were updated with minor increases and decreases. Crab and lobster (pre-Covid) prices increased by 15% in the more recent report.
- Generally, methods used in this report present a more accurate representation of the potential impact to fisheries than the previous report for Project *Dorrigo*. See more details in the section titled “Variance between the 2020 Sequoia and 2018 Dorrigo report”.

Findings:

The MSS operational area (Figure 1) overlaps with fisheries across three management jurisdictions:

A. Commonwealth – managed by the Australian Fisheries Management Authority (AFMA);

B. Tasmania – managed by the Department of Primary Industries, Parks, Water and Environment (DPIPWE) Sea Fishing & Aquaculture; and,

C. Victoria – managed by the Victorian Fisheries Authority (VFA).

There are eight fisheries that would, to some extent, be potentially impacted by Project Sequoia. This report determines and ranks the magnitude of impact by gross fishery revenue and estimated catch within the operational area (Table 2) and also indicates the seasonality for each fishery. By order of potential annual impact these are:

1. Victorian Rock Lobster Fishery (Victoria) - revenue of $1,280,000, catch of 13.0 t or 5.2% of the fishery’s total annual catch ($641,000 based on beach prices during the Covid-19 pandemic). Catches of Southern Rock Lobster by the Victorian Rock Lobster Fishery (for the whole State) are generally highest from December to January or February (Figure 7);
2. Tasmanian Giant Crab Fishery (Tasmania) - revenue of $737,063, catch of 7.4 t or 39% of the fishery’s total annual catch ($553,000 based on beach prices during the Covid-19 pandemic). Seasonal data for the operational area cannot be provided to maintain confidentiality, however catches across the entire Fishery are highest during January to March (Figure 8);
3. SESSF Commonwealth Trawl Sector (SESSF, Commonwealth) - revenue of $322,000, catch of 79 t or 1% of the fishery’s total annual revenue. Otter trawl catch from the MSS operational area is highest in March and November and lowest in June, April and December (Figure 9);

4. Tasmanian Rock Lobster Fishery (Tasmania) - revenue of $238,154, catch of 2.4 t or less than 1% of the fishery's total annual catch ($119,077 based on beach prices during the Covid-19 pandemic); Seasonal data cannot be provided to maintain confidentiality, however looking at the State-wide data (Figure 10), most catch in the fishery is taken during December to April;
5. Victorian Giant Crab Fishery - revenue of $161,000, catch of 2.4 t or 16.3% of the fishery's total annual catch ($121,000 based on beach prices during the Covid-19 pandemic);
6. SESSF GHaT Shark Gillnet sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF, Commonwealth) - revenue of $38,900, catch of 6.3 t or 1% of the fishery's total annual revenue.
7. SESSF Commonwealth Scalefish and Shark Hook sectors (SESSF, Commonwealth) - revenue of $37,200, catch of 5.2 t or <1% of the fishery's total annual revenue.

Variance between the 2020 Sequoia and 2018 Dorrigo report:

The value of impact **increased** by $179,000 in the most recent analysis. Significant changes included:

- Commonwealth data (three GHaT fisheries and CTS Trawl) increased because of the method used to filter catch and effort data. The previous report (*Dorrigo*) filtered data to retain recorded data with either a start or end point that was within the area of operation. This method misses fishing effort that starts and ends outside of the area of operation, but that travelled through it. Examination of maps of effort revealed that there was significant effort on the shelf break that passed through the area of operation. To capture these records, a straight line was drawn between start and end points, and data was filtered to retain records that in any way overlapped the area of operation. The use of straight lines joining start and end points was appropriate given they generally follow the depth contours, and depth contours in this area are relatively straight in a south-south-east to north-north-west direction.
- Victorian Rock lobster (250% increase) and Victorian giant crab (794% increase) catch impacts both increased significantly due to the modified MSS operational area that extends further into Victorian fisheries jurisdiction.
- Tasmanian giant crab data increased 54% because the data provided for Project *Dorrigo* was aggregated by 1-degree block. One of those blocks contained data from less than 5 vessels and so was confidential and therefore the catch from that area was not reported. For Project *Sequoia*, data was provided at a finer spatial scale, and then aggregated across all overlapping grids. This enabled inclusion of catch that was confidential in the Project *Dorrigo* report. The increase is mostly due to the inclusion of catch from that area in this report.
- Tasmanian rock lobster data decreased 84% because the data provided for Project *Dorrigo* was provided in blocks larger than the reporting grids, and so overestimated the catch. Data included in this report comprises only reporting grids requested.
- Data presented in this report presents a more accurate representation of the potential impact to fisheries than the previous report for Project *Dorrigo*.

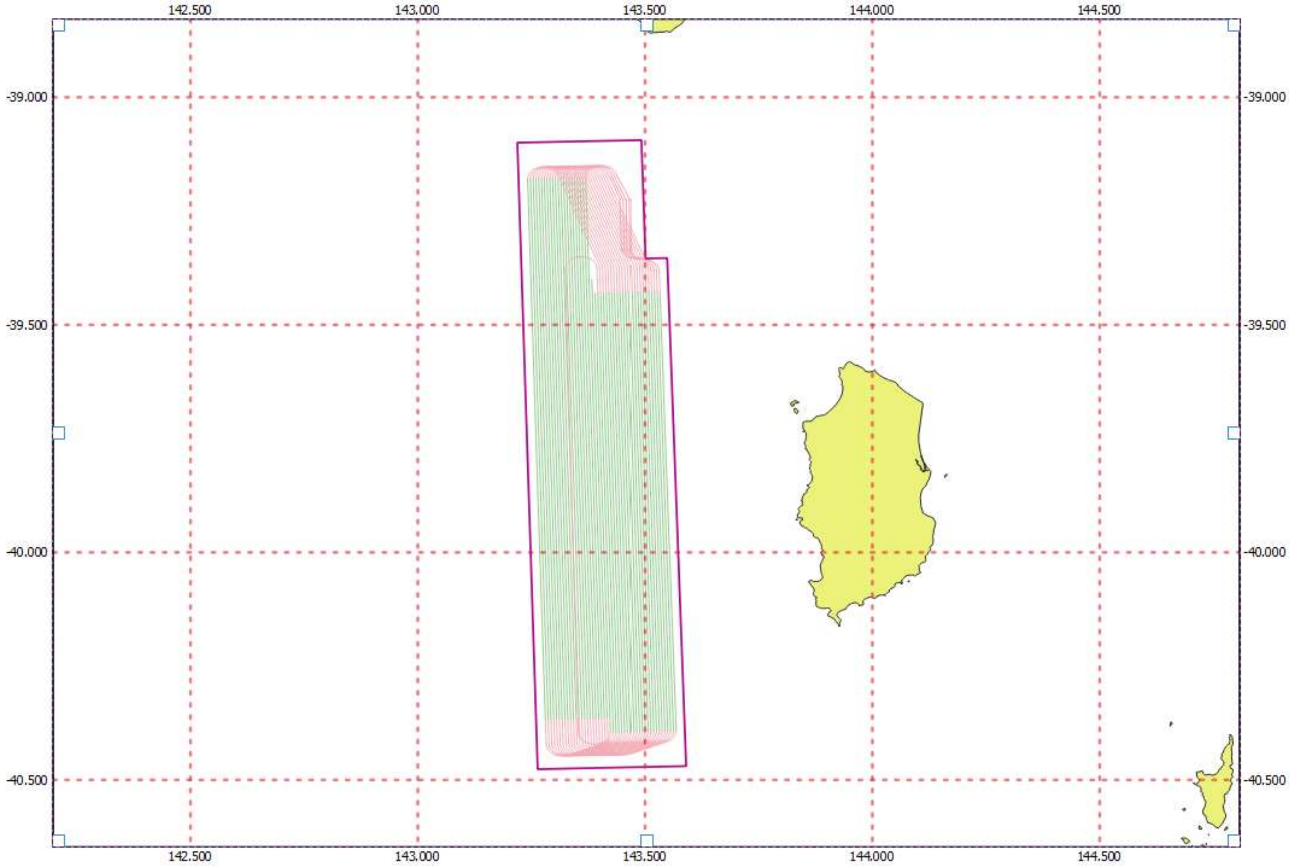

Figure 1. The Project Sequoia tow lines (green lines) and operational area (purple outline).

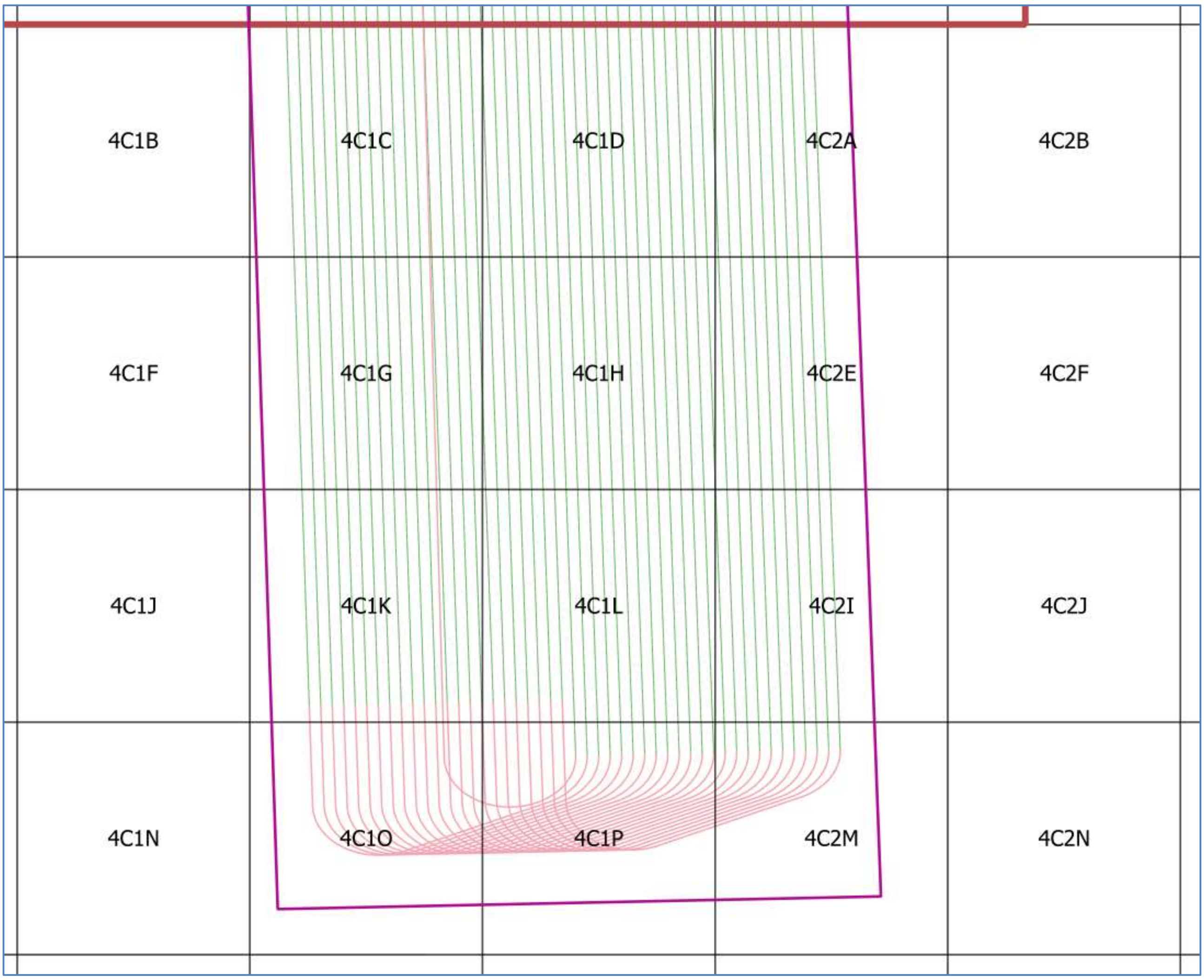

Figure 2. The Project Sequoia tow lines (green lines) and operational area (purple outline) and overlapping Tasmanian reporting grids.

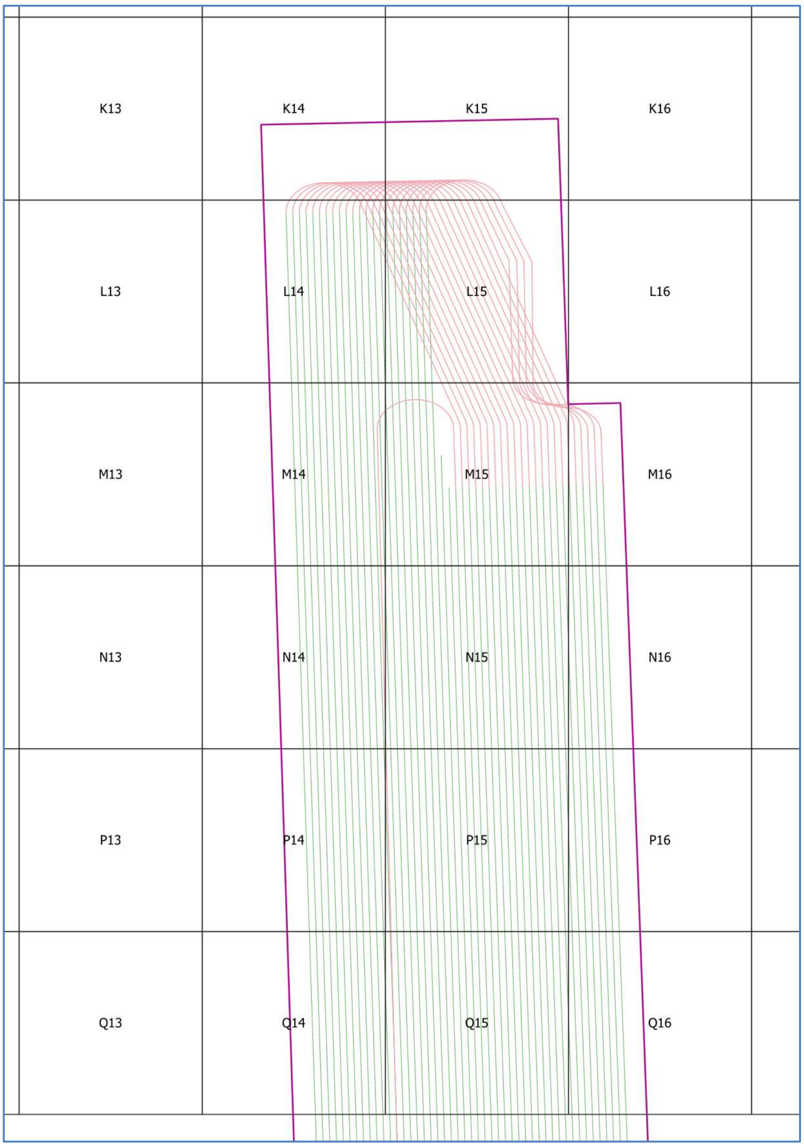

Figure 3. The Project Sequoia tow lines (green lines) and operational area (purple outline) and overlapping Victorian reporting grids.

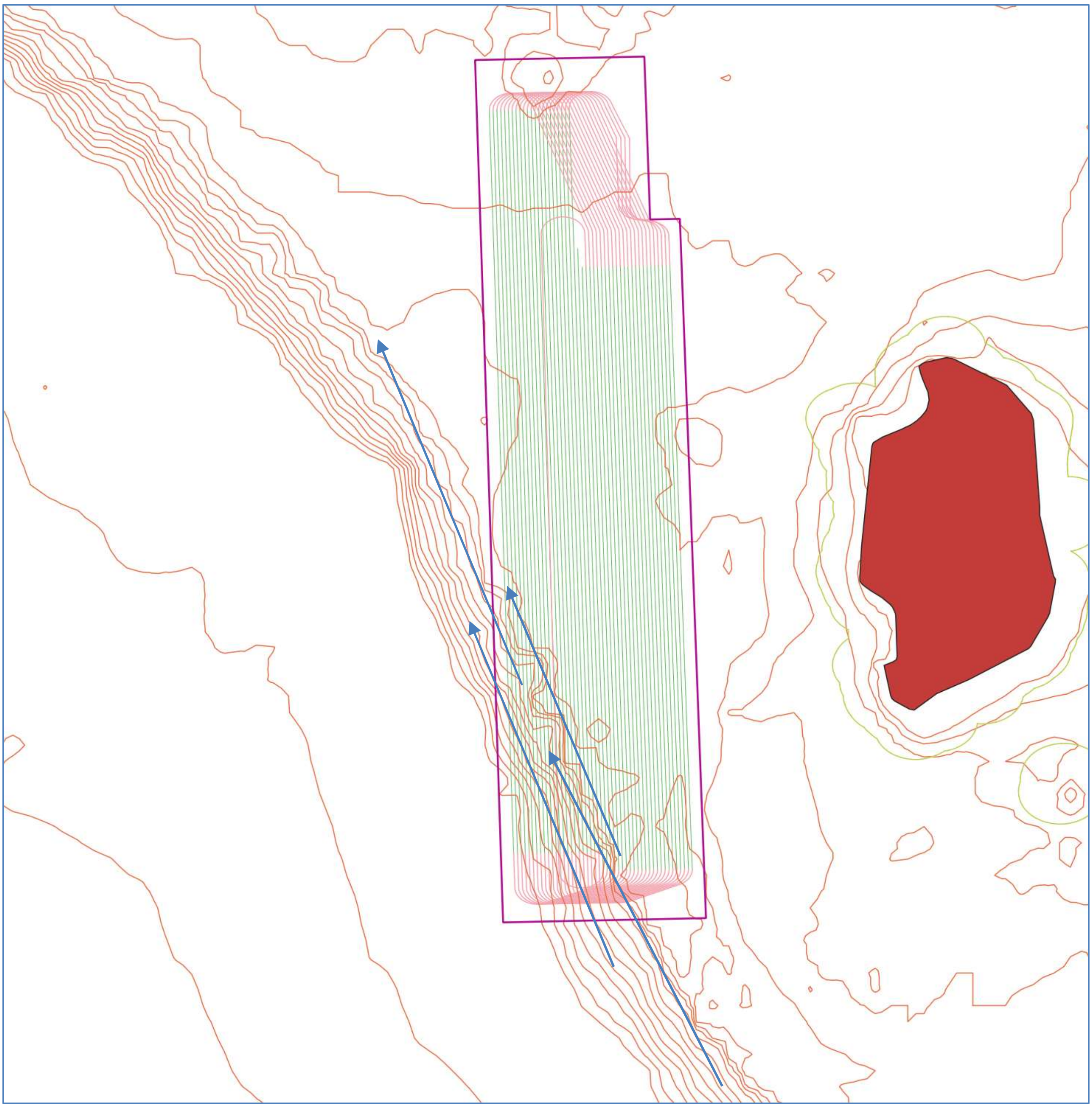

Figure 4. The Project Sequoia tow lines (green lines) and operational area (purple outline) showing examples of trawl effort that were retained by the data filter (blue arrows).

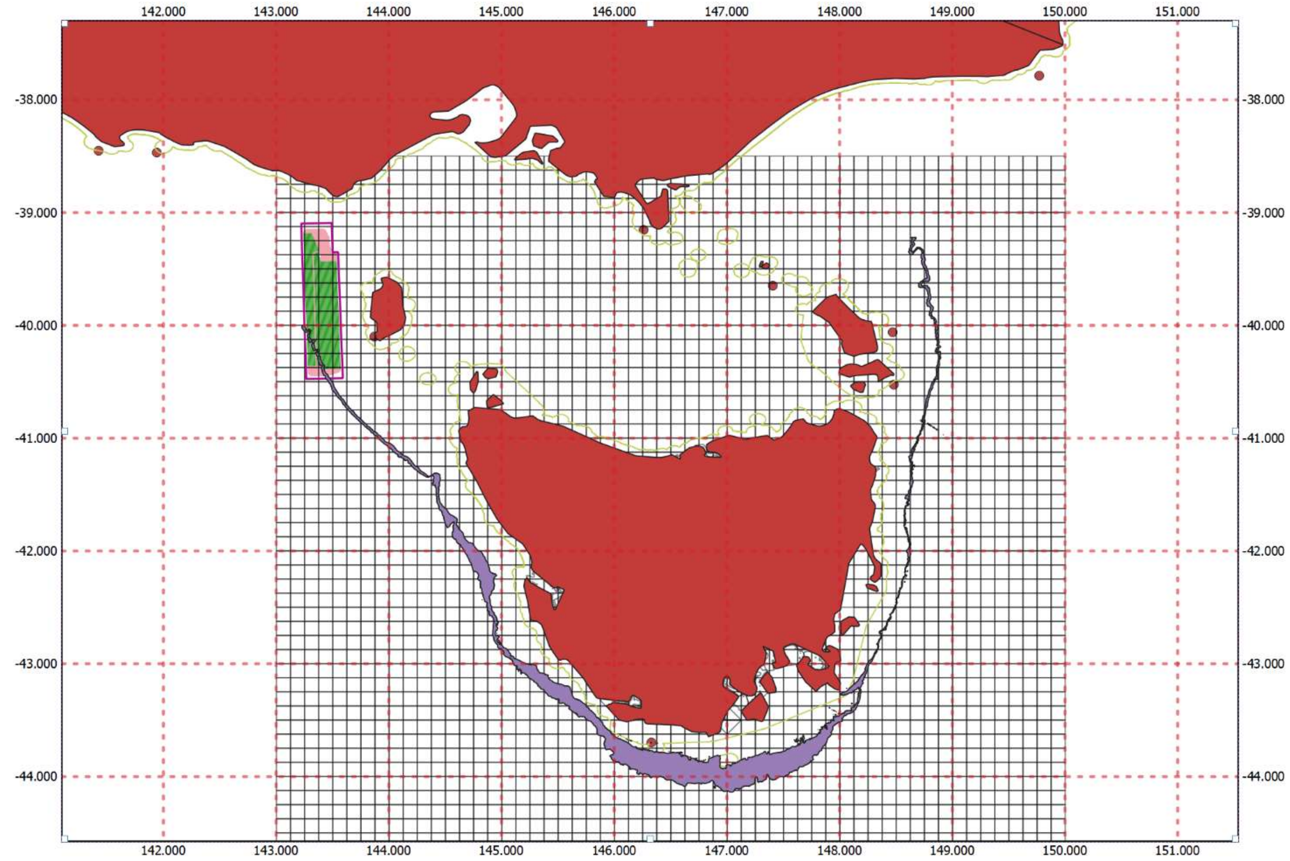

Figure 5. Tasmanian Giant Crab habitat in relation to the area of operation.

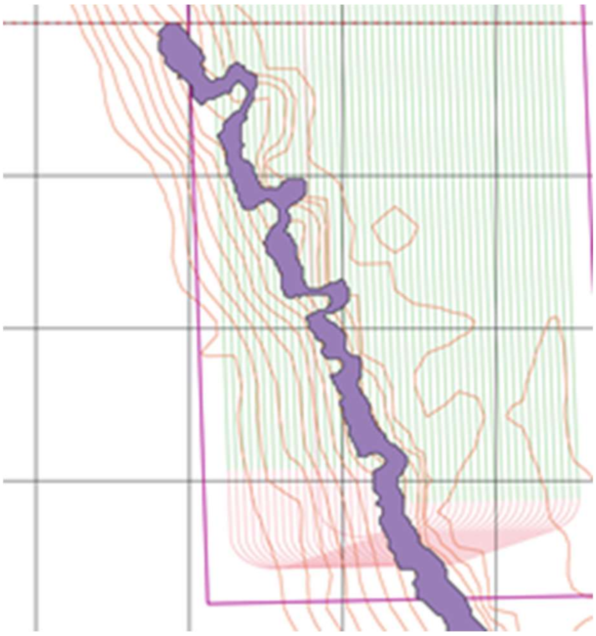

Figure 6. Reporting grids that overlap with Giant Crab habitat in relation to the area of operation.

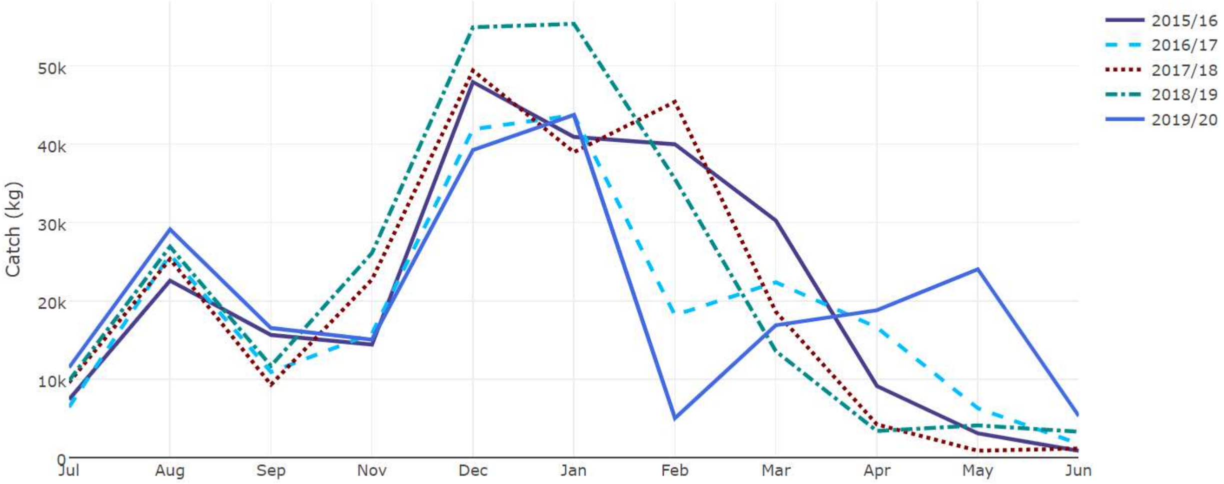

Figure 7. Monthly catch of Southern Rock Lobster by the Victorian Rock Lobster Fishery by year in the western zone[1].

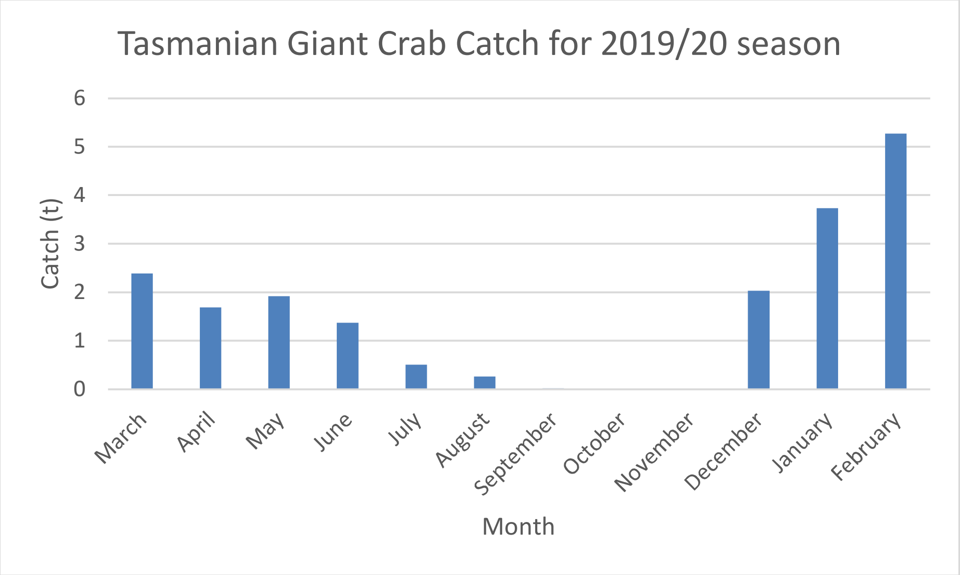

Figure 8. Monthly catch of Giant Crab by the Tasmanian Giant Crab Fishery for 2019/20[2].

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[1] https://vfa.vic.gov.au/commercial-fishing/rock-lobster/interactive-stock-assessment-report/western-zone

[2] https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/giant-crab-fishery/giant-crab-catch

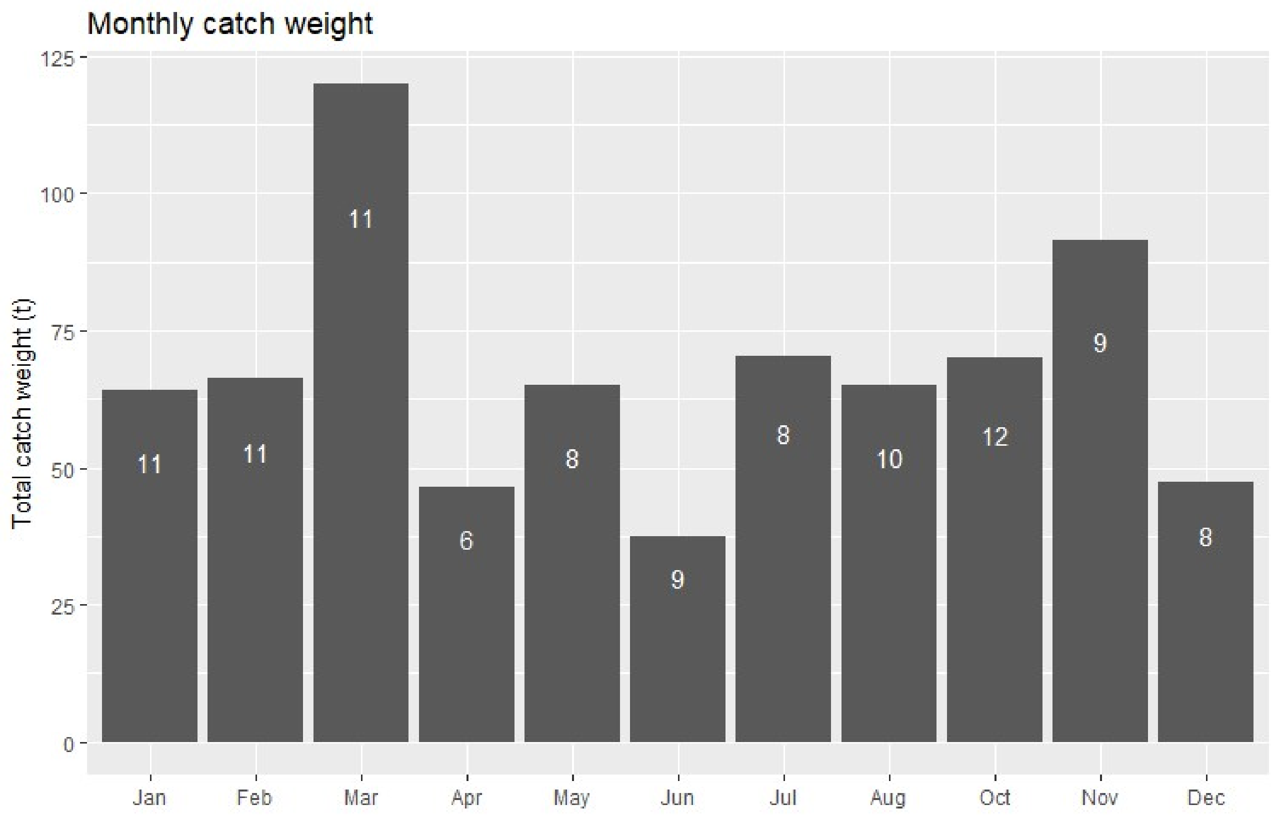

Figure 9. Monthly total catch by otter trawl in the operation area from July 2010 to Jun 2020.

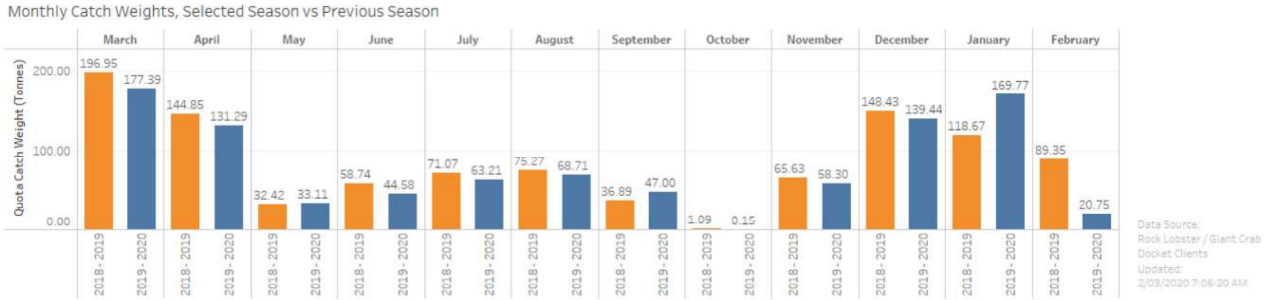

Figure 10. Monthly catch of Southern Rock Lobster by the Tasmanian Rock Lobster Fishery by year[3].

Table 1. Seasonality of fisheries showing seasonal closures (red), low to medium effort (orange) and high effort (green)

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Victorian Rock Lobster	🟩	🟩	🟩	🟩	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟥	🟥	🟥	🟥	🟩	🟩	🟩
Tasmanian Gant Crab	🟩	🟩	🟩	🟩	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟥	🟥	🟥	🟥	🟥	🟥	🟧	🟩	🟩
CTS otterboard trawl	🟩	🟩	🟩	🟩	🟩	🟩	🟧	🟧	🟩	🟩	🟧	🟧	🟧	🟧	🟧	🟧			🟩	🟩	🟩	🟩	🟧	🟧
Tasmanian rock lobster fishery	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟥	🟥	🟥	🟥	🟥	🟧	🟩	🟩
Vic giant crab				**C**	**o**	**n**	**f**	**i**	**d**	**e**	**n**	**t**	**i**	**a**	**l**			🟥	🟥	🟥	🟥			

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[3] https://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/rock-lobster-fishery/rock-lobster-catch

Table 2 Summary of affected fisheries (some figures rounded)

Fishery (by impact)	**Effort (footprint)**	**Jurisdiction**	**10 yr. average catch in Operational area**	**Fishery TAC 2019**	**Fishery catch most recent year**	**% of catch potentially impacted by Operational area**	**Annual average revenue potentially impacted (Covid reduced prices)**
			tonnes	tonnes	tonnes	%	($000's)
			A	B	C	D=A/C	=A*price
Vic rock lobster (western)	Recent	Victoria (VFA)	13.0[4]	245[5]	245[2]	5.2%	$1,280[6] ($641[7])
Tasmanian giant crab fishery	Some over last decade	Tasmania (DPIPWE)	7.4	22.6	19	39%	$737[8] ($553[9])
CTS otterboard trawl	Recent	Commonwealth (AFMA)	79	≈ 19,268[10]	7,714[11]	1%	$322
Tasmanian rock lobster fishery	Some over last decade	Tasmania (DPIPWE)	2.4	1,051	961	<1%	$238[12] ($119[13])
Vic giant crab	Recent	Victoria (VFA)	1.6[14]	10.5[15]	9.8[16]	16.3%	$161[17] ($121[18])
GHaT shark gillnet	Recent	Commonwealth (AFMA)	6.3	2,522[19]	1,789[20]	1%	$39
GHaT shark hook	Recent	Commonwealth (AFMA)	5.2				$37
GHaT scalefish hook	Recent	Commonwealth (AFMA)		≈ 19,268[21]	740[22]	<1%	
TOTAL			**115**	**23,119**	**11,478**	**<1%**	**$2,814 ($1,708)**

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[4] Data provided by VFA (does not include 2014/2015 data which was missing due to confidentiality issues)
[5] 2018/2019 TACC for the Western Zone https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production#fp-srl-year
[6] Based on $100/kg for Rock Lobster and $10.5/kg for Octopus bycatch
[7] Based on the price during the Covid-19 pandemic - $50/kg and $10.5/kg for Octopus bycatch
[8] Based on industry estimate of $100/kg
[9] Based on industry estimate of $75/kg during the Covid-19 pandemic. Beach prices were not as affected by the pandemic as Southern Rock Lobster
[10] Combined 2018-19 total for 27 SESSF fish stocks mostly caught by the CTS
[11] Total 2018-19 CTS and Scalefish Hook catch minus Scalefish hook catch. 8,454 t-740 t from https://www.agriculture.gov.au/abares/research-topics/fisheries/fishery-status/trawl-scalefish-hook-sectors#91-description-of-the-fishery
[12] Based on $100/kg for Rock Lobster
[13] Based on the price during the Covid-19 pandemic - $50/kg
[14] This is the average "overestimation" of Giant Crab catch from the area of interest calculated by subtracting catch by the Rock Lobster Fishery from catch by asll fisheries in the area of interest. This catch will include some other species including Velvet Crab from the Commercial Permit issued for that species, Banded Ling, Southern Rock Lobster, School Shark and Striped Trumpeter from the Giant Crab Fishery and Conger Eel, Unspecified Eel, Leatherjacket, Gummy Shark, School Shark, Snapper, Striped Trumpeter and Unspecified Wrasse from the Rock Lobster Fishery. It is likely that this overestimation is close to the actual weight as byproduct in the Giant Crab Fishery is considered "negligible" (https://www.environment.gov.au/system/files/pages/b676dcfc-7165-4fbd-812b-013c75357b4c/files/assessment-2016.pdf), and by-product in the Rock Lobster Fishery is considered "low" (https://www.environment.gov.au/system/files/pages/41d461ff-6187-4ffd-ba73-bbc39dcd4334/files/vic-rlf-assessment-2016.pdf)
[15] 2018/2019 https://vfa.vic.gov.au/commercial-fishing/commercial-fish-production#fp-srl-year
[16] 2018/2019 https://vfa.vic.gov.au/__data/assets/pdf_file/0004/596866/FINAL_GC_ASSESS_1819.pdf
[17] Based on industry estimate of $100/kg
[18] Based on industry estimate of $75/kg during the Covid-19 pandemic. Beach prices were not as affected by the pandemic as Southern Rock Lobster
[19] School shark and gummy quota 2017/18
[20] https://www.agriculture.gov.au/abares/research-topics/fisheries/fishery-status/shark-gillnet-shark-hook-sectors#121-description-of-the-fishery
[21] Combined 2018-19 total for 27 SESSF fish stocks mostly caught by the CTS
[22] 2018/2019 https://vfa.vic.gov.au/__data/assets/pdf_file/0004/596866/FINAL_GC_ASSESS_1819.pdf

Final Report to 3D Oil
on
Dorrigo Marine Seismic Survey

Prepared by the

South East Trawl Fishing Industry Association

2 August 2018

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1. EXECUTIVE SUMMARY

A list of potentially affected fisheries was provided to 3D Oil at the beginning of the project to assist in their preliminary discussions with the fishing industry.

Data requests were then submitted to three fishery management agencies. This data was analysed and showed that there are nine fisheries that are potentially affected by the 3D Oil Seismic survey (shown in Table 1). Two Tasmanian, two Victorian and five Commonwealth fisheries. They are, in order of potential impact:

1. Tasmanian rock lobster fishery
2. **Tasmanian giant crab fishery**
3. Vic rock lobster (western)
4. Vic giant crab
5. Commonwealth CTS otterboard trawl
6. Commonwealth CTS Danish Seine
7. Commonwealth GHaT shark gillnet
8. Commonwealth GHaT shark hook
9. Commonwealth GHaT scalefish hook

The total estimated annual port value of these fisheries is $2.6m

The total estimated annual tonnage of potentially impacted annual catch from these fisheries is 94 tonnes.

A key metric when considering the potential impact on fisheries is the % of the catch coming from within the area proposed for the seismic survey (stated in Table 1 column titled, "% of annual average catch potentially impacted"). This metric indicates that the **Tasmanian Giant Crab fishery** (embolden in Table 1**)** will require the most consultation in order to reduce the affects of the proposed survey on that fishery.

The remaining eight fisheries are important and individual operators may be affected on a localised basis but the affect across these fisheries in their entirety is low.

A list of industry associations representing these fisheries and a more extensive (but not exhaustive) list of commercial fishers from these fisheries who might be affected are contained in this report.

SETFIA is currently involved in consultation around four seismic surveys and has been involved in assessing and reducing impacts in many othe projects. This Dorrigo project is the least impactful of these four current proposals. The Association notes the effort and good faith in which 3D Oil has conducted itself to date in making genuine attempts to reduce impacts on the fishing industry.

Table 1 Summary of affected fisheries (some figures rounded)

Fishery (by impact)	**Effort (footprint)**	**Jurisdiction**	**Annual average catch potentially impacted**	**Fishery TAC most recent year**	**Fishery catch most recent year**	**% of annual average catch potentially impacted**	**% of TAC caught**	**Annual average catch potentially impacted**
			tonnes	tonnes	tonnes	%	%	($000's)
			A	B	C	=A/C	=C/B	=A*price
Tasmanian rock lobster fishery	Some over last decade (Table 12)	Tasmania (DPIPWE)	17.3 (Table 8)	1,051	1,026	2%	97%	$1,509[2]
Tasmanian giant crab fishery	Some over last decade (Table 12)	Tasmania (DPIPWE)	4.8 (Table 8)	20.7	16	25%	23%	$480[3]
Vic rock lobster (western)	<5 fishers in last decade (Table 12)	Victoria (VFA)	4.4 (Table 7)	230[1]	209[1]	2%	91%	$368[2] (96%[3])
Vic giant crab	< 5 fishers in last decade (Table 12)	Victoria (VFA)		10.5[1]	9[4]		67%	$17.6[5]
CTS otterboard trawl	Recent (Figure 45)	Commonwealth (AFMA)	57.4 (Table 4)	≈ 19,200[6]	7,318[7]	<1%	38%	$204 (Table 4)
CTS Danish Seine	Recent (Figure 45)	Commonwealth (AFMA)						
GHaT shark gillnet	Recent (Figure 45)	Commonwealth (AFMA)	9.6 (Table 5)	1,989[8]	1,690[1]	negligible	84%	$54 (Table 5)
GHaT shark hook	Recent (Figure 46)	Commonwealth (AFMA)						
GHaT scalefish hook	Recent (Figure 45)	Commonwealth (AFMA)		458[9]	270[6]		58%	
Southern squid jig	Some recent (Figure 46)	Commonwealth (AFMA)	negligible[10]	2	see note[11]	negligible	negligible	highly variable
TOTAL			**94**	**23,961**	**10,538**	**<1%**	**44%**	**$2,635**

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[1] 2016/17 (Victorian Fisheries Authority, 2017a)

[2] Based on $87/kg (Victorian Fisheries Authority, 2017a)

[3] Relative slit in catch between Victorian Rock Lobster and Victorian Giant Crab based on split across the Western Zone.

[4] 2016/17 (Victorian Fisheries Authority, 2017a)

[5] Based on industry estimate of $100/kg

[6] Combined total for 27 SESSF fish stocks mostly caught by the CTS

[7] ABARES 2014/15

[8] School shark and gummy quota 2017/18

[9] Blue eye trevalla TAC stated 2017/18 - the main target species

[10] In the past five years, there has only been a very smal amount of catch and effort recorded from within in the area of interest

[11] Given the short lifespan of squid the fishery is managed by effort controls not a TAC

Table 2 Summary of unaffected fisheries

Fishery (by impact)	Effort (footprint)	Jurisdiction	Annual average catch (tonnes)	Catch most recent year (tonnes)	TAC most recent year (tonnes)	Annual average catch ($000's)
Tasmanian scalefish fishery	Some over last decade (Table 12)	Tasmania (DPIPWE)	0	N/A	N/A	0
Small pelagic fishery	No recent (Figure 45)	Commonwealth (AFMA)	0	N/A	N/A	0
Eastern tuna and billfish	No recent (Figure 45)	Commonwealth (AFMA)	0	N/A	N/A	0
Skipjack tuna fishery	Nothing since 2008-9	Commonwealth (AFMA)	0	N/A	N/A	0
Southern bluefin	No recent (Figure 45)	Commonwealth (AFMA)	0	N/A	N/A	0
Bass Strait central zone scallop	No recent (Figure 46)	Commonwealth (AFMA)	0	N/A	N/A	0
Victorian Scallops (Ocean) Fishery	No overlap	Victoria (VFA)	N/A	N/A	N/A	N/A

2. INTRODUCTION

The Otway Basin covers an area of about 150,000 km^2 in south-east Australia (Earth Resources, 2018), extending about 500 km in length from Cape Jaff (South Australia) to the Mornington Peninsula (Victoria) (Mehin and Kamel, 2002). About 80% of the basin is offshore, basin extending out from shore to an arbitrary depth of 4,500 m (Earth Resources, 2018). The area has revealed a number of important gas discoveries, and wells have been drilled in the Otway Basin since the 1920s (Earth Resources, 2018).

The ocean waters of the Otway Basin has had a rich history of shipping, whaling and fishing since European settlement. These waters now support a range of State and Commonwealth commercial fisheries that use a variety of different fishing gears (Figure 1) including otter-board trawl, Danish seine, demersal gill nets, demersal longlines, droplines, scallop dredges and traps to target more than 15 commercial species. This commercial fishing provides fresh fish and other products mainly to local, Melbourne and Sydney markets, and are an important source of employment in Victoria and Tasmania (Figure 1).

The proposed 3D Oil Seismic Survey (the survey) area is within the West Tasmania Transition and Western Bass Strait Shelf Transition provincial bioregions within the South East Marine Region (Commonwealth of Australia, 2015). The nearest key ecological features are the West Tasmania Canyons (see Figure 9 in Commonwealth of Australia, 2015), which are located on the edge of the continental shelf from Western Victoria south to Macquarie Harbour. The closest marine protected area in the Zeehan Commonwealth Marine Reserve transects the Area of Operation.

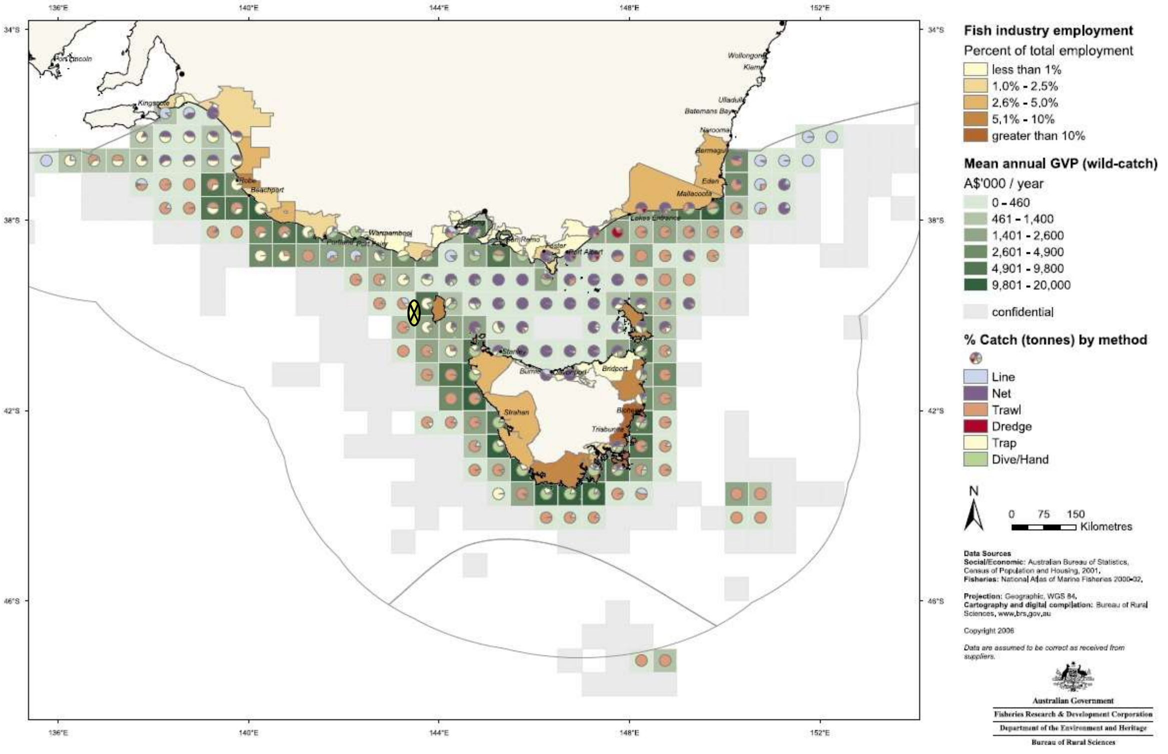

Figure 1. Fishing industry employment, mean annual gross value production from fishing and percent catch by method for south east Australia from 2000–02. From Larcombe *et al.* (2006). Approximate location of proposed seismic survey area shown as yellow balloon.

1.1. Client Brief

The 3D Oil engaged the South East Trawl Fishing Industry Association (SETFIA) to prepare a report on the proposed seismic survey and its potential impact on commercial fishing in the area. Specifically, SETFIA were engaged to provide the following:

1. A high revel review of ABARES effort data (not catch) that will give some indication of the Commonwealth sectors that fish in the proposed area. This will allow consultation 3D Oil to begin consultation with the fishing industry;
2. An immediate review and simple statement of Tasmanian and Victorian fisheries whose boundaries extend into the proposed area;
3. From formal catch and effort data requests to Tasmania, Victoria and Commonwealth fisheries managers; the commercial fishing sectors that operate in the proposed area; their catches, number of vessels and licenses, their effort and approximate revenue;
4. Information obtained by discussions with any operators who for reasons of confidentiality do not appear in the data in (3) that the project believes do fish in the relevant area;
5. An analysis and presentation in a meaningful way of commercial fishing effort and catch identified in (3);
6. The seasonality of the fishing effort identified in (3) with regard to any proposed survey timing; and,
7. The best contact points for sectors identified in (3);
8. Supporting background information on affected fishing sectors in (3) and (4);
9. An SMS notification service to affected fishers; and,
10. Report covering (3) to (8) and project management.

3. DATA REQUEST

Fisheries catch and effort figures from published reported were used if available. Data requests were sent to the, Victorian Fisheries Authority (VFA) and the Institute of Marine and Antarctic Studies (IMAS) (Hobart).

Catch and effort data for Commonwealth managed fisheries was requested from the Australian Fisheries Management Authority. Most Commonwealth managed fisheries report effort by either start or start and end position. We requested records where either the start or end position was reported from within the Area of Operation (Table 3, Figure 2). Ten Commonwealth managed fisheries or fishery sectors are permitted to operate in the Area of Operation are listed in Table 12 (and see Figure 43 and Figure 44). Of those, recent effort has been recorded in the area by the SESSF Commonwealth Trawl Sector (CTS), SESSF Scalefish Hook Sector (CSHS), SESSF Shark Gillnet Sector (CGS) and SESSF Shark Hook Sector (CHS) (Table 12, Figure 45, Figure 46). Data fields requested included trip, shot and catch data from 2008–2017. AFMA have a confidentiality policy that restricts release on data comprising of less than 5 vessels. As such, we aggregated data to as fine a level as possible so as not to break that policy, but still be able to address the scope of the work.

Table 3. Coordinates defining the Area of Operation.

Latitude	Longitude
-40.41	143.6388
-40.4181	143.1935
-39.3857	143.1656
-39.3779	143.6066

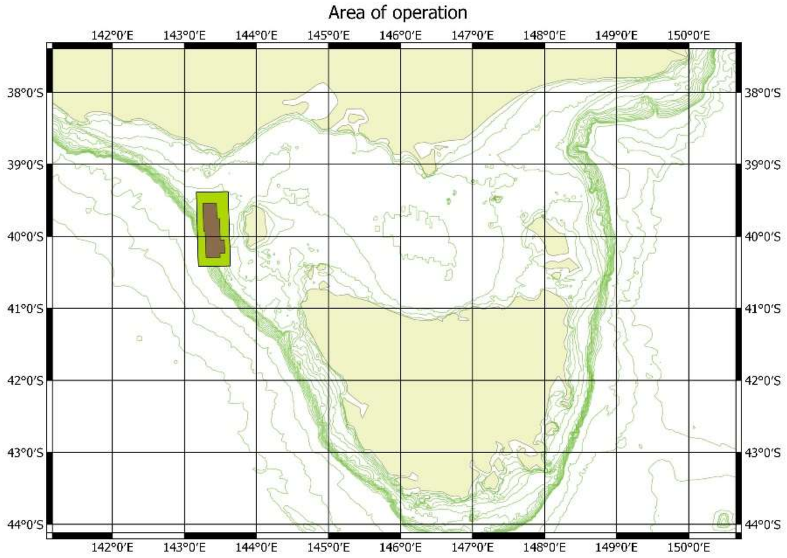

Figure 2. Data requested from AFMA included records where the start or end position was located within the Area of Operation (green polygon) from 2008–2017 (total area 4,344 km^2).

The VFA manage Victorian Fisheries. Victorian Fisheries permitted to operate in the Area of Interest are the Rock Lobster and Giant Crab fisheries, and there has been recent effort by those fisheries in the Area of Operation (Table 12, Figure 44). Those fisheries report catch and effort by 10 x 10 minutes grid areas. The VFA have a policy whereby they will not release data that is not aggregated in accordance with the 5 boat rule. Data requests submitted at too small a temporal or spatial scale risk being filtered to such course level of detail that it is not useful for management informing projects such as these. We have requested data in such a way so that as much of the data can be included, but it is aggregated in a way that can be used to address the information requirements. The following aggregations were requested for the Area of Operation and the Fold Area:

- Total annual catch by fishery and species (or summed across the 10 years if needed)
- Average annual effort by fishery (or summed across the 10 years if needed)
- Average monthly catch by fishery and species (averaged across the 10 years)
- Average monthly effort by fishery (averaged across the 10 years)

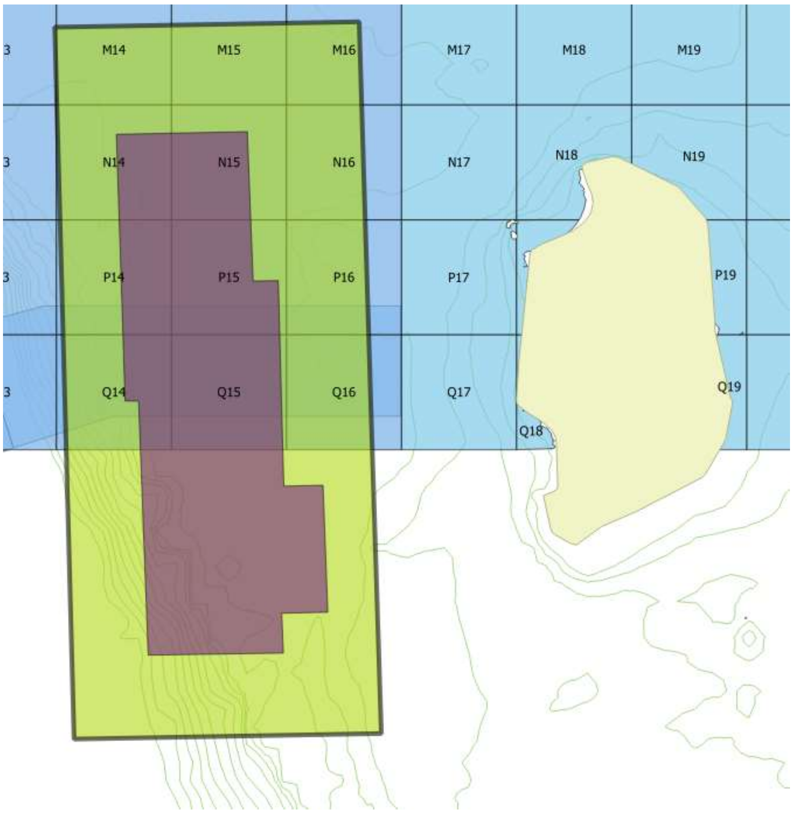

Figure 3. Data requested from VFA included records from within grid areas that overlapped with the Area of Operation(green) and Fold Area (purple) 2008–2017 (total area 3,172 km^2).

Catch and Effort reporting of Tasmanian Fisheries is undertaken by IMAS. Tasmanian fisheries permitted to fish in the area of interest include the Rock Lobster, Giant Crab and Scalefish fisheries, and there has been recent effort from all three in that area (Table 8, Table 9). Like the VFA, IMAS are reluctance to disburse raw data, and have a confidentiality policy that includes the 5 boat rule. Tasmanian fishers report catch and effort by 7.5 x 7.5 degree grids. We have requested data aggregated as for the Victorian, but for the relevant Tasmanian reporting grid areas.

Figure 4. Data requested from IMAS included records from within grid areas that overlapped with the Area of Operation(green) and Fold Area (purple) 2008–2017 (total area 2,331 km^2). Note the northern boundary of the Tasmanian fisheries is the red line.

4. DESCRIPTION OF FISHERIES

The location of the proposed seismic survey is within with areas of numerous State and Commonwealth fisheries. These fisheries use a range of fishing gear from relatively selective methods such as potting in the Rock Lobster fisheries, to less selective methods such as trawling. Species landed across the various fisheries include molluscs, crustaceans, teleosts (ray-fined fishes) and elasmobranches (cartilaginous fishes like sharks and rays).
Victorian State fisheries are managed by the newly formed Victorian Fisheries Authority (VFA), Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA), and while Tasmanian fisheries are managed by the Department of Primary Industries, Parks, Water and Environment (DPIPWE), data analysis and stock assessments for Tasmanian fisheries (DPIPWE run fisheries) are conducted by the IMAS. Commonwealth and State managed fisheries that are licensed to fish in the survey area are shown in Table 12, Figure 43 and Figure 44. Recent (2015 or 2015–16) fishing effort by 1-degree block for Commonwealth managed fisheries is shown in Figure 45 and Figure 46.

4.1. Commonwealth managed fisheries:

1. Southern and Eastern Scalefish and Shark Fishery (SESSF) which includes four sub-sectors that operate within Bass Strait:
    a. Commonwealth Trawl Sector (CTS)
        i. Otter-board trawl gear – recent effort in area (Figure 45d)
        ii. Danish seine gear – recent effort in area Figure 45c)
    b. Shark Gillnet and Shark Hook Sector
        i. Shark Gillnet – recent effort in area (Figure 45f)
        ii. Shark Hook – recent effort in area (Figure 46a)
    c. Scalefish hook – no recent effort in area (Figure 45e)

2. Southern Squid Jig Fishery – some recent effort nearby but outside of the survey area (Figure 46d)
3. Small Pelagic Fishery – no recent effort in area (Figure 46b)
4. Eastern Tuna and Billfish Fishery – no recent effort in area (Figure 45a)
5. Skipjack Tuna Fishery – there has been no fishing effort in this fishery since the 2008–09 season, and that took place of South Australia (Patterson *et al*., 2016)
6. Southern Bluefin Tuna Fishery – no recent effort in area (Figure 45b)
7. Bass Strait Central Zone Scallop Fishery – no recent effort in area (Figure 46v)

4.2. State (Victoria) managed fisheries:

8. Victorian Rock Lobster Fishery – some effort in area over past 10 years (Table 12)
9. Victorian Giant Crab Fishery – – some effort in area over past 10 years (Table 12)

4.3. State (Tasmanian) managed fisheries:

10. Tasmanian Rock Lobster Fishery – some effort in area over past 10 years (Table 12)
11. Tasmanian Giant Crab Fishery – – some effort in area over past 10 years (Table 12)
12. Tasmanian Scalefish Fishery – – some effort in area over past 10 years (Table 12).

5. DESCRIPTION OF FISHING METHODS USED IN THE SURVEY AREA

5.1. Otter-board trawl

There are two types of trawling that currently operate in eastern Bass Strait as part of the CTS: otter-board trawl and Danish seine. These are termed as “active” fishing gear because they are towed through the water to catch fish.

Otter-board trawls come in a wide variety of configurations, but the typical set up is described. Otter-board trawls are towed behind the fishing vessel using two long steel cables called “warps” (Figure 5a). Warps are set and hauled using hydraulic net drums on the deck of the vessel. At the other end, each warp is attached to an otter-board, which are large, rectangular steel ‘boards’ that are attached at an angle designed to provide the outward force needed to spread the mouth of the net. While being towed, otter-boards can spread as wide as 100–120 m. The otter-boards connect to the net via sweeps and bridles, which act to herd the fish into the wings, then the mouth of the net[12], and eventually to the cod-end. The net is widest at its mouth and tapers towards the cod-end (the closed end or bag of the net), where the fish accumulate. The vertical opening of the mouth is maintained using floats on the headline. The lower edge of the net is weighted and uses ‘bobbins’ or ‘rollers’ to help the net move across the sea bed and protect it from damage (Figure 5c). Otter-board trawls can also be fished off the bottom to target schools of pelagic fish. When used for this purpose, they are called “mid-water” trawls (Figure 5b).

CTS otter-board trawl vessels are typically 18–28 m long, weigh 50–150 tonnes and are powered by 250–700 HP engines (Figure 5d). These vessels are generally operated by a skipper and two to four crew members. The net is towed behind the boat at speeds of 2.0–3.5 knots depending on current

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[12] This report uses the term “net” to refer to the mesh part of the gear and the term “trawl” to refer to the net, headline, floats and ground gear when assembled.

and ocean conditions and the species of fish targeted. Tows (fishing time) range from very short (5–10 minutes) to several hours. Once the cod-end has been hauled aboard, it is untied, and the catch is spilled onto the deck (Tomkin, 1998) and sorted. Otter-board trawl mesh sizes vary according to target species but in eastern Bass Strait they are ≥90 mm[13].

Typical CTS otter-boards measure 3–4 m^2 in area, and weigh about 700 kg each. Warps usually comprise 16–22 mm wire cable[14] and are fished using a 1:3 ratio with depth (i.e. 100 m deep = 300 m warp length when fishing). These warps typically have a breaking strain of 14–26 tonnes (Noble, 2006). The sweeps, which connect the net to the otter-boards, typically comprise 18–20 mm wire rope with a breaking strain of 16–20 t (Noble, 2006). Ground gear can be 16 mm chain and/or 4–8 inch (100 mm-200 mm but always referred to in inches) rubber bobbins. An average set of trawl gear (net, ground gear, bridles) weighs about 1,000 kg.

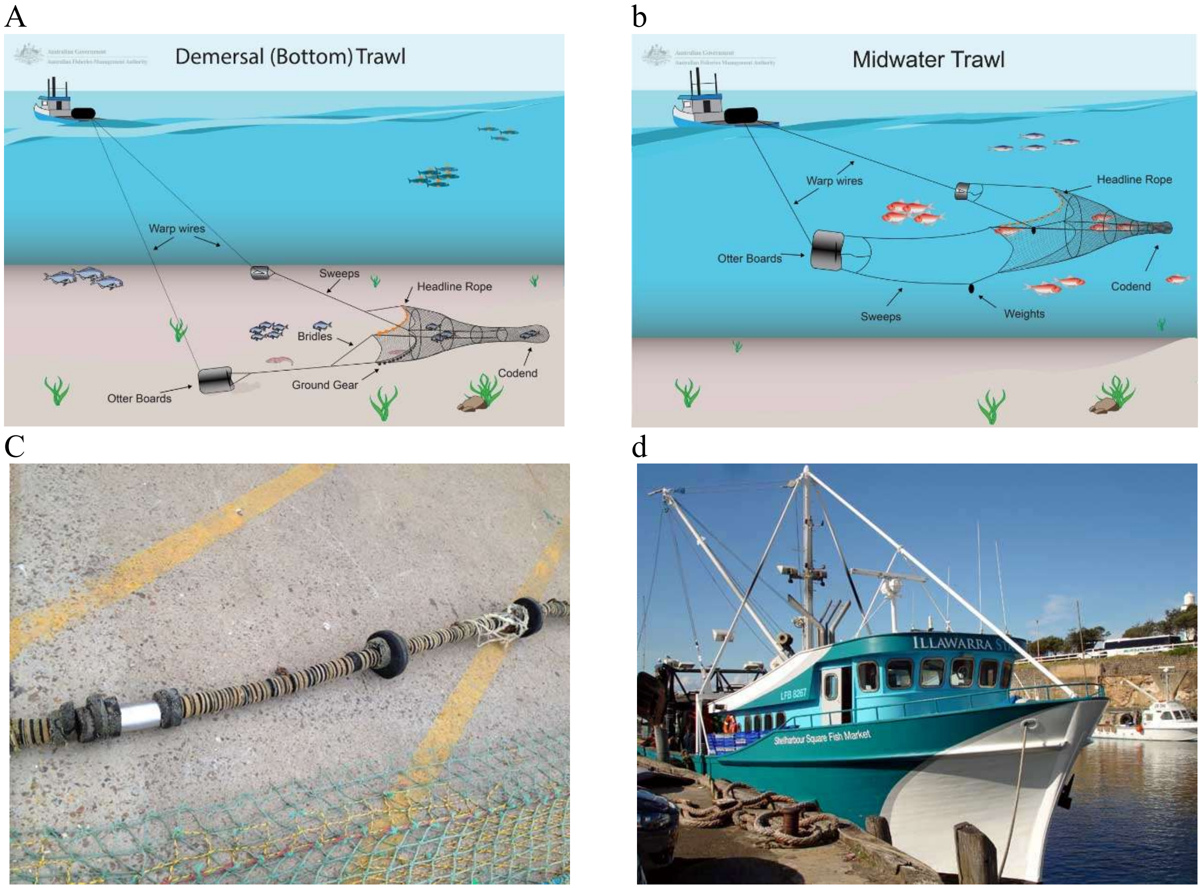

Figure 5 Illustrations of an (a) otter-board trawl (AFMA, 2018) and (b) midwater trawl and images of (c) typical trawl ground rope and (d) a typical trawl vessel.

5.2. Danish seine

CTS Danish seine vessels are typically 15–20 m long, and powered by 250–300 HP engines. They are usually crewed by one skipper and one or two deckhands (Figure 6b). Danish seine nets are conical in shape with two long wings, a bag where fish collect and warps that connect the net to the vessel and to surround an area fished (Figure 6a). Unlike otter trawls, Danish seines have no otter-boards, and they are not towed behind the boat, rather set in a circle over relatively flat sea beds and hauled slowly back to the vessel, only moving a distance of about 1 nm while it surrounds a large, pear shaped area. A Danish seine shot usually lasts around 70 minutes, and can be described by three distinct phases (Koopman *et al* 2010), setting, towing and retrieval. The setting phase of the Danish seine trawl is of much longer duration than for an otter trawl. For the first ~45 minutes of the shot the tow ropes and wings of the net are let out and the net sinks to the sea floor; the codend

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[13] Measured internally from the edge to edge of a stretched mesh.

[14] Most fishing vessels use 6*19 general purpose round strand galvanised wire rope. All breaking strains stated for otterboard trawling wire rope are for this specification unless stated otherwise.

only moves very slowly through the water during this phase. The shoulders and wings of the net are vertically flat for the first 15 minutes, before becoming concaved as the net starts to move. The towing phase is characterised by an increase in the codend speed, and therefore water flow through the net as the ropes are hauled back onto the vessel. The wings of the net are bowed over, and are being pulled forwards, as well as being drawn in towards the opposite wing. It is during this phase that most fish are herded towards the back of the net. As the retrieval phase begins, the wings begin to lift off the sea floor. After about an hour, fish have stopped entering the net apart from a few fish that are caught in higher sections of the net, and the foot-line in the shoulder comes off the seafloor. The net is tight and meshes fully stretched because of the pressure of being hauled in, and the weight of the fish in the codend. After a further ten minutes, the codend is on the surface, and usually hauled onboard within 2 or 3 minutes.

Danish seine warps are initially 22 mm lead core polypropylene rope with a breaking strain of 8.0 t (Noble, 2006), but taper down to lighter 12 mm polypropylene rope with a breaking strain of 3.0 t (Noble, 2006) under the net, with the same 22 mm rope at the other end of the gear (Figure 6c). Mesh size used depends on the target species and can be as small as 38 mm stretched diameter, but more typically 60–70 mm (Figure 6d).

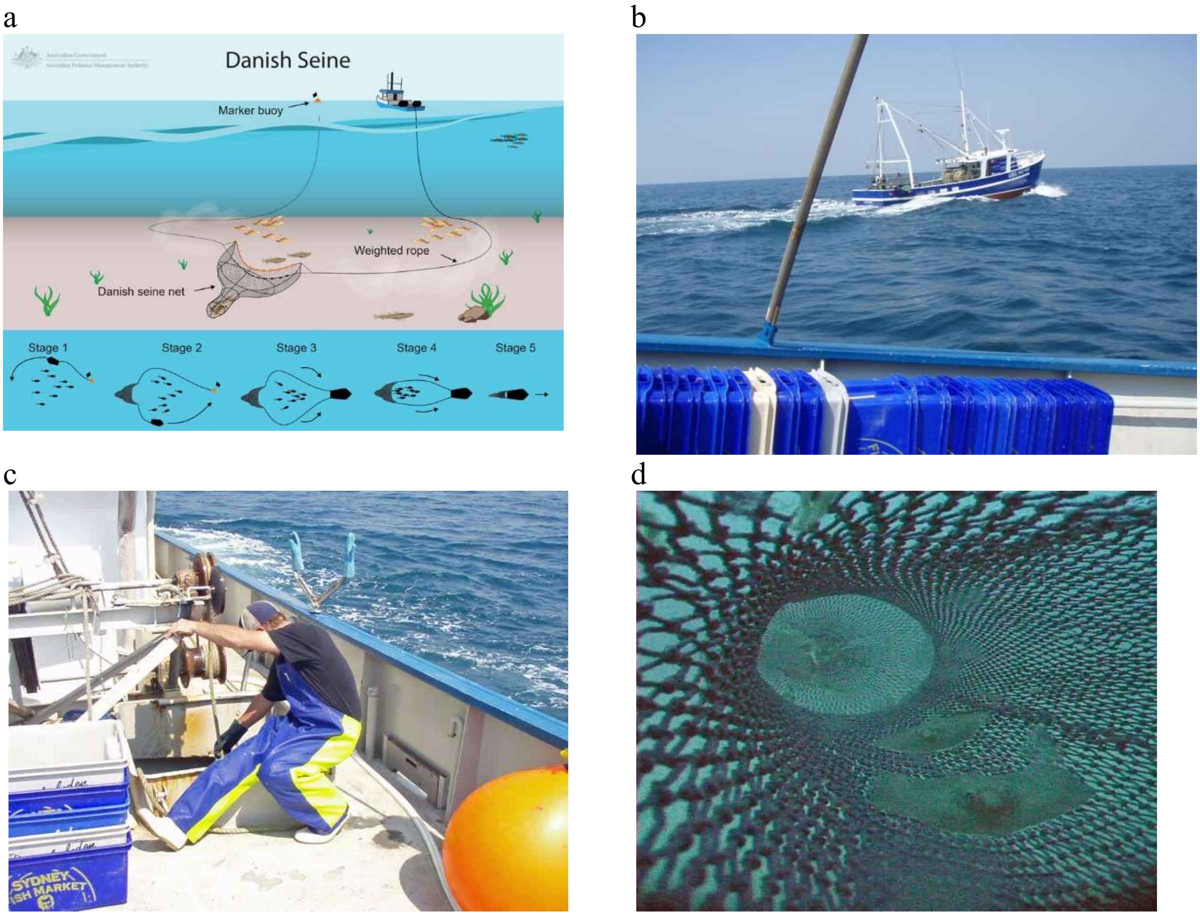


Figure 6 (a) Illustration of a Danish Seine shot (AFMA, 8, (b) a typical Danish seine vessel, (c) the ropes being hauled onboard, and (d) a view looking done the net into the codend.

5.3. Demersal gillnets (SGSHS)

Demersal gillnets are a “passive” fishing gear (they are not towed — the fish have to swim into the gear) comprising a series of long panels of diamond shaped mesh anchored at each end, and weighted along the bottom rope to keep the net on the sea floor. It is held upright by a series of floats (Figure 7a). Used in the SESSF mainly to target Gummy Sharks, the uniform sized (6 inch) meshes on a gillnet (Figure 7d) make them highly selective for a particular size of shark. Sharks that are smaller than the mesh can pass through, while larger sharks tend to “bounce” off the net without getting meshed. Operators in the SGSHS can use gillnets up to 6,000 m long in Bass Strait. Many operators divide their maximum legal net length into two or three fleets, which can either be fished together or separately.

Gillnets used in the SGSHS generally have the headline (top horizontal rope) set 2.0 m above the seafloor. The headline is typically a 16 mm polypropylene rope floated using small floats (Figure 7b). The monofilament net is connected to a ground rope on the lower horizontal edge. The ground rope is usually a 14 mm weighted (lead core) polypropylene rope. At either end of the gillnet, a 9 mm down-line with a breaking strain 2.0 t (Noble, 2006) runs from floats that indicate the position of the net on the surface, to 2.0 m of chain attached to a 10–15 kg “J” anchor or lead weights (Figure 7c). Depending on tide and sea conditions there are often three or four other anchors along the ground rope. The chain is attached to the anchor mid-way down the anchor shaft, and a lighter break-away cord is usually used.

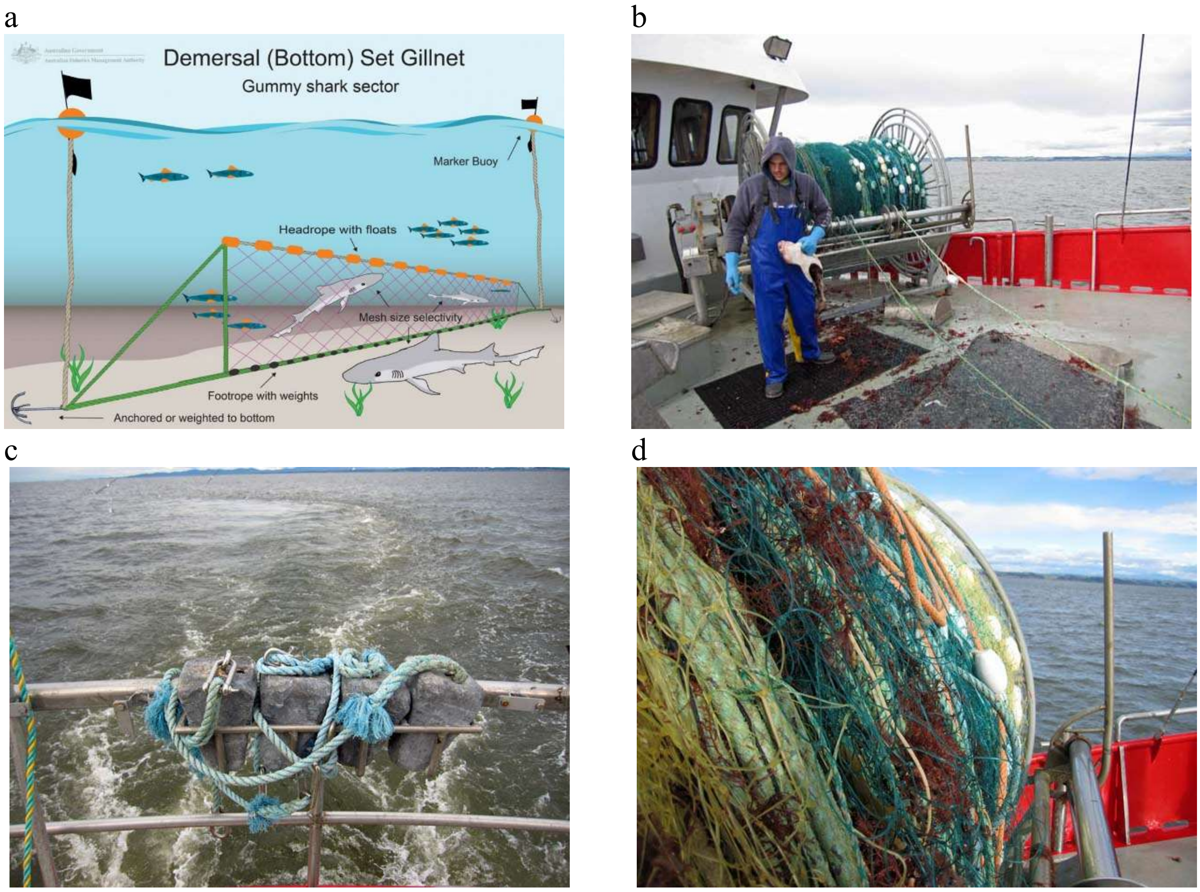


Figure 7 (a) Illustration of a demersal gillnet (AFMA, 2018), (b) a typical net drum, (c) lead weights, and (d) close-up of a gillnet.

5.4. Demersal longline (SGSHS and SFHS)

Demersal longlines are also a passive fishing gear consisting of a long mainline laid along the seabed, to which hundreds or thousands of baited hooks are attached at regular intervals (~1.4 m) via short lines (30 cm) called “snoods”. In the SGSHS, longlines are typically 1.5 to 5.0 km in length (Figure 8) with less than 15,000 hooks. As the mainline is set from the stern of the vessel, each hook is baited by either hand or a baiting machine and released. The mainline is marked by a buoy with lights and can be anchored at each end. Some vessels use radio beacons to be able to find gear in low visibility or if it drifts in heavy current.

Demersal longline gear is much lighter than otter-board trawl or Danish Seine gear. Downlines (ropes connecting floats and the mainline) are generally made of 8–10 mm polypropylene with a 1.0–2.0 t breaking strain (Noble, 2006). Mainlines are thinner (eg 7 mm) but are more abrasion resistant. Snoods are usually monofilament with very low breaking strain (approximately 50 kg). Anchors are only large enough to manage onboard by hand (~15–25 kg). The number of anchors used depends on many factors including, currents, sea condition, ground fished and species targeted.

Like other fishing vessels, longliners may lay-up at anchor during bad weather or while fishing gear soaks (fishes). Auto longlining is a variation of demersal longlining in which some of the functions (for example baiting the hooks) are automated. Many “autoliners” set, haul and steam between lines on a continual basis.

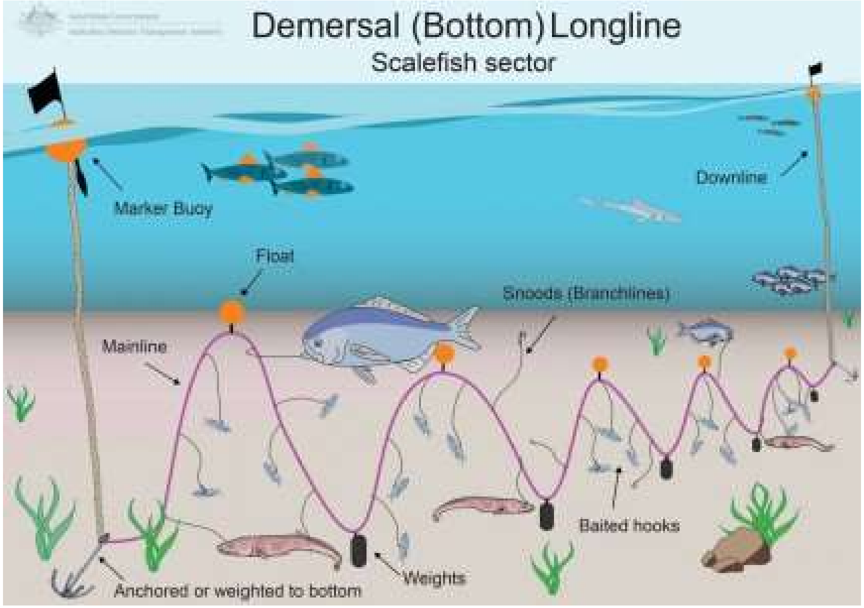


Figure 8 Illustration of a demersal longline: (AFMA, 2018)

5.5. Rock Lobster / Giant Crab pots (Victorian and Tasmanian Rock Lobster and Giant Crab fisheries)

Pots are a form of rock lobster traps that are baited and set individually, usually over rocky reef. A variety of baits are used, and include barracouta heads, salmon, carp and wrasse. Cray pots used in Victoria are usually ‘bee hived’ in shape, with a steel frame encased in with either cane or wire mesh (Figure 9a). Maximum dimensions are 150 cm x 150 cm x 120 cm high, but are usually smaller than that and weigh ~ 15 kg each. Pots are attached to a surface float via 10–12 mm polypropylene rope. They are set by being pushed overboard, and retrieved using hydraulic pot hauler (Figure 9b).

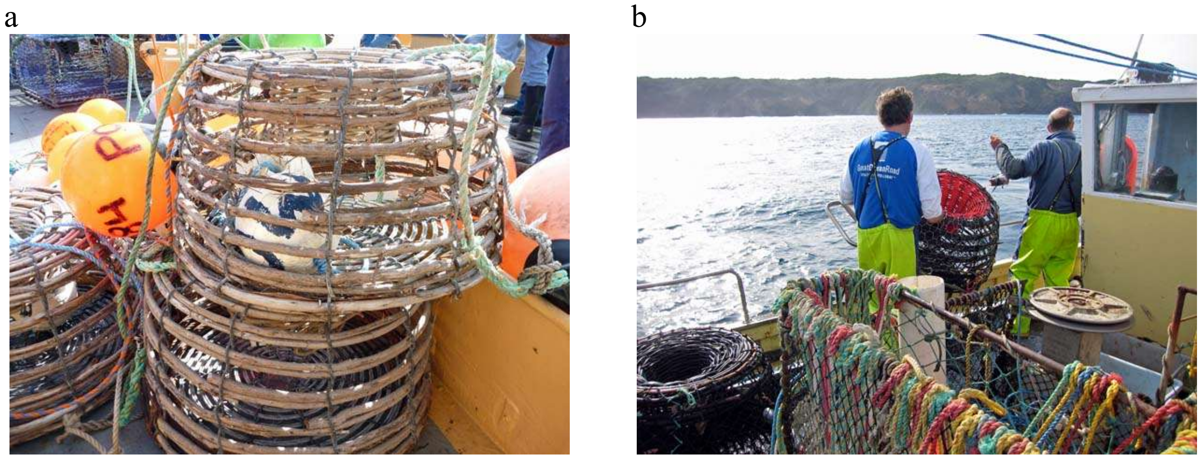


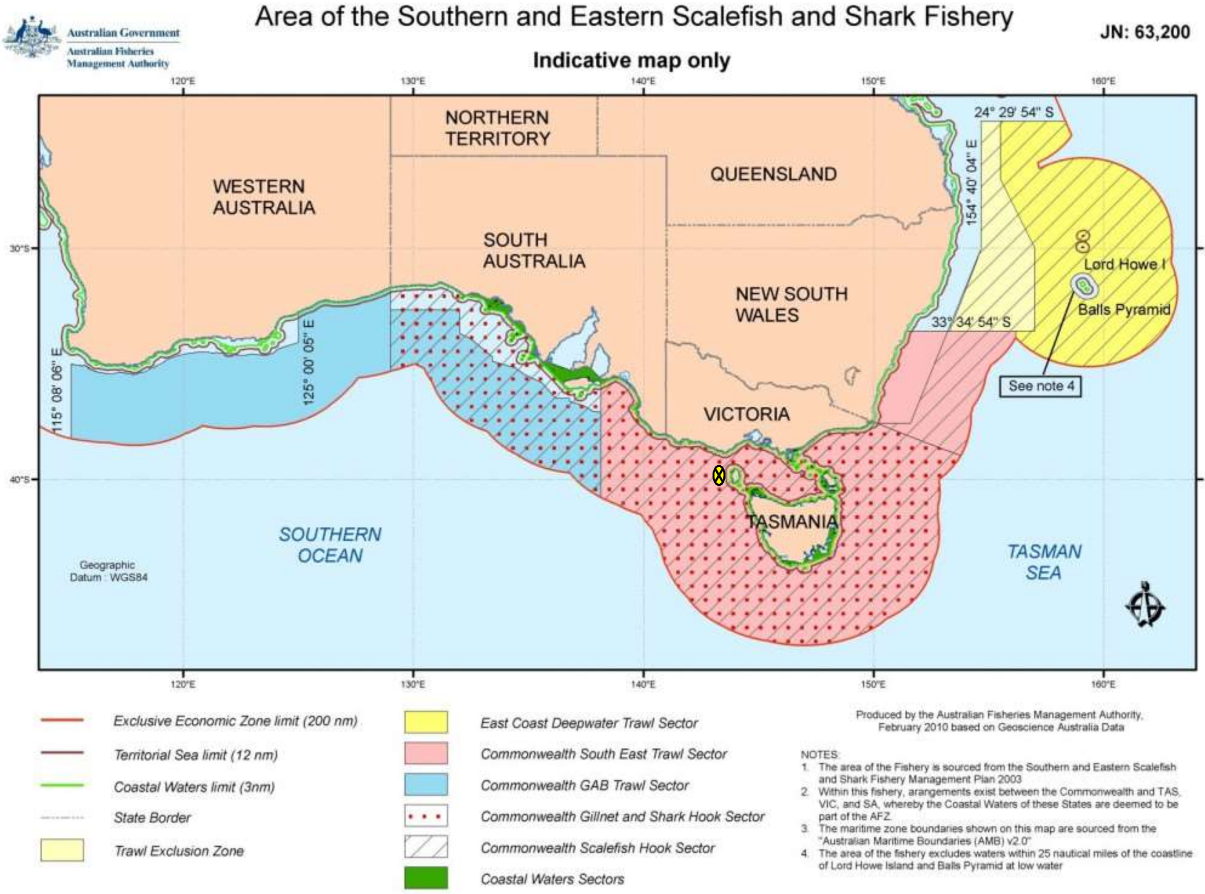
Figure 9 Photos showing (a) close up of cray pots, and (b) the retrieval of cray pots using the pot hauler.

6. BACKGROUND INFORMATION ON FISHING SECTORS

6.1. Southern and Eastern Scalefish and Shark Fishery (SESSF)

The SESSF extends from Cape Leeuwin in Western Australia to Fraser Island in Queensland (Figure 10). This Commonwealth managed fishery is the main provider of fresh fish to the Melbourne and Sydney markets. The SESSF gross value of production (GVP) was about $75 million in the 2015–16 financial year but catches have declined significantly from historical levels primarily due to a reduction in fishing effort (Figure 11), largely associated with a 2006 Commonwealth Government led *Structural Adjustment* which removed 50% of fishing concessions but also from greatly reduced catches of Orange Roughy and Blue Grenadier (Patterson *et al.*, 2017).

AFMA manages fisheries to maintain stocks at ecologically sustainable levels, while maximising the net economic returns to the Australian community (DAFF, 2007). Main management measures used in the SESSF include limited entry, gear restrictions, closed areas and Total Allowable Catch (TAC) limits. Fishing licenses are required for fishermen to operate in the SESSF and there are dormant (unused) licenses in most sectors. TAC's are set each year based on outcomes of stock assessments conducted for each quota species. Statutory fishing right (SFR) quota units are converted to tonnes of quota each year depending on the annual TAC set.



Produced by the Australian Fisheries Management Authority, February 2010 based on Geoscience Australia Data

NOTES:
1. The area of the Fishery is sourced from the Southern and Eastern Scalefish and Shark Fishery Management Plan 2003
2. Within this fishery, arangements exist between the Commonwealth and TAS, VIC, and SA, whereby the Coastal Waters of these States are deemed to be part of the AFZ.
3. The maritime zone boundaries shown on this map are sourced from the "Australian Maritime Boundaries (AMB) v2.0"
4. The area of the fishery excludes waters within 25 nautical miles of the coastline of Lord Howe Island and Balls Pyramid at low water

Figure 10 Area of the Southern and Eastern Scalefish and Shark Fishery (www.afma.gov.au). Very approximate location of proposed seismic survey shown by yellow balloon.

More than 100 species are regularly landed in the SESSF but only the main species are managed under quotas. At present, there are 34 fish stocks subject to TACs (Table 4). Only those in bold are generally found in the vicinity of proposed seismic survey area.

The SESSF is comprised of five sectors: the Commonwealth Trawl Sector (CTS), Great Australian Bight Trawl Sector (GABTS), East Coast Deepwater Trawl Sector (ECDTS), Gillnet and Shark

Hook Sector (SGSHS) and Scalefish Hook Sector (SHS) (Figure 10). Of these, only the CTS, SGSHS and SHS sectors operate within the area of the proposed survey. Total landings by the CTS and SHS in 2016–17 was 8,691 t (Patterson *et al.*, 2017). GVP of the 2015–16 catch by the CTS and SHS was $41.52 million. The SGSHS landed 1,832 t of shark during 2016–17, and had a GVP of $17.21 million during 2015–16.

Table 4 List of 2017–18 TACs (whole fish unless otherwise stated) for SESSF quota species (AFMA, 2017b). Species that are likely to be caught in the area of the proposed seismic survey area are highlighted.

Species	TAC (t)	Species	TAC (t)
Alfonsino	1,017	Orange Roughy – (GAB)	50
Bight Redfish (GAB)	800	Orange Roughy – (Cascade)	500
Blue Eye Trevalla	458	Orange Roughy – (East)	465
Blue Grenadier	8,765	Orange Roughy – (South)	35[15]
Blue Warehou	118	Orange Roughy – (West)	60
Deepwater Flathead (GAB)	1,128	Oreo (smooth Cascade)	150
Deepwater Shark (east)	46	Oreo (smooth other)	90
Deepwater Shark (west)	215	Oreo (basket)	128
Elephant Fish	114	**Pink Ling**	1,154
Flathead	2,712	Redfish	100
Gemfish East	100	**Ribaldo**	355
Gemfish West	199	Royal Red Prawn	384
Gummy Shark	1,774[16]	**Saw Shark**	442
Jackass Morwong	513	**School Shark**	215
John Dory	175	School Whiting	986
Mirror Dory	235	**Silver Trevally**	613
Ocean Perch	190	**Silver Warehou**	605

6.2. Commonwealth Trawl Sector

The CTS is one of the oldest commercial fisheries in Australia, with over a 100-year catch history. The main fishing gears used in this sector are otter-board trawl and Danish seine nets. The sector's area of operation extends from Cape Jervis in South Australia around the Victorian, Tasmanian and NSW coastlines northward to Barranjoey Point (Figure 10). During the 2016–17 fishing season there were 34 otter-board trawl and 16 Danish seine vessels actively operating in the CTS (Patterson *et al*, 2017).

SETFIA is the industry association for CTS operators, representing more than 80% of the catching and quota owning sector through voluntary membership. Contact details for SETFIA are provided in Table 10.

Overlap between CTS grounds and the area of the proposed seismic survey area

Total annual catch (fishery wide) in the CTS peaked in 1990 at just over 60,000 t, but fell to 20,000–30,000 t during the late 1990s (Figure 11) mainly as a result of the overfishing of Orange Roughy. Catches again fell during 2002–2007 from about 30,000 t to its current level of below 10,000 t.

The waters west of King Island are fished by the otter trawl sector, and there was some effort by the Danish seine fishery in a 1-degree block that overlaps with the area in 2015–16. Historical fishing effort shows some otter trawl effort along the shelf break (Figure 12), but little on the shelf in the vicinity of the proposed seismic survey area. Data from 2015–16 shows there has been some effort

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[15] Plus 31 t incidental

[16] Trunk weight.

in the 1 degree x 1 degree blocks that overlap with the survey area, particularly in the south of the area of interest (Figure 13).

CTS catch and effort data in the AFMA data area (see Figure 2) includes both otter trawl and Danish seine data, however because of the very low number of Danish seine vessel that reported effort in this area, aggregating those data alone at any level would result in data being omitted because of the confidentiality policy. For this reason we have combined data from both CTS gear types.

Logbook data revealed that the area around the proposed seismic survey is somewhat important for fishing by the CTS, particularly those using otter trawl gear. Since 2008, between 6 and 9 CTS vessels (including 1 a small number of Danish seine vessels) have recorded fishing within the area (Figure 15). Annual effort recorded by those vessels has fluctuated from 63 shots in 2017 to 91 shots in 2010. Annual landings recorded by the CTS from the area of the data request ranged from 34 t in 2011 to nearly 90 t during 2010 (Figure 16). The estimated annual value of the catch was lowest in 2011 at $129,000, and highest in 2010 at $308,000 (Figure 17). Over the 10 year period of 2008–2017, a total of 574 t of fish was caught by the CTS within the Dorrigo survey area, with a value of just over $2 million (Table 5), and in 2017, just under 60 t of fish was landed with a value of just over $200,000 (Figure 16, Figure 17). Catch was dominated by slope dwelling species including Blue Grenadier (55%), Silver Warehou (18%), King Dory (12%), Pink Ling (11%) and Platypus Shark (6%) (Table 5, Figure 20). Other main species with a total catch of more than 10 t and which were caught by 5 or more different vessels were Spikey Oreodory, Orange Roughy, mixed Oreodories, Ribaldo, Sleeper Sharks, Reef Ocean Perch, Mirror Dory and mixed fish.

Effort by the CTS in the area around the proposed seismic survey has been highest from October to March over the past 10 years, with a peak of 100 shots during October (Figure 18). Effort was lowest during July, with 32 shots recorded since 2007. The monthly catch trend somewhat reflects the pattern of effort, however the highest catches were taken during February and March (Figure 19).

The Zeehan Commonwealth Marine Reserve transects the area of the seismic survey, and fishing using bottom trawl and Danish seine are prohibited in that area (National Parks, 2013).

Likelihood of fishing grounds developing in the future

Fishing effort in the CTS is more limited by quotas (TAC's) than the limited number of fishing licenses. Improved technology and exploration saw expansion of fishing grounds over the decades since the 1980s but subsequent to several Government-led structural adjustments and closures of many areas to trawling during the mid-2000s, there has been some contraction of fishing effort on both the shelf and shelf break. Figure 11 shows that in recent years, effort in the otter-board trawl fleet has fallen to the lowest levels on record (apart from 1985 when logbooks were introduced), while Danish seine effort slightly increased in 2016. The fishing grounds around the survey area are categorised as having low otter trawl (<0.5 hrs per km^2), and which Danish seine effort directly overlapping the survey area cannot be shown because of confidentiality policies, it is unlikely there is any significant amount of Danish seine effort in that area. While the catch of some CTS species is limited by TACs, the fishery has been unable to catch that TAC in recent year for unknown reasons that are now being investigated. Thus, while there is a significant amount of CTS catch and effort recorded from within the area of the seismic survey, it is unlikely that this will increase to any appreciable extent in the near future.

Table 5. CTS effort, catch, catch value and main species caught in the AFMA data area. Original data source: AFMA.

Years included	2008–2017
Number of different vessels	17
Total shots	761
Total catch (t)	574 t
Total value	$2,040,188
Main species caught	Blue Grenadier (55%) Silver Warehou (18%) King Dory (12%)
Fishing methods used	Otter trawl Midwater Trawl Twin rigged trawl Danish seine

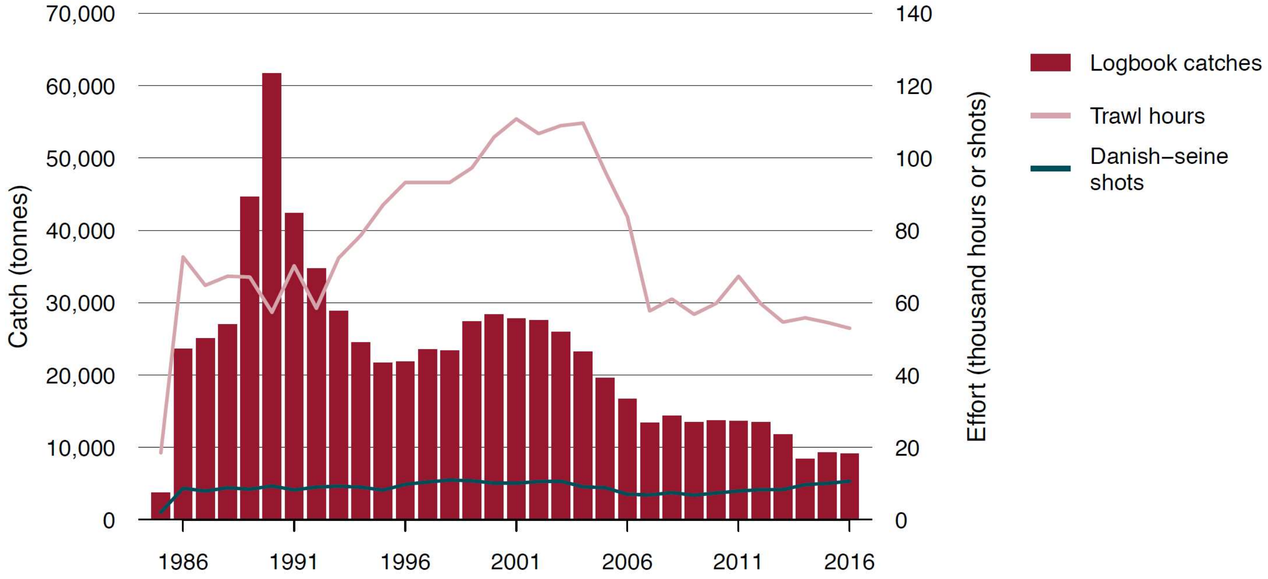


Figure 11. Total catch and effort by the CTS during 1985–16 (Patterson *et al*, 2017).

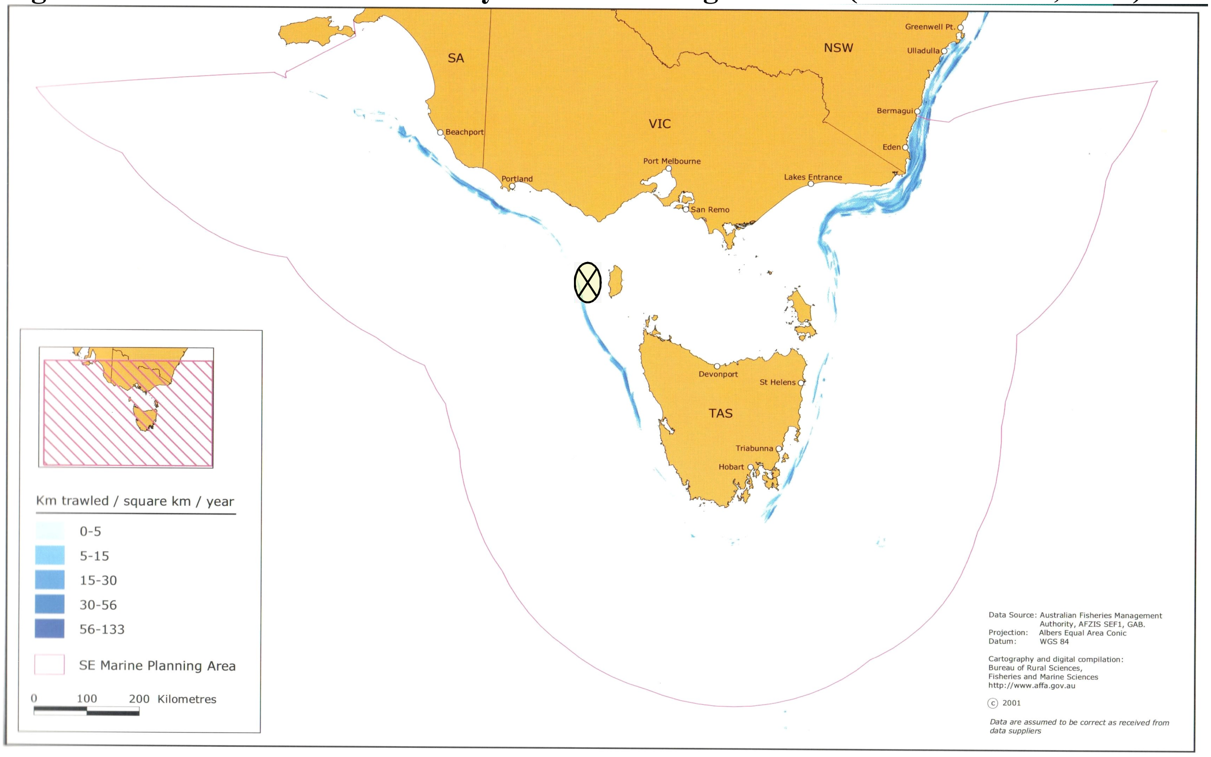


Figure 12 Fishing effort (km trawled/square km/year) by CTS otter trawl in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed seismic survey area shown by yellow shaded balloon.

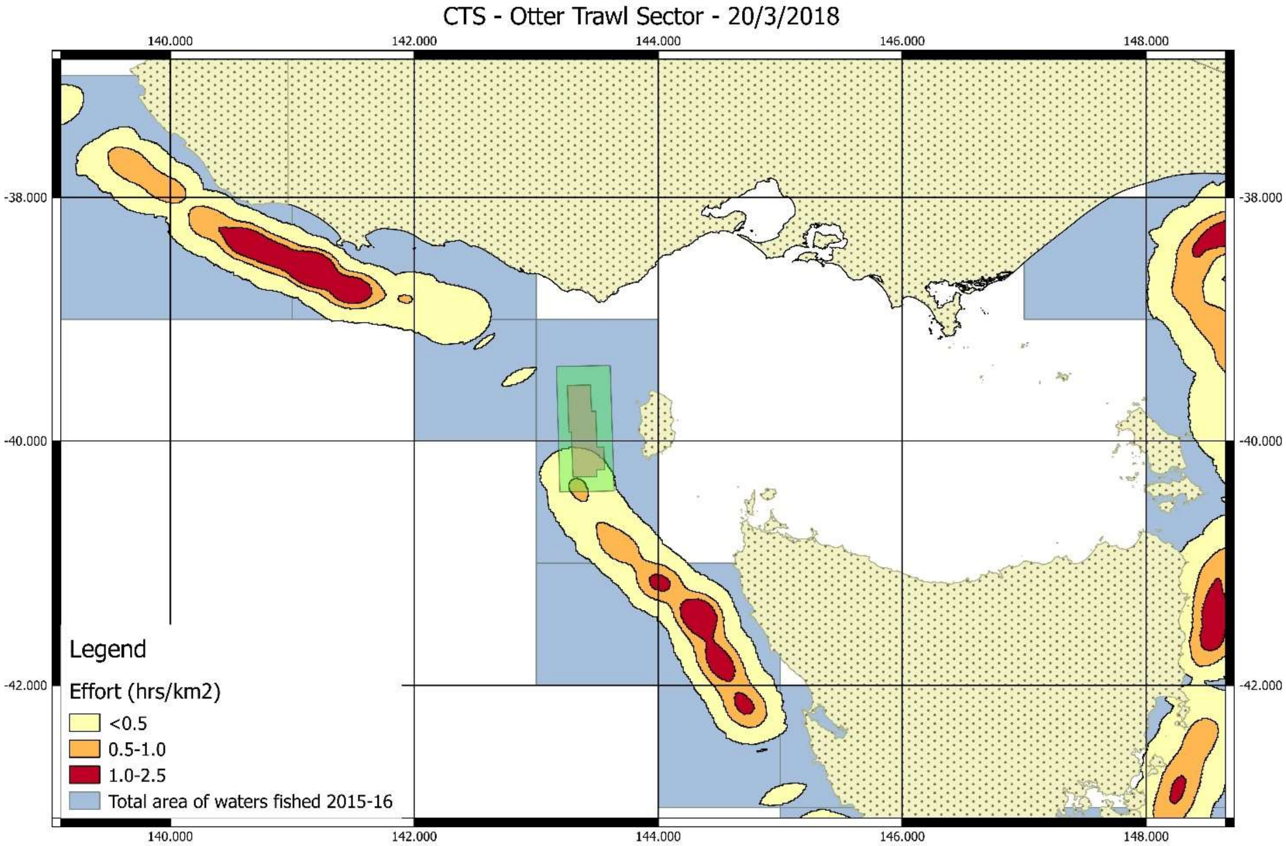


Figure 13. Relative fishing intensity (hrs/km^2) by the CTS using otter trawl in relation to the proposed seismic survey area (brown) and the wider area of interest (green) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

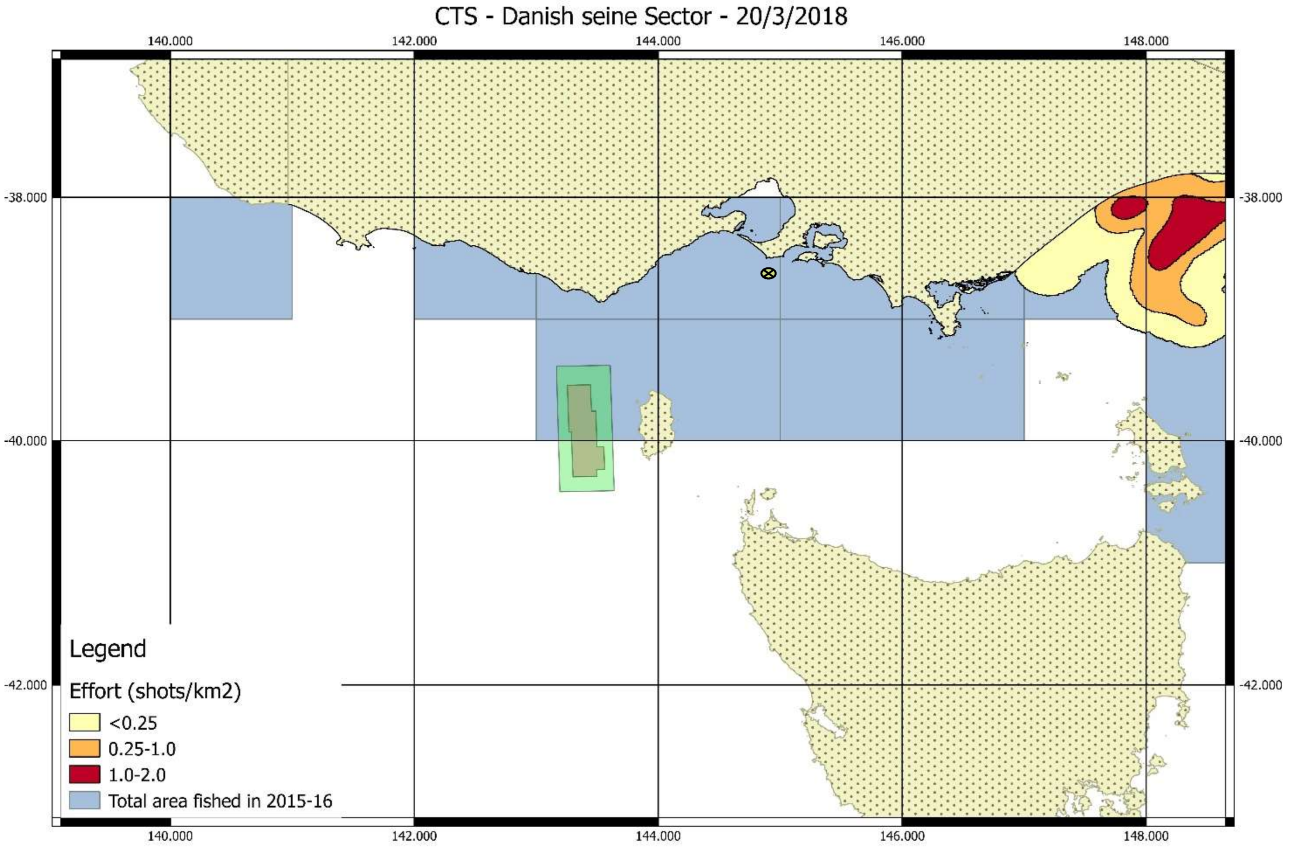


Figure 14 Relative fishing intensity (shots/km^2) by the CTS using Danish seine nets in relation to the proposed seismic survey area (brown) and the wider area of interest (green) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

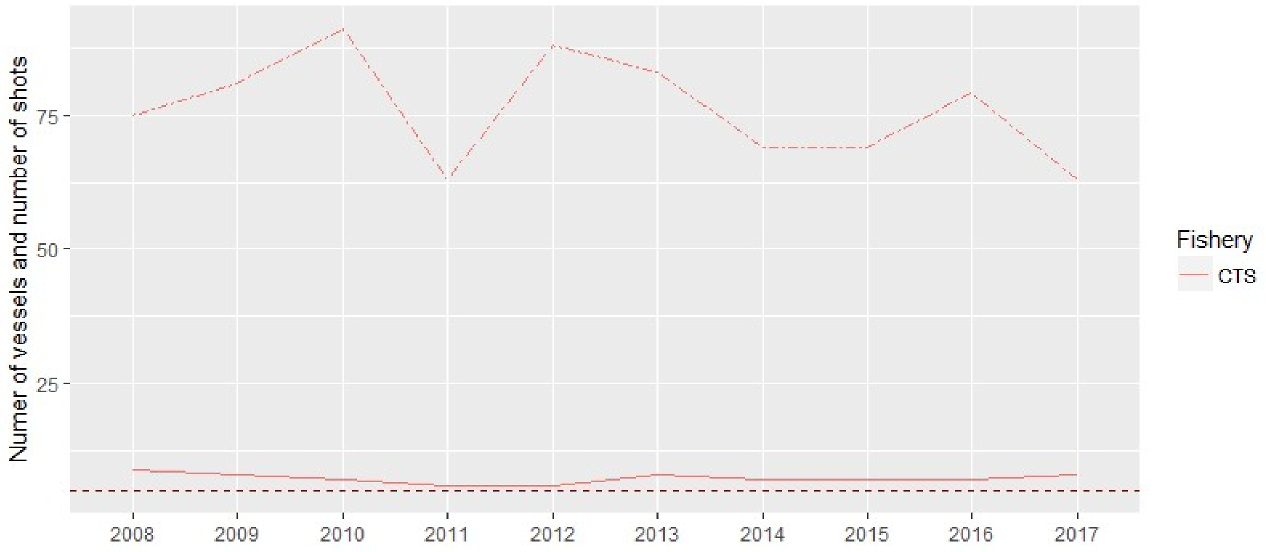


Figure 15. Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) within the AFMA data area in each year from 2008-17 by the CTS. Note the minimum number of vessels in any one year was 6. The horizontal red line intercepts the y-axis at 5. Other sectors could not be shown to protect confidentiality, Original data source: AFMA.

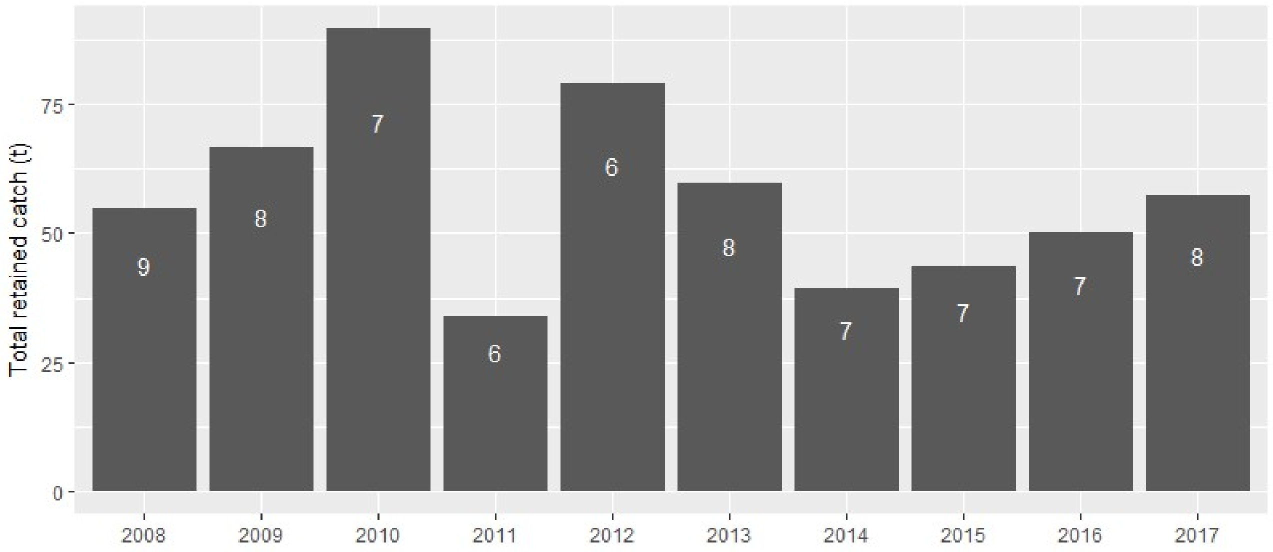


Figure 16. Annual retained catch by the CTS within the AFMA data area (see Figure 2). Note the minimum number of vessels in any one year was 6. Number of vessels is annotated on bars. Original data source: AFMA.

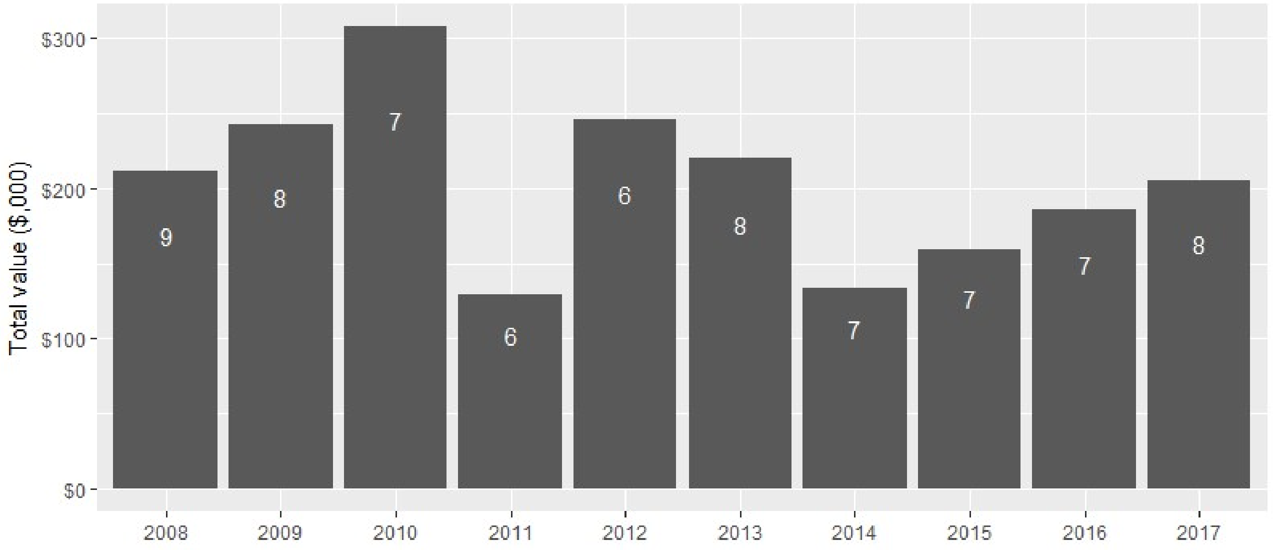


Figure 17. Estimated annual value of fish landed by the CTS within the AFMA data area (see Figure 2). Note the minimum number of vessels in any one year was 6. Number of vessels is annotated on bars. Original data source: AFMA.

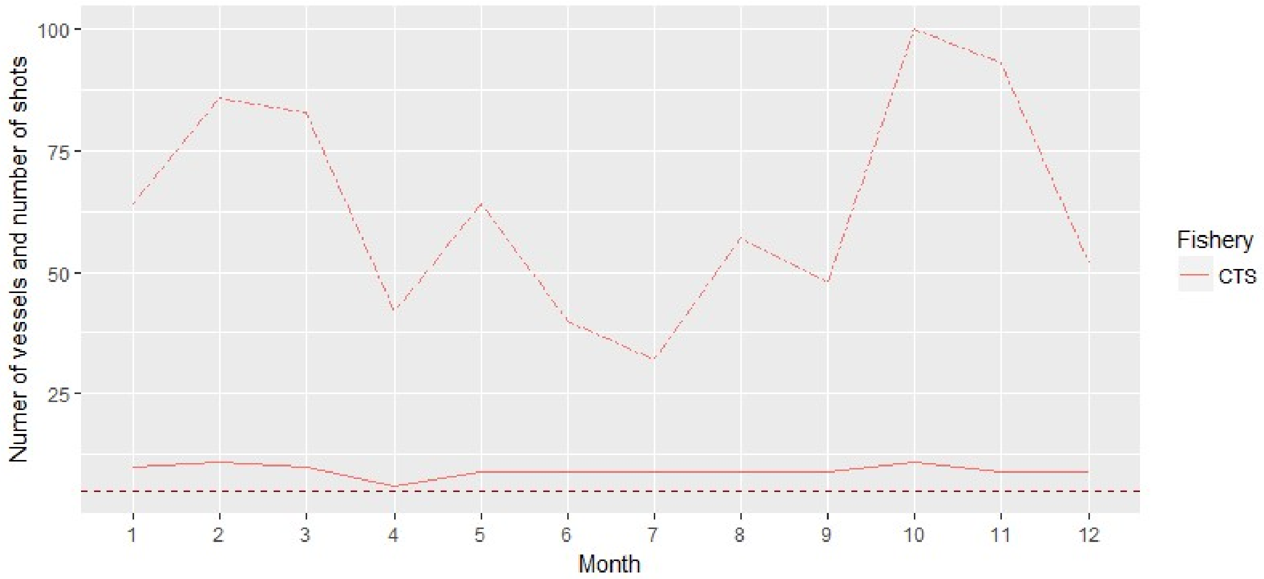


Figure 18. Number of vessels that recorded effort (solid line) and number of shots recorded (dashed lines) within the AFMA data area in each month from 2008-17 by the CTS. Note the minimum number of vessels in any one month was 6. The horizontal red line intercepts the y-axis at 5. Original data source: AFMA.

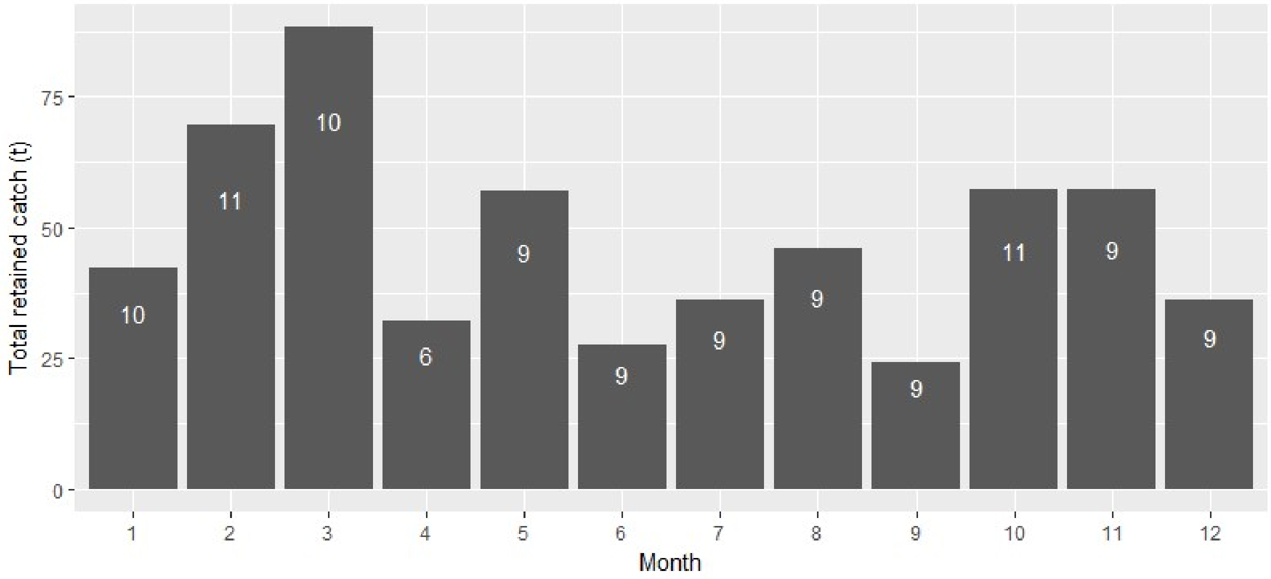


Figure 19. Total monthly (2008–17) retained catch by the CTS. Note the minimum number of vessels in any one month was6. Number of vessels is annotated on bars. Original data source: AFMA.

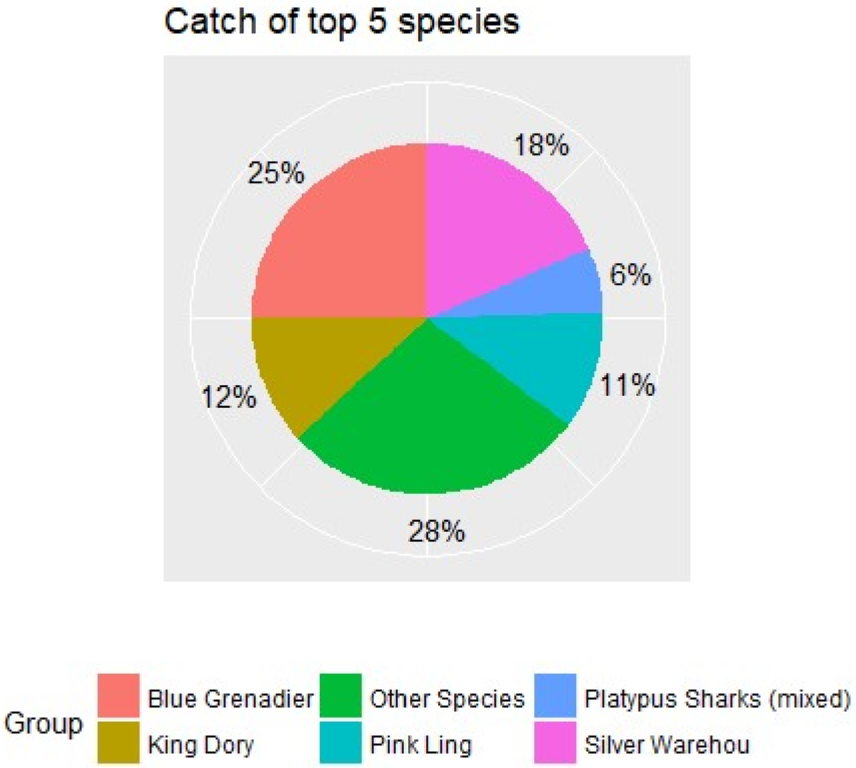


Figure 20. Main species caught by the CTS. Note the minimum number of vessels in any species was 5 or greater. Original data source: AFMA.

6.3. Shark Gillnet and Shark Hook Sector (SGSHS)

The SGSHS extends from the South Australian / Western Australian border to the Victorian / NSW border (Figure 21). The SGSHS targets Gummy Shark using demersal gillnets and demersal longlines (including auto-longline) and is restricted to waters shallower than 183 m. Both gear types were used in one degree boxes that overlap with the area of interest during 2015–16 (Figure 45f, Figure 46a), and there has also been historical records of effort in that area (Figure 23). These SGSH sectors landed 1,832 t of shark in 2016–17, and had a GVP of $17.21 million in 2015–16 (Patterson *et al*, 2017). During 2016–17 there were 36 active SGSHS vessels operating gillnets and 26 vessels using demersal longlines (Patterson *et al*, 2017).

Overlap between SGSHS grounds and the area of the proposed seismic survey area

Catch in the SGSHS peaked at more than 4,000 t during 1986, and effort peaked in the following year at about more about 120,000 km-lifts (Figure 22). Catch and effort has decreased considerably since, mainly due to declining stocks of School Shark, conservative School Shark management arrangements to promote recovery of that species, and removal of effort through Government-led structural adjustments and closures. Despite this decrease, Gummy Shark landings have increased from 1,288 t in 2012 to 1,667 t in 2015.

Figure 24 and Figure 25 show that relative to other areas of the fisheries, effort in the area of the proposed survey is low. There are records from both the SGSHS (both gillnet and hook) and SHS (Scalefish Hook Sector) sectors from the area, however because of the low number of vessels contributing to the data, data from these sectors is combined here which we refer to as the GHAT. Disaggregation into year or month would also contravene the confidentiality policy and so cannot be shown. A summary of catch and effort for both sectors is shown in Table 6. Over 2008–2017, a total of 18 GHAT vessels have fished the area. From 181 shots by they GHAT, they took 95 t of fish valued at about $540,000. Main species caught were School Shark (33%), Gummy Shark (29%) and Pink Ling (14%) (Figure 28). Catch has increased from just under 10 t in 2014 to about 12.5t in 2016 and nearly 15 t in 2017 (Figure 26). Because of the small number of species dominating the catch, value closely follows catch in increasing from about $50,000 in 2014 to $65,000 in 2016 and just under $80,000 in 2017 (Figure 31).

Effort in the GHAT was highest during September to April, and this is when most of the catch is also taken (Figure 29). There were three months for which less than five vessels fished the area during 2008–2017, and these data are omitted from Figure 29. Seventeen vessels fished in the area during April, while 16 vessels fished the area during November, when the bulk of the catch was taken.

Likelihood of fishing grounds developing in the future

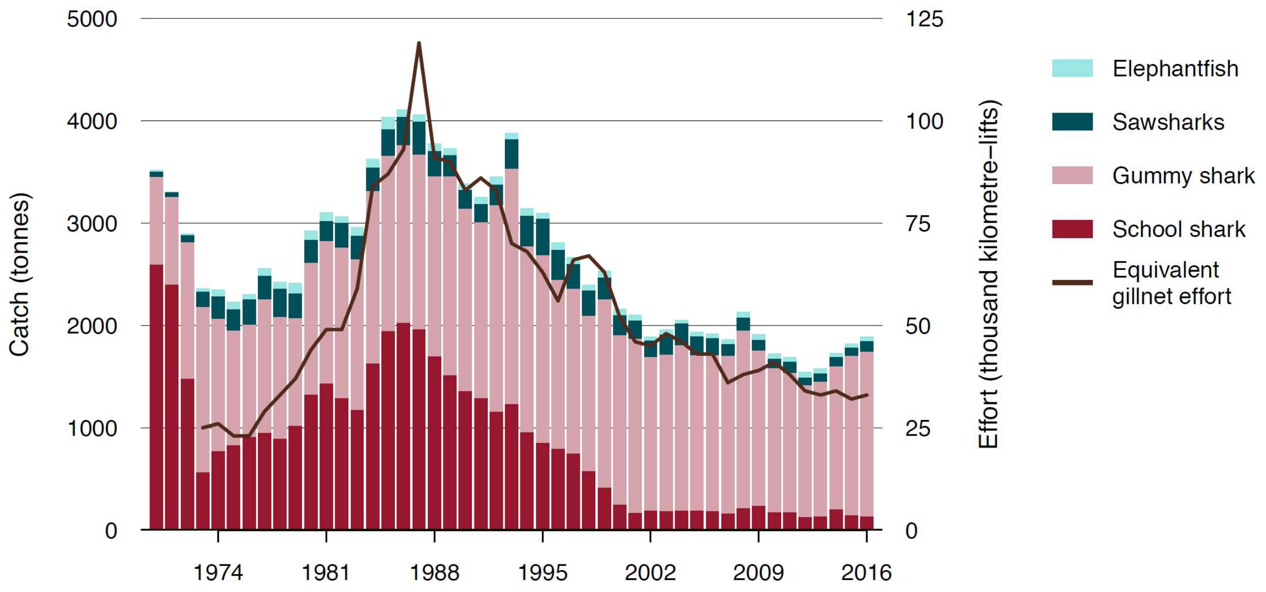
Of the 61 shark gillnet fishing permits available, only 36 were used during 2016/17, offering considerable latent effort in the fishery (Patterson *et al*, 2017). However 87% of the Gummy Shark TAC was caught during that season, and would likely be a limiting factor in the expansion of effort. Given the low levels of effort recorded in the area of the seismic survey, it is unlikely that there will be a significant increase in fishing effort in that area in the near future.

There are two industry associations that represent SGSHS, the Sustainable Shark Fishing Association and the Southern Shark Industry Alliance. Contact details for these industry associations are provided in Table 10.

Table 6. GHAT effort, catch, catch value and main species caught within the AFMA data area. Original data source: AFMA.

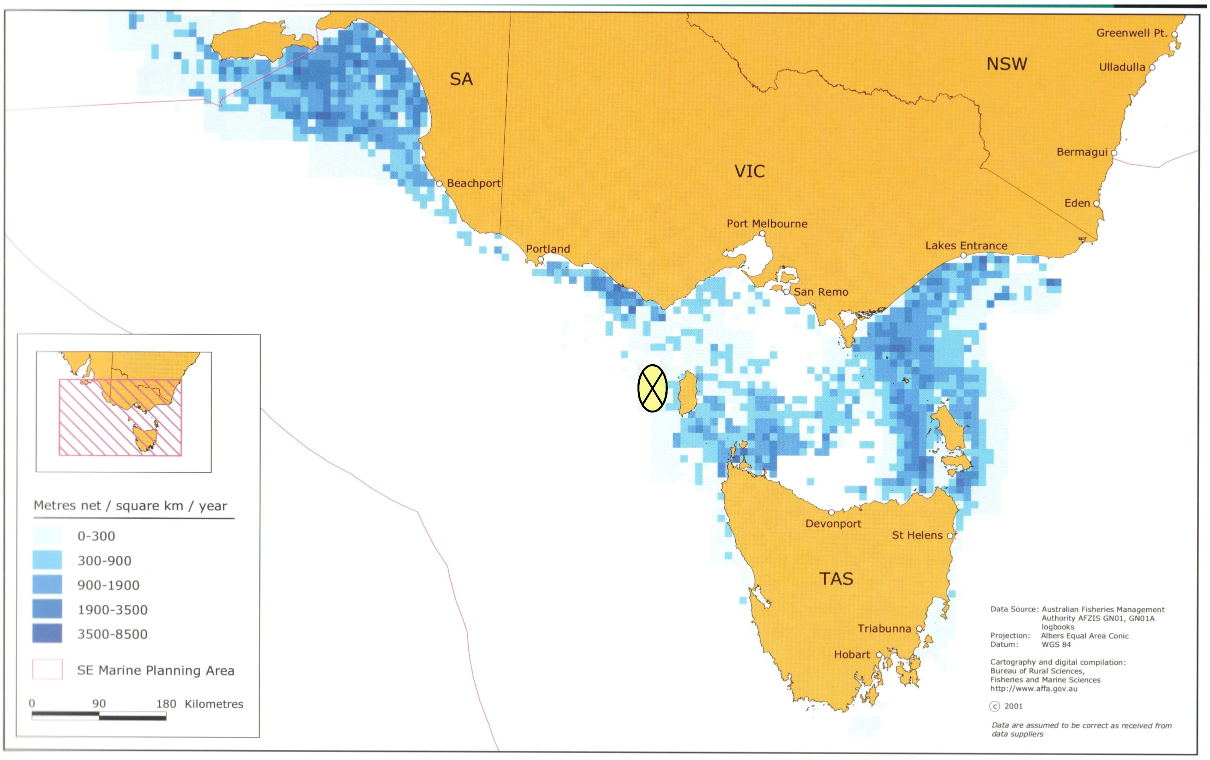
Years included	2008–2017
Number of different vessels	18
Total shots	181
Total catch (t)	96 t
Total value	$539,819
Main species caught	School Shark (33%) Gummy Shark (29%) Pink Ling (14%)
Fishing methods used	Gillnet Autolongline Dropline Minor lines

Figure 21 Shark Hook and Gillnet Sector (AFMA, 2017a). Approximate location of proposed seismic survey area shown as yellow balloon.



Note: 'Equivalent gillnet effort' is an estimate of total effort after converting hook effort to the equivalent gillnet effort using the methods in Walker et al. (1994).

Figure 22. Catch and effort in the SGSHS 1970–16 (Patterson *et al*, 2017)



Data Source: Australian Fisheries Management Authority AFZIS GN01, GN01A logbooks
Projection: Albers Equal Area Conic
Datum: WGS 84

Cartography and digital compilation:
Bureau of Rural Sciences,
Fisheries and Marine Sciences
http://www.affa.gov.au

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Data are assumed to be correct as received from data suppliers

Figure 23. Fishing effort (metre of net/square km/year) of the Commonwealth Gillnet Fishery in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Very approximate location of proposed seismic survey area shown as yellow balloon.

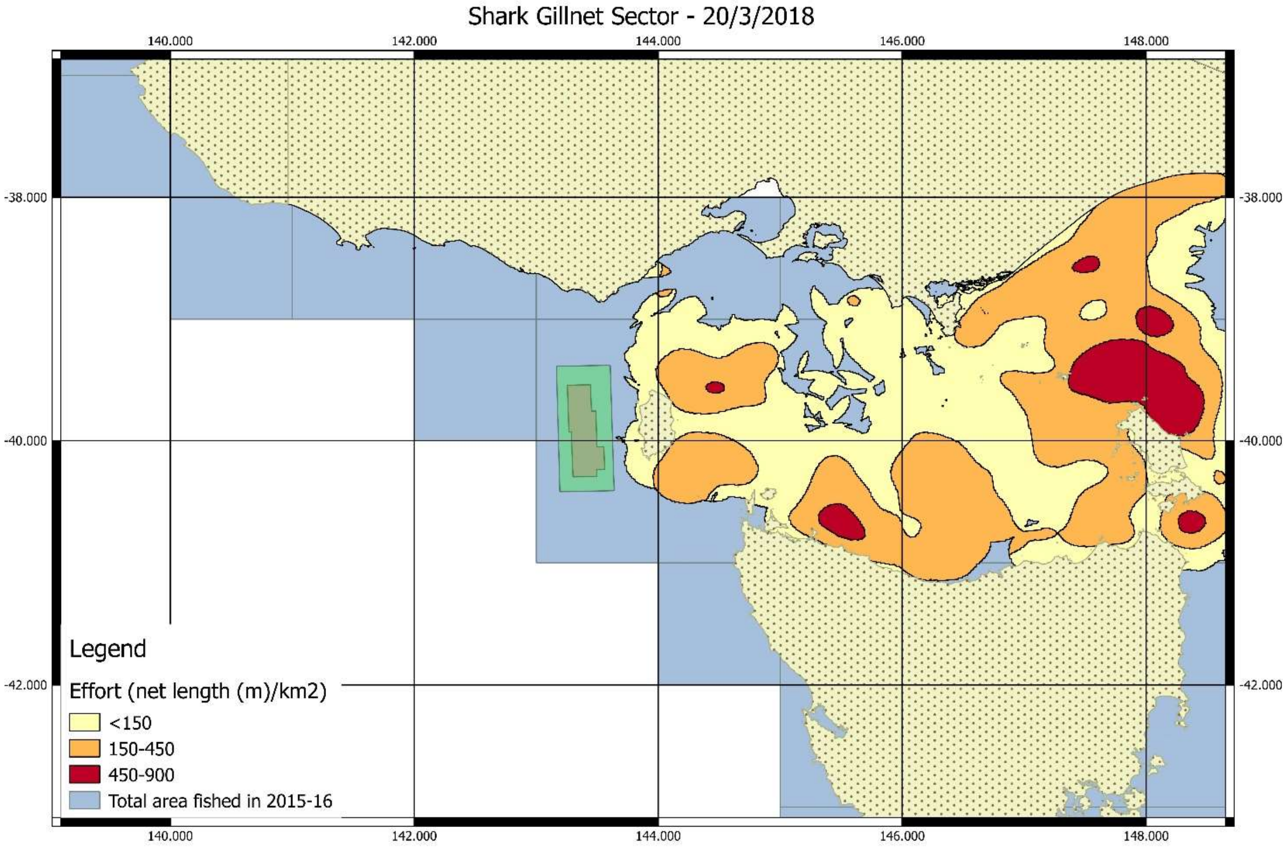


Figure 24. Relative fishing intensity (shots/km^2) by the Shark Gillnet sub-sector of the SGSHS in relation to the proposed seismic survey area (brown) and the wider area of interest (green) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

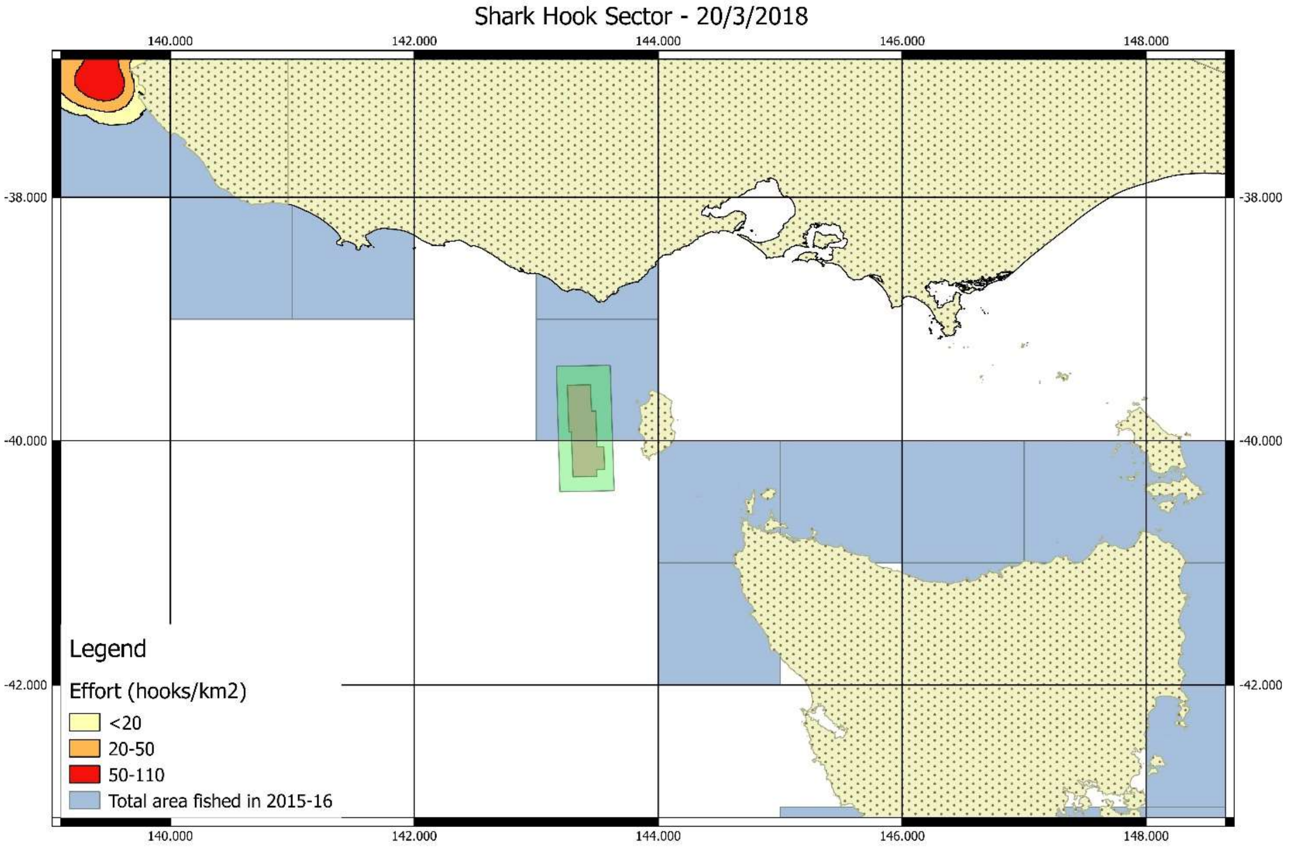


Figure 25. Relative fishing intensity (hooks/km^2) by the Shark Hook sub-sector of the SGSHS in relation to the proposed seismic survey area (brown) and the wider area of interest (green) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

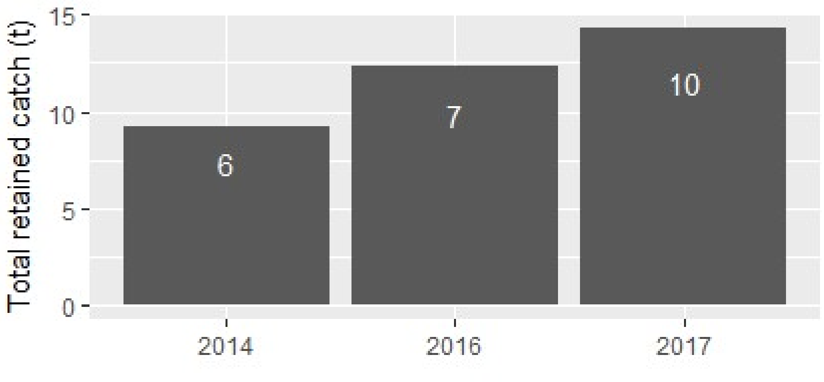


Figure 26. Annual retained catch by the GHAT within the AFMA data area (see Figure 2). Note the minimum number of vessels in any one year was 6. Number of vessels is annotated on bars. Original data source: AFMA.

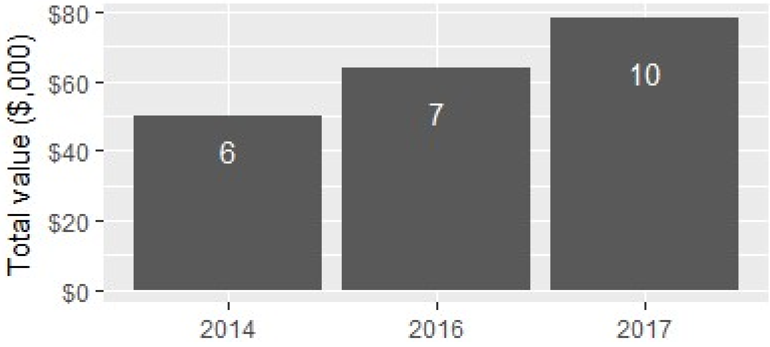


Figure 27. Estimated annual value of fish landed by the GHAT within the AFMA data area (see Figure 2). Note the minimum number of vessels in any one year was 6. Number of vessels is annotated on bars. Original data source: AFMA.

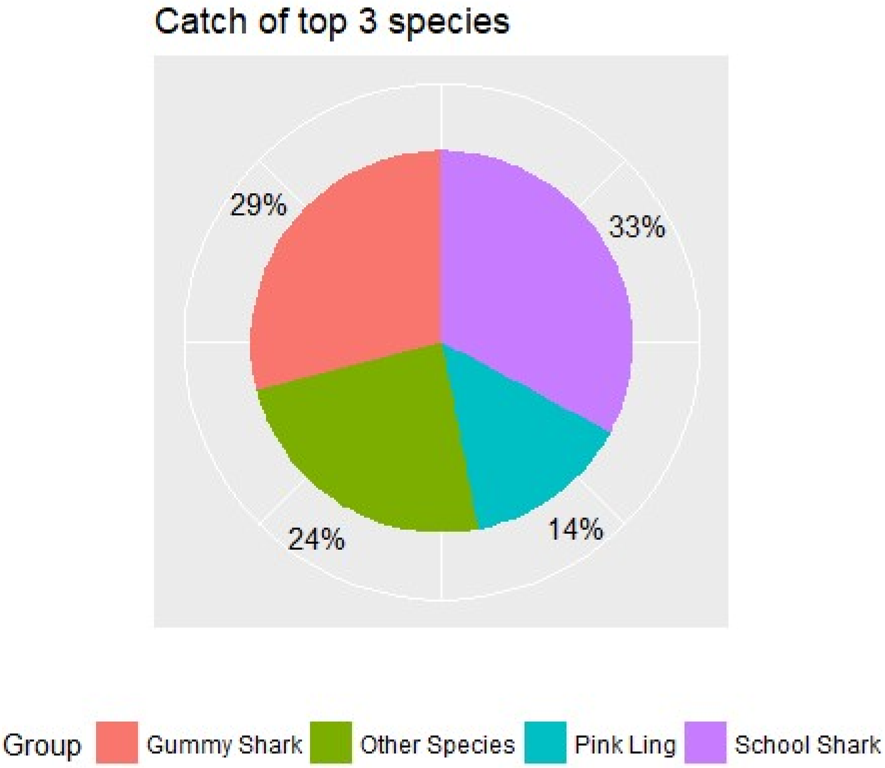


Figure 28. Main species caught by the GHAT during 2008–2017 within the AFMA data area (see Figure 2). Note the minimum number of vessels in any species was 5 or greater. Original data source: AFMA.

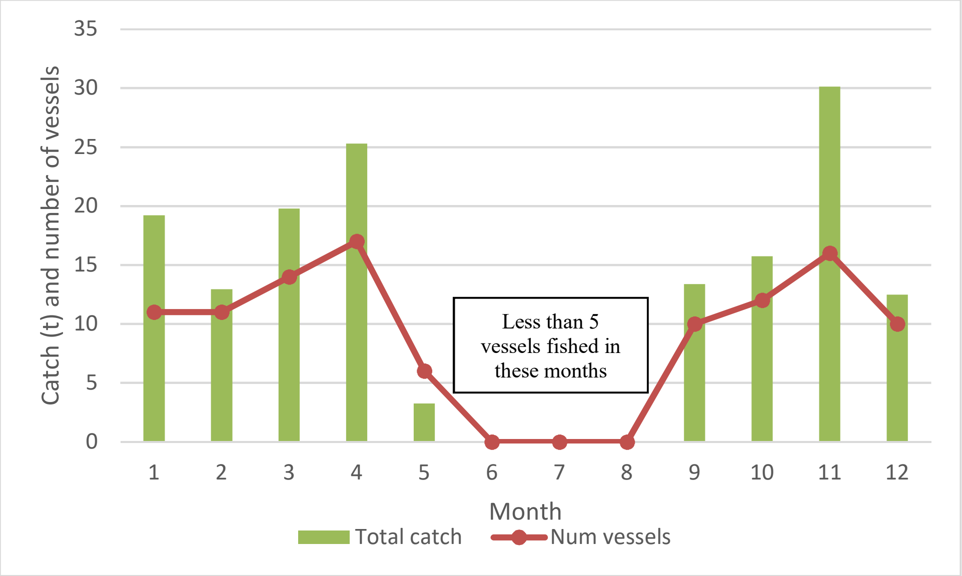


Figure 29. Seasonality of catches (green bars) and number of vessels (red line) by the GHAT during 2008–2017 within the AFMA data area (see Figure 2). Note the minimum number of vessels in any species was 6. Original data source: AFMA.

6.4. Scalefish Hook Sector (SHS)

The SHS extends from the South Australian / Western Australian border, around south-east Australia and up the east coast to latitude 24˚29´54´´S (Figure 30). The SHS targets Pink Ling and Blue-eye Trevalla using demersal longlines (including auto-longline) and, the use of auto-longline is restricted to waters deeper than 183 m. The SHS operated in 1 degree boxes that overlap with the area of interest during 2015–16 (Figure 31).

This sectors landed about 600 t of fish in 2016, and had a GVP of $4.71 million in 2015–16 (Patterson *et al*, 2017). During 2016–17 there were 17 active SHS vessels operating in the fishery from the 37 boat SFRs allocated (Patterson *et al*, 2017).

Overlap between SHS grounds and the area of the proposed seismic survey area

Catch in the SHS peaked at just over 1,500 t during 2004, and effort peaked in the following year at about more about 10,000,000 hook-lifts (Figure 31). Catch and effort has decrease considerable since 2014 largely due to decreasing TACs and removal of effort through Government-led structural adjustments and closures. Figure 32 shows that some effort was recorded by the SHS from 1 degree blocks that overlap with the area of interest. Because of the small number of operators in this sector, SHS data were combined with the SGSHS data to be able to display results without compromising confidentiality.

Likelihood of fishing grounds developing in the future

While there were 20 inactive boat SFRs in the fishery during 2016/17 which potentially harbours considerable latent effort, (Patterson *et al*, 2017), in the 2016/17 season, of the two main target species of the SHS, 100% of the Blue-eye Trevella and 74% of the Pink Ling TAC was caught. The TACs would likely be a limiting factor in the expansion of effort, and given the low levels of effort recorded in the area of the seismic survey, it is unlikely that there will be a significant increase in fishing effort in that area in the near future.

Many SHS fishers are members of SETFIA and the SSIA (Table 10).

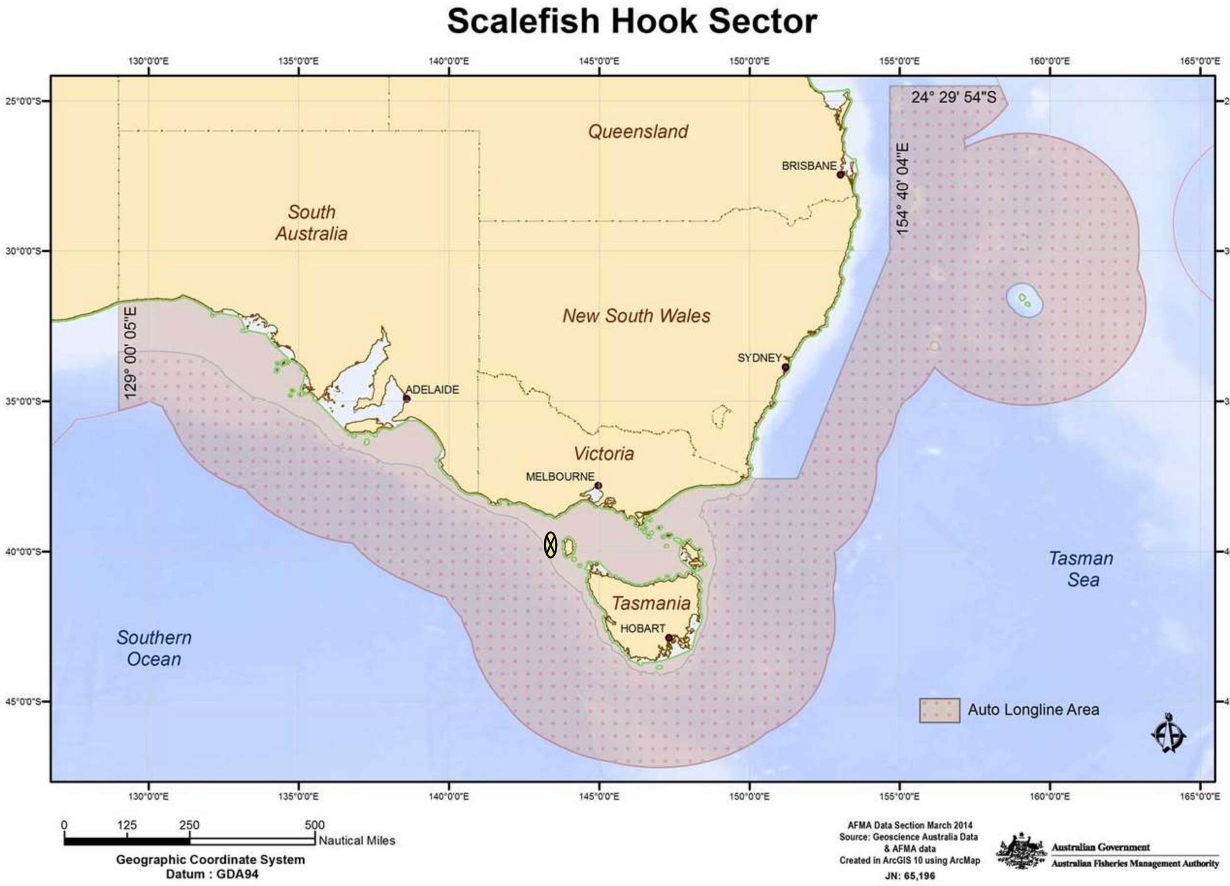


Figure 30 Scalefish Hook Sector (AFMA, 2017a). Approximate location of proposed seismic survey area shown as yellow balloon.

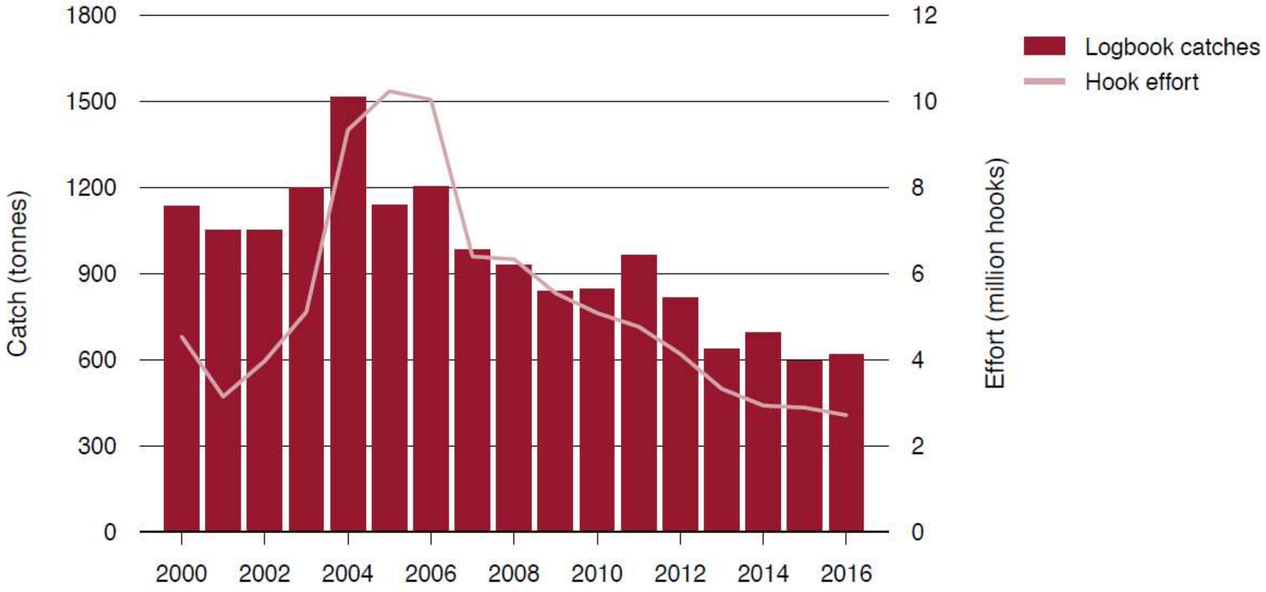


Figure 31. Catch and effort in the SHS 1970–16 (Patterson *et al*, 2017)

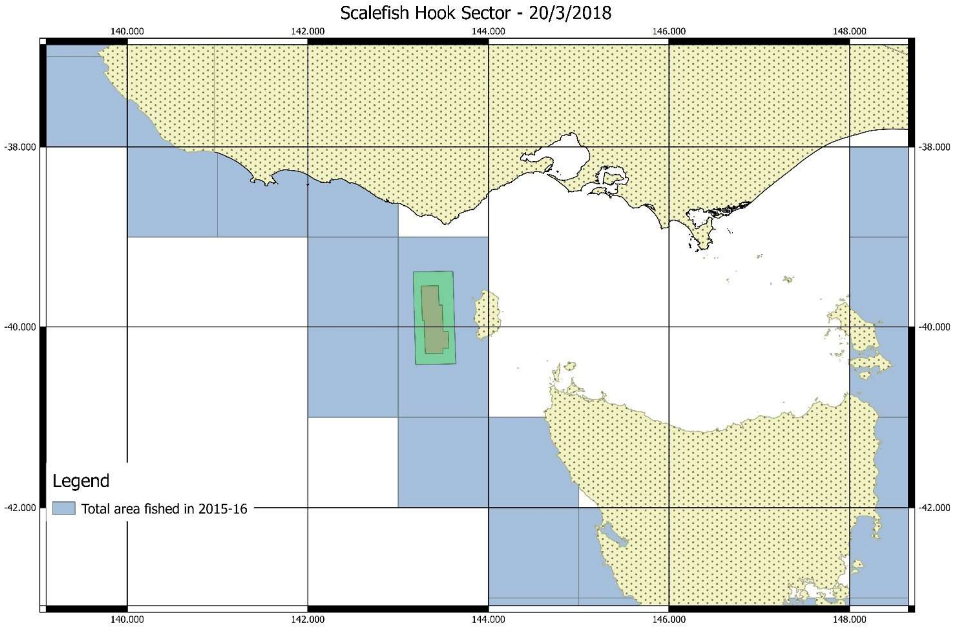


Figure 32. Area fished by the Scalefish Hook Sector in relation to the proposed seismic survey area (brown) and the wider area of interest (green) during 2015–16. Note that effort comprising data of less than 5 vessels has been removed in accordance with the AFMA's confidentiality policy. Data provided by Rupert Summerson (ABARES). Original data source: AFMA.

6.5. Victorian Rock Lobster and Giant Crab fisheries

Information for the Victorian Rock Lobster and Giant Crab fisheries are combined here because fisheries catch and effort data received from the Victorian Fisheries Authority for those fisheries was largely combined to conform with their confidentiality policy. Data is reported separately where possible.

The area of the Victorian Rock Lobster Fishery extends along the Victorian coast, out into Commonwealth waters (>3 nm offshore). The fishery targets Southern Rock Lobster (*Jasus edwardsii*), and is managed through both input and output controls, with limited entry, gear restrictions, effort limits and a Total Allowable Commercial Catch (TACC – The TACC for the Western Zone was 230 t in 2016–17 (Victorian Fisheries Authority, 2017a)). Baited pots are used to target lobster over reef substrate on coastal reefs to depths of 200 metres (Department of Environment and Heritage, 2004). The fishing season is open from 16 November to 14 September each year. The fishery is divided into two management zones separated at longitude 143° 40'E, with most of the catch coming from the Western Zone (Figure 33), with which area of the proposed seismic survey overlaps. Catches in the eastern zone have ranged between 209–554 t since 1982–83 (Victorian Fisheries Authority, 2017a). During 2016–17, a total of 209 t of Southern Rock Lobster was landed from the Western Zone with a value of $16,517,000 (Victorian Fisheries Authority, 2017a). In comparison, 53 t was landed from the Eastern Zone. Effort during 2016/17 in the Western Zone was highest in December and January (51,000 and 52,000 pot-lifts), and apart from the closed season, effort was lowest during May and June (12,000 and 4,000 pot-lifts) (Figure 34). Catch largely followed a similar seasonal cycle to effort during 2016/17, with the highest catches in December and January, however catches during August were disproportionately low compared to effort. As of September 2017, there were 71 Fishery Access Licences in the Western Zone (Victorian Fisheries Authority, 2017a).

The area of the Victorian Giant Crab Fishery is the same as for the Victorian Rock Lobster Fishery, including the separation into Western and Eastern zones (Fisheries Victoria, 2010). The fishery targets the Giant Crab (*Pseudocarcinus gigas*) using baited Rock Lobster pots in depths of 150–

300 m (Fisheries Victoria, 2010). The Victorian Giant Crab Fishery is also managed by both input and output controls including a Total Allowable Commercial Catch (TACC – which was 10.5 t in 2016/17 (Victorian Fisheries Authority, 2017a)), limited entry, gear restrictions, size limits and seasonal closures. The closed season for females and males is from 1 June – 15 November and from 15 September – 15 November, respectively, and retention of berried females is prohibited. The catch of Giant Crab in the Western Zone has ranged <1 –171 t since 1982/83 and in 2015/16 (the latest year for which annual catch data is available) was 9 t, with a value of $280,000. The seasonality of the Victorian Giant Crab Fishey is unreported because of the low number of operators, however in the Tasmnaian fishery, catch is highest from December to February, and lowest from June to October (Mills *et al*., 2006). As of September 2017, there were 14 Fishery Access Licences state-wide (Victorian Fisheries Authority, 2017a). It is uncertain how many of these are active, but it is less than 5 as the data are confidential.

Overlap between Victorian Rock Lobster Fishery and area of the proposed seismic survey

Historical fishing effort by the Victorian Rock Lobster Fishery shows some effort in the area of the proposed seismic survey (Figure 35). Detailed catch and effort data was not provided by the Victorian Fisheries Authority to maintain confidentiality. In the reporting grids for which data was requested, a total of 2,358 kg of Southern Rock Lobster was caught during 2007/08 from 4,483 pot-lifts over 69 fishing days (Table 7). Over the period 2007/08 – 2016/17, a total of 44,883 kg of Southern Rock Lobster and Giant Crab was caught from 30,618 pot lifts over 460 fishing days by 13 different fishers (Table 7). Based on average price per kg of Southern Rock Lobster in 2016/17 (calculated from figures in Victorian Fisheries Authority, 2017a), the total value of the Southern Rock Lobster and Giant Crab catch during 2007/08 – 2016/17 was about $3.5 million, or an average of $350,000 per year representing about 2% of the 2016/17 value of the Victorian Rock Lobster Fishery in the Western Zone. A total of 13 different operators in the Victorian Rock Lobster and Victorian Giant Crab fisheries fished in the area of the proposed seismic survey during 2007/08 – 2016/17. Species recorded in catch and effort logbooks from that time include: Giant Crab (*Pseudocarcinus gigas*), Southern Rock Lobster (*Jasus edwardsii*), Octopus (Order *Octopoda*), Leatherjacket (Family *Monacanthidae*), School Shark (*Galeorhinus galeus*), Gummy Shark (M*ustelus antarcticus*) and Snapper (*Chrysophrys auratus*).

Likelihood of fishing grounds developing in the future

The TACC for the Victorian Rock Lobster Fishery in the Western Zone has decreased from 450 t in 2006–07 to 230 t in 2016–17 (Victorian Fisheries Authority, 2017a). Given the small volume of catch coming from the area of the proposed seismic surveys, and the declining TACC, it is unlikely that effort by the Victorian Rock Lobster Fishery in the area will increase greatly in the near future. Likewise, the TACC for the Victorian Giant Crab Fishery in the Western Zone has decreased for 25 t in 2009/10 to9 t in 2013/14, but increased slightly to 10.5 t in 2016/17 (Victorian Fisheries Authority, 2017a). For the same reasons as for the Victorian Rock Lobster Fishery, it is unlikely that effort by the Victorian Giant Crab Fishery will increase greatly in the near future in the area of the seismic survey. Even when aggregated across Giant Crab and Rock Lobster fisheries and year, there were less than five fishers operating in the area during 9 of the past 10 years (from 2007/08–2016/17).

The Victorian Rock Lobster Association and SIV represent the Victorian Rock Lobster Fishery, while SIV represent the Victorian Giant Crab Fishery. Contact details for this industry association are provided in Table 10.

Figure 33. Extent of the Victorian Rock Lobster Fishery showing eastern and western zones. From Victorian Fisheries Authority (2017b).

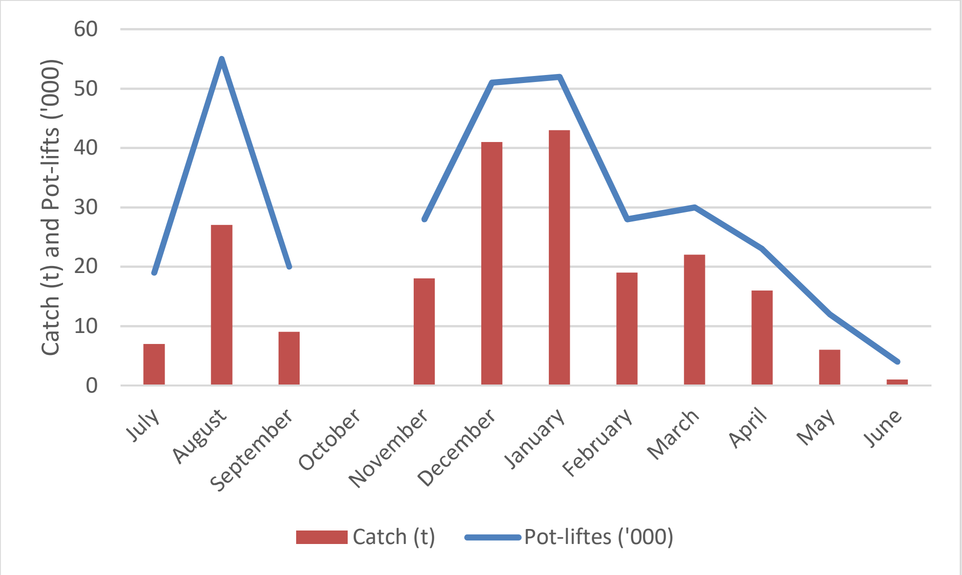
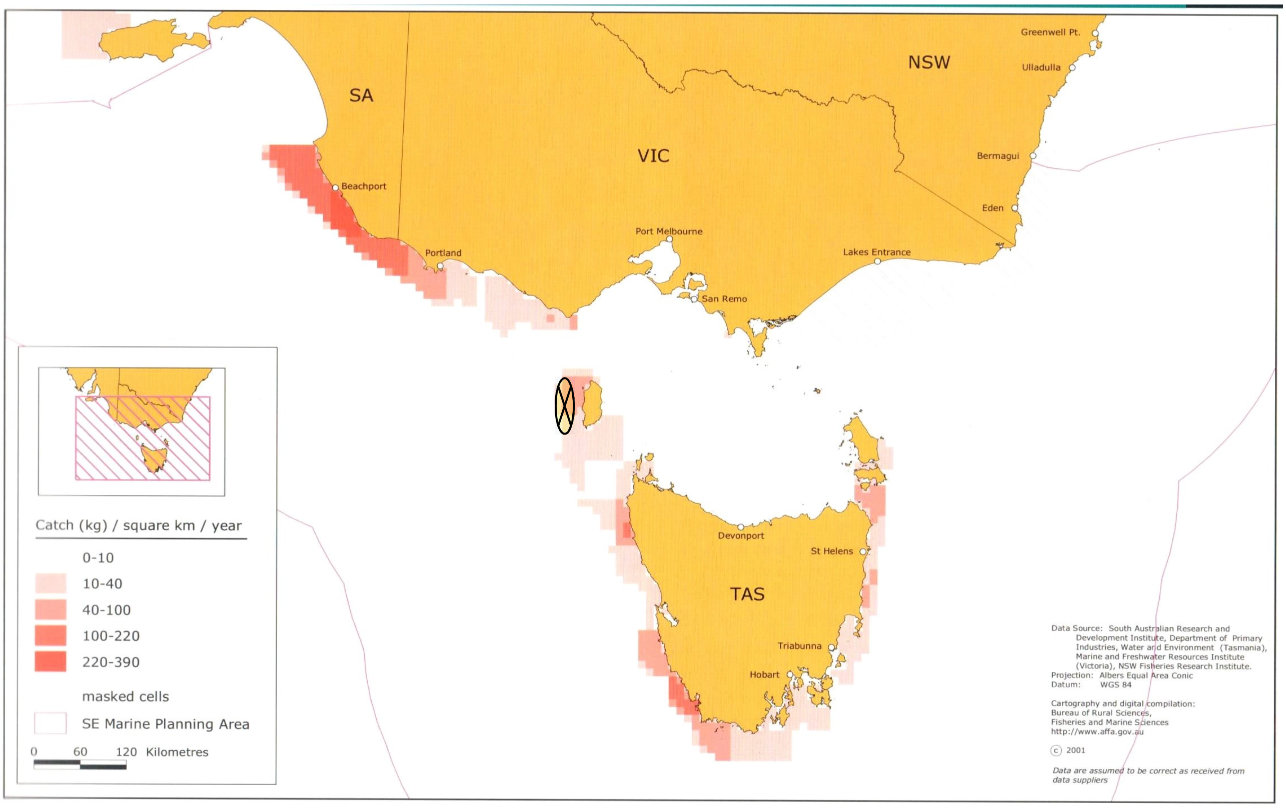


Figure 34. Catch (t) and number of pot-lifts ('000) in the western zones of the Victorian Rock Lobster Fishery for 2016-17. From Victorian Fisheries Authority (2017a).



Data Source: South Australian Research and Development Institute, Department of Primary Industries, Water and Environment (Tasmania), Marine and Freshwater Resources Institute (Victoria), NSW Fisheries Research Institute.
Projection: Albers Equal Area Conic
Datum: WGS 84

Cartography and digital compilation:
Bureau of Rural Sciences,
Fisheries and Marine Sciences
http://www.affa.gov.au

ⓒ 2001

Data are assumed to be correct as received from data suppliers

Figure 35 Catch rate (kg/square km/year) in the combined (Victorian and Tasmanian) Rock Lobster fisheries in south east Australia 1995 – 99 (Larcombe *et al*, 2002). Approximate location of proposed seismic survey shown by yellow balloon. Note that we have unsuccessfully attempted to obtain higher quality images of historical catch rate.

Table 7. Total catch and effort by the Victorian Rock Lobster Fishery and Victorian Giant Crab Fishery from July 2007 to June 2017 (Fiscal Year). Note *id* indicates insufficient data to report because there are less than five licence holders (policy requirement to protect commercial confidentiality of data), and the data have been included in the "Total" row.

Year	Fishery	Catch (kg)	Days	Pot-lifts
2007/08	GC	id	id	id
2007/08	RL	2,358	69	4,483
2008/09	GC, RL	id	id	id
2009/10	GC, RL	id	id	id
2010/11	GC, RL	id	id	id
2011/12	GC, RL	id	id	id
2012/13	GC, RL	id	id	id
2013/14	GC	id	id	id
2014/15	GC, RL	id	id	id
2015/16	GC, RL	id	id	id
2016/17	GC	id	id	id
Total	GC, RL	44,883	460	30,618

6.1. Tasmanian Rock Lobster Fishery

The Tasmanian Rock Lobster Fishery targets Southern Rock Lobster (*Jasus edwardsii*), and is managed through both input and output controls, with limited entry, gear restrictions, effort limits and a Total Allowable Commercial Catch (TACC). Baited pots are used to target lobster over reef substrate. There are two management areas subject to catch cap closures, however neither are in the region of the Dorrigo area. In 2018, the North East Area was re-opened to fishing on 1 March 2018[17]. The East Coast Catch Cap Area is also currently open to fishing. At the time of writing season end dates had not been set. The TACC for the 2018–19 season is 1050.7 t. There were 235 active fishers during 2011/12 (Hartmann *et al.*, 2013). There are seasonal closures in this fishery the 2018 closure dates are as follows, while the 2018 opening date is to be advised: females – 1 May (all State waters); male 1 September 2018 all waters south of St Helens Pt around to Sandy Cape (41° 29' South); male - 1 October 2018 all other State waters[17].

Annual catch of Southern Rock Lobster has decreased from nearly 1,500 t in 2007/08 and 2008/09, to a total of 1026.71 t during the 2017/18 quota year (Figure 36). Percent of TACC caught dropped to 91% in 2010/11, but has since been about 98%. Most of the catch comes from 0–40 m depth, some catch is taken from as deep as 200 m (Environment Australia, 2001).

Overlap between Tasmanian Rock Lobster Fishery and area of the proposed seismic survey

Catch data were provided by the University of Tasmania from either a 1 degree x 1 degree block, 0.5 degree x 0.5 degree block, and combinations of both that overlap the area of interest. Choice of blocks from which to send data was determined by identifying the smallest spatial scale without compromising the confidentiality policy. Annual catches from the blocks provided are shown in Table 8. More than 100 t of Southern Rock Lobster was taken was the area of interest annually during 2000–2006, but this has since fallen to less than 30 t since 2008. From 2013 to 2015, catch from the area of interest represents 0.8–2.3% of the total catch of the fishery.

Total 10 year catches of Southern Rock Lobster in the area of interest increased from late winter to January, when about 55 t was reported (Figure 37). February catches were lower at about 34 t, before increasing to 61 t and 57 t in March and April. Catches were lowest during May – July. Catch data from October were omitted to protect confidentiality

Likelihood of fishing grounds developing in the future

TACCs have been lowered in recent years to allow recovery of the stock, coinciding with a decease on catch from the area of interest. The latest (2014–15) combined stock assessment for South Australia, Victoria and Tasmania estimated that the combined egg production was above the limit reference points. If the stock recovers sufficiently it is possible that TACCs will also increase, potentially resulting in an increase in fishing in the area of interest.

The Tasmanian Rock Lobster Fisherman’s Association and TSIC represent Tasmanian Rock Lobster Fishery. Contact details for this industry association are provided in Table 10. The Tasmanian Seafood Inducyry Council is the peak state body representing all seafood producers.

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[17] http://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/rock-lobster-fishery/rock-lobster-fishing-seasons

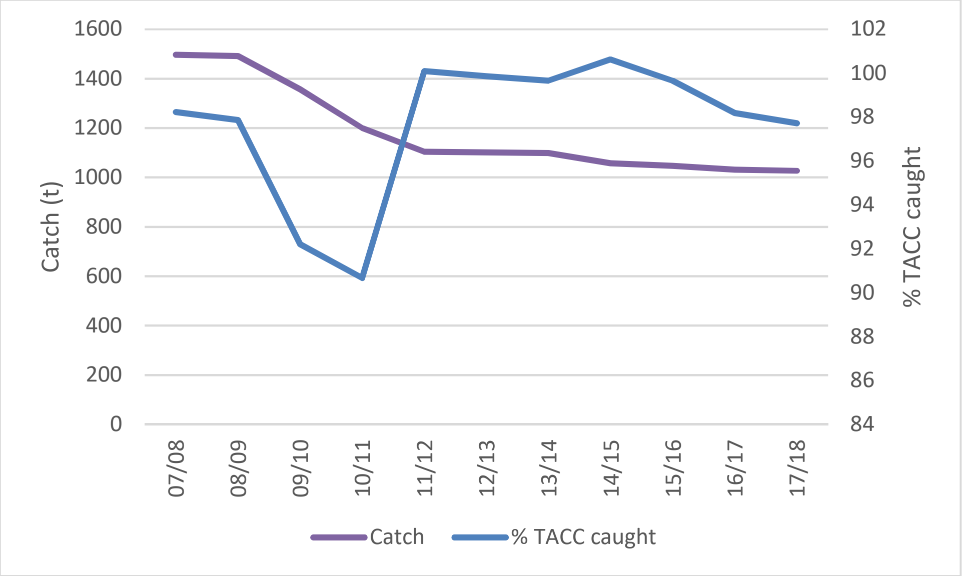

Figure 36. Annul catch of Southern Rock Lobster by the Tasmanian Lobster Fishery since 2007/08. Based on data reported by DPIPWE (2018[18]).

Table 8. Annual catch of Southern Rock Lobster and Giant Crab from 1 degree x 1 degree blocks and 0.5 degree x 0.5 degree blocks that overlap with the area of interest.

	Southern Rock Lobster		Giant Crab	
	Catch (t)	Num blocks reported from (1x1˚,0.5x0.5˚)	Catch (t)	Num blocks reported from (1x1˚,0.5x0.5˚)
2000	134.8	(1,2)	5.7	(0,1)
2001	174.4	(2,0)	9.0	(2,0)
2002	164.6	(2,0)	11.0	(2,0)
2003	179.4	(2,0)	1.3	(1,1)
2004	161.7	(2,0)	12.2	(2,0)
2005	132.9	(2,0)	10.4	(2,0)
2006	118.0	(2,0)	17.1	(2,0)
2007	86.7	(2,0)	13.7	(2,0)
2008	22.6	(1,2)	13.0	(2,0)
2009	12.5	(2,0)	15.8	(2,0)
2010	28.9	(1,2)	14.7	(2,0)
2011	26.9	(1,2)	7.5	(2,0)
2012	14.1	(1,2)	7.9	(1,0)
2013	8.3	(2,0)	8.8	(2,0)
2014	24.2	(1,2)	4.8	(2,0)
2015	17.3	(1,2)	4.8	(2,0)

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[18] http://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/rock-lobster-fishery/rock-lobster-catch

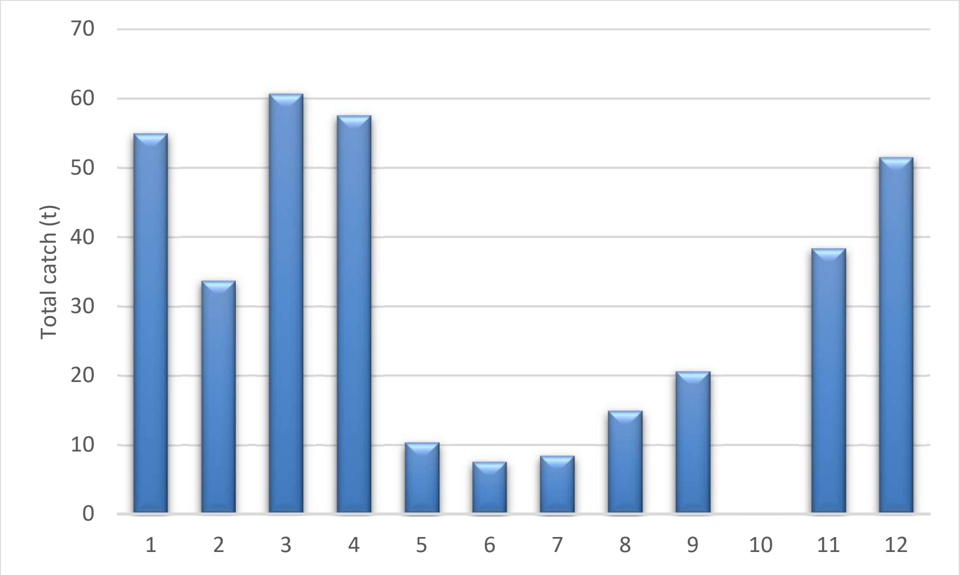

Figure 37. Total monthly catch of Southern Rock Lobster by the Tasmanian Lobster Fishery since 2007/08.

6.2. Tasmanian Giant Crab Fisheries

The Tasmanian Giant Crab Fishery targets Giant Crab (*Pseudocarcinus gigas*), in waters surrounding Tasmania south of 39˚12΄ out to the EEZ. Most fishing takes place on the edge of the continental slope using baited steel traps (pots) (Figure 38). The fishing seasons runs from 1 March to the last day of February, and there is a seasonal closure for females between. 1 June and 14 November. Main management measures include limited entry, pot restrictions and a seasonal spawning closure to protect females, TACs and minimum size limits (Department of Environment, 2014). The TAC during 2013/14 was 46.6 t (Emery *et al*., 2015)

Catches have declined from over 50 t in 2008/09 to 15 t in 2017/18 (Figure 40). Percent of TAC caught from 2008/09 to 2011/12 was above 80%, but this dropped to 54% in 2015/16, but increased to 77% and 79% in the following two years. The value of the fishery's catch in 2013/14 was $1.36 million. Effort on the West coast is lowest from July to August, and highest from November to February (Figure 39). It is uncertain how this relates to effort in the Dorrigo survey area.

Overlap between Tasmanian Rock Lobster Fishery and area of the proposed seismic survey

Catch data were provided by the University of Tasmania in the same format as for the Tasmanian Rock Lobster Fishery. Annual catches from the blocks provided are shown in Table 8. Catches of Giant Crab from the area of interest peaked in 17.1 t in 2006, but fell below 10 t in 2011 and below 5 t in 2014 (Table 8). From 2010 to 2015, catch from the area of interest represents 17–34% of the total catch of the fishery.

Likelihood of fishing grounds developing in the future

The Tasmanian Giant Crab stock of is currently considered overfished because of the lack of egg production relative to unfished levels [19]. Given the declining catches and TACs, and classification as overfished, it is unlikely that there will be an expansion of the fishery in the area of interest in the near future.

The Tasmanian Rock Lobster Fisherman's Association and TSIC represents the Tasmanian giant Crab Fishery. Contact details for this industry association are provided in Table 10. The Tasmanian Seafood Inducyry Council is the peak state body representing all seafood producers.

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[19] http://fish.gov.au/report/29-Giant-Crab-2016

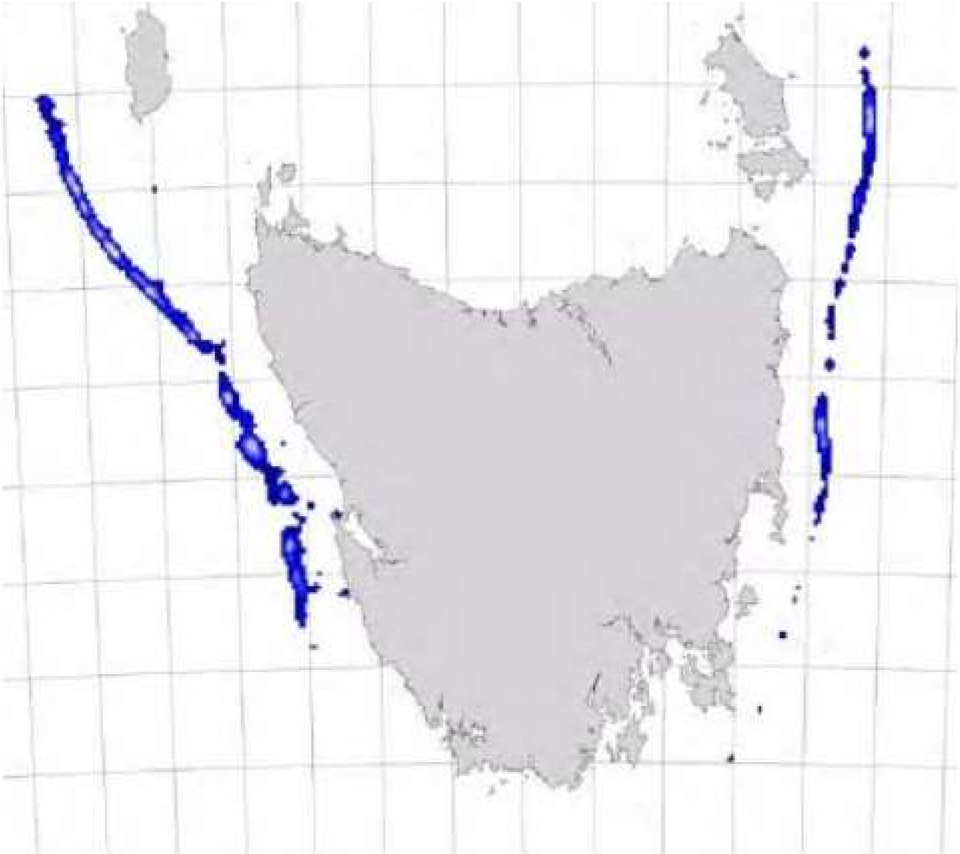

Figure 38. Distribution of fishing effort in the Tasmanian Giant Crab fishery reported in Department of Environment (2014).

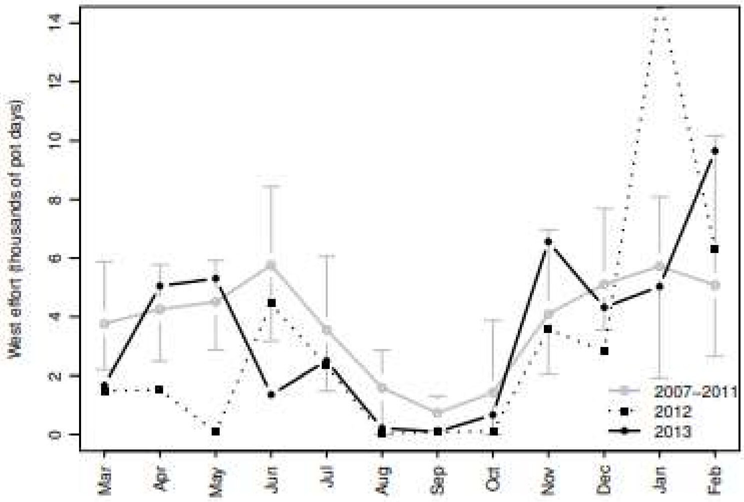

Figure 39. Seasonal effort by the Tasmanian Giant Crab fishery on the West Coast reported in Emery *et al*. (2015).

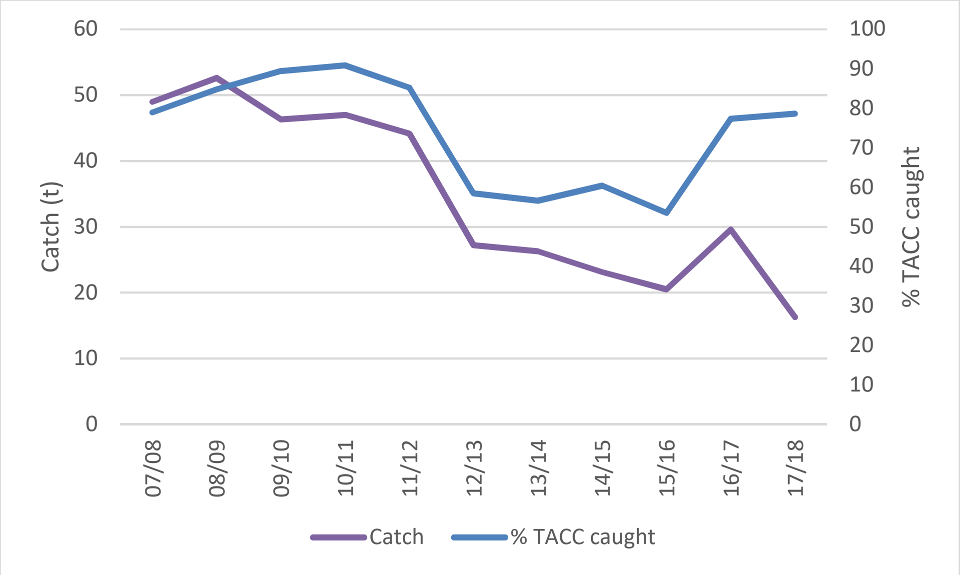

Figure 40. Annul catch of Giant Crab by the Tasmanian Giant Crab Fishery since 2007/08. Based on data reported by DPIPWE (2018[20]).

6.3. Tasmanian Scalefish Fishery

The Tasmanian Scalefish Fishery is multi-gear, multi-species fishery that operates in waters around Tasmania (Emery *et al*., 2017). The fishery is largely controlled via input controls such as limited entry, closed seasons and gear restrictions. Output controls include minimum and maximum size limits and quota management for Banded Morwong on the east coast. Licencing arrangements in the fishery comprises gear-based and species-based licence types and endorsements for different areas and gear types. The area of the fishery and reporting blocks are shown in Figure 42. Gears used in the fishery include beach seine/purse seine, graball/small mesh net, drop-line, hand-line, fish trap, squid-jig, spear and dip-net.in 2015 there was a total of 281licences in the fishery, 195 of which were active (Emery *et al*., 2017).

More than 90 different species are reported in catch logbook, and assessments conducted vary depending on them being classified as either Key Species or Minor Species, and the level of data available. Determination of stock status is based on a number of performance indicators and references points outlined in (Emery *et al*., 2017). Catch of scalefish has been declining since the late 1990sfrom about 1,400 t to 343 t in 2015/16 (Figure 41). Catch of small pelagic species has generally been low, but spiked at more than 1,000 t in 2008/09 and 2009/10. Annual catches of cephalopods have generally been just below 200 t, but reached 600 t in 1999/00, 625 t in 2011/12 and 1,261 t in 2012/13. The large decline in reported shark catch around 1997 was a result of the introduction of Commonwealth logbooks for the GHATS in which sharks were subsequently reported.

Overlap between Tasmanian Scalefish Fishery and area of the proposed seismic survey

Emery *et al*. (2017) report catch and effort in the fishery by management block averaged from 2010/11 to 2014/15 and for 2015/16. Species from which there was catch reported from fishing blocks that overlap with the area of interests are listed in Table 9. Of the 85.2 t of Australian Salmon caught in 2015/16, only 0.1–4.0 t was caught in blocks overlapping the area of interest. While small catches of Striped Trumpeter, Bluethroat Wrasse and Purple Wrasse from reported from those fishing blocks during 2010/11 to 2014/15, no catch was reported for 2015/16. An average of 0.1–50 t of Gould’s Squid was reported for 2010/11 to 2014/15, and this was likely driven by a large catch of 42 t during 2011. No catch of Gould’s Squid was reported from 2015/16.

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[20] http://dpipwe.tas.gov.au/sea-fishing-aquaculture/commercial-fishing/giant-crab-fishery/giant-crab-catch

The project spoke to Mr Stuart Richie who holds a Tasmanian scalefish concession and catches 85% of the salmon in that fishery using purse seine gear. He has confirmed that Tasmanian scalefish vessels do not fish in the vicinity of the proposed seismic survey and that his operation has never caught a salmon in deeper than 20m of water.

Significant catches (>10 t) of Gummy Shark and School Shark were reported from the area of interest in the late 1990's, but this has decreased substantially in the introduction of GHAT logbooks, and in the latest years from what catch data was made available, 184.5 kg of Gummy shark was landed in 2011, and 772.5 kg of School Shark was landed in 1999.

Likelihood of fishing grounds developing in the future

Given the declining catches in the fishery overall, and especially from the area of interest, it is unlikely that there will be an expansion of the fishery in the near future. However, both small pelagic species and Gould's Squid can undergo large annual fluctuations in biomass, and it is possible that those species might "boom" in the area of interest which could attract significant amounts of fishing effort in the area. However this is impossible to predict. The main fish-fish species caught in the area are considered to be shallow water species (Gomon *et al*., 2008) — Australian Salmon (near-share waters), Bluethroat Wrasse (to 20 m depth) and Purple Wrasse (shallow rocky reefs) — and so are unlikely to be targeted in the area of the Dorrigo survey.

Table 9. Annual catches of main species by the Tasmanian Scalefish Fishery reported in Emery *et al*. (2017) for fishing blocks 3C2, 3C41, 3C42 and 4C2 in Figure 42.

Species	Average annual catch from 2010/11 to 2014/15 (t)	2015/16 catch (t)	2015/16 State-wide catch (t)
Australian Salmon	4–20 t	0.1–4 t	85.2 t
Striped Trumpeter	0.1–1 t	0 t	5.9 t
Bluethroat Wrasse (*Notolabrus tetricus*) and Purple Wrasse (*Notolabrus fuciola*)	0.1–2 t	0 t	69.3 t
Gould's Squid (*Nototodarus gouldi*)	0.1–50 t	0 t	325.1 t

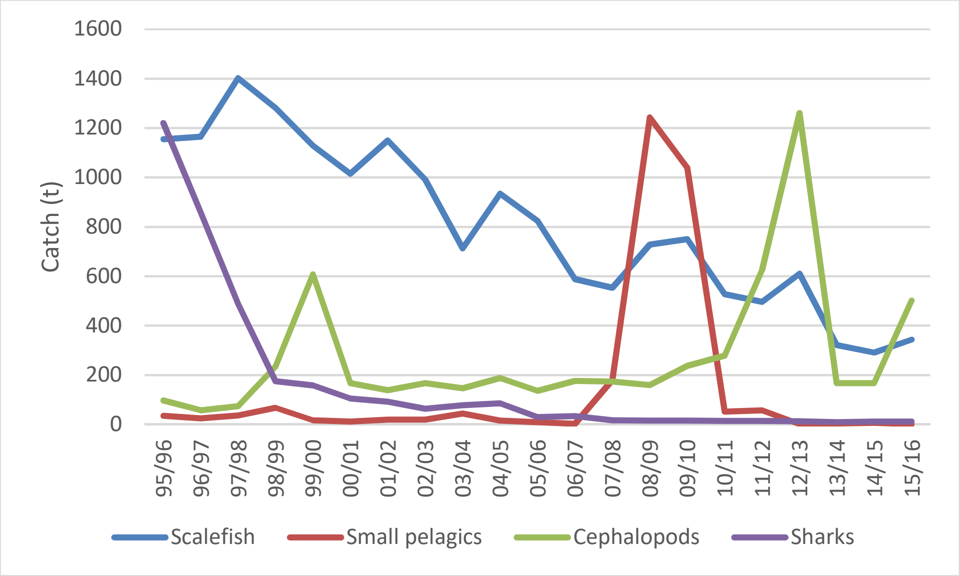


Figure 41. Annul catch of scalefish, small pelagic species, cephalopods and sharks by the Tasmanian Scalefish Fishery since 1995/96. Based on data in Emery *et al.* (2017).

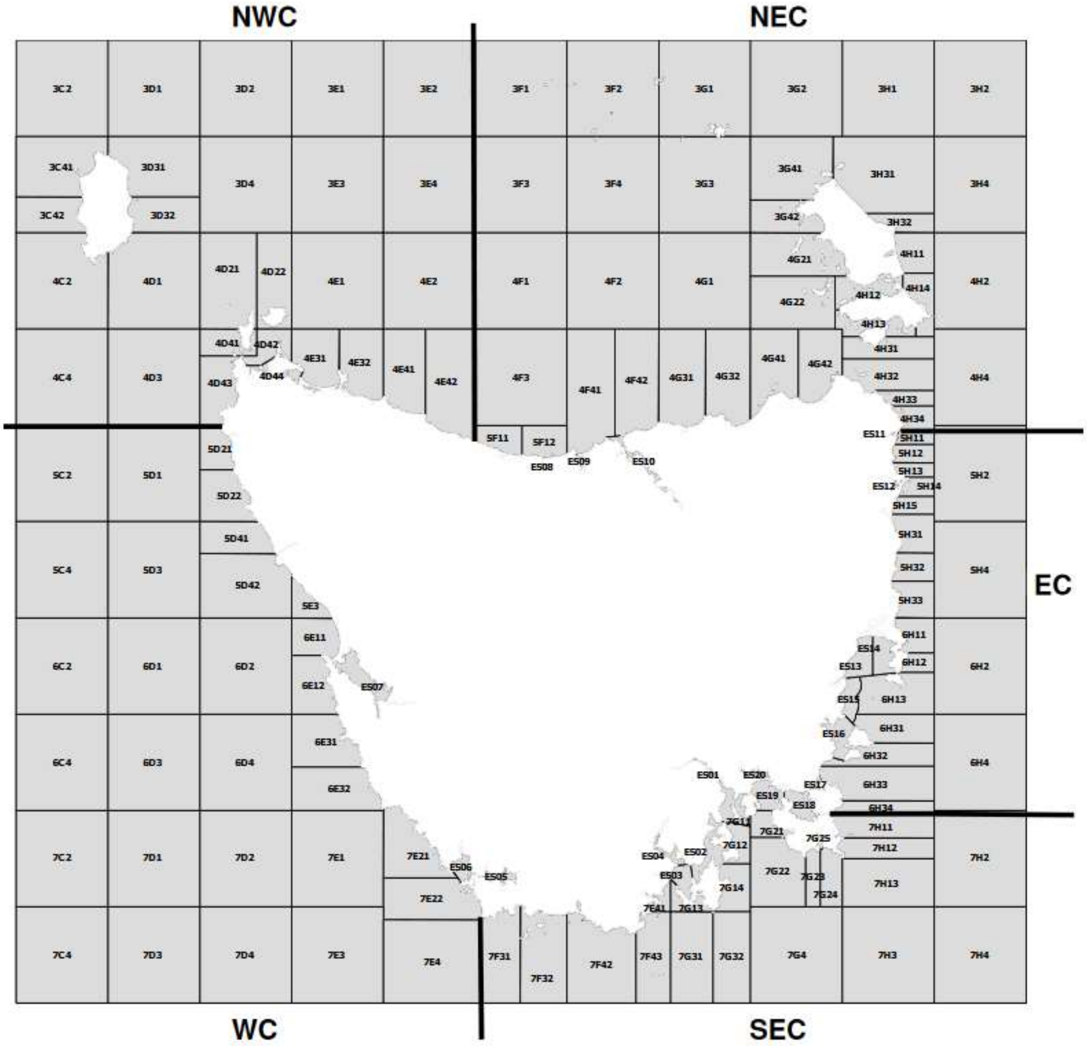


Figure 42. The area of the Tasmanian Scalefish Fishery comprising the southeast coast (SEC), east coast (EC), northeast coast (NEC), northwest coast (NWC), and west coast (WC). zones. From Emery *etal*. (2017).

7. CONTACTS FOR FISHING SECTORS

Some sectors have their own representative body (or two), but both Commonwealth and State managed fisheries and are also represented by overarching representative bodies. Key contacts for each are listed in Table 10.

Table 10. Key contacts for representative bodies for each affected sector.

Fisheries	Representative organisations	Key contact name	Key contact phone number	Key contact email address
Commonwealth Trawl Sector (CTS) and Scalefish Hook Sector	SETFIA	Simon Boag	0428-141591	simonboag@setfia.org.au
Shark Gillnet and Shark Hook Sector and Scalefish Hook Sector	Southern Shark Industry Alliance (SSIA)	Simon Boag	0428-141591	simon@atlantisfcg.com
Shark Gillnet and Shark Hook Sector	Sustainable Shark Fishing Inc.	David Stone	0488-002898	ssf5@bigpond.com
Victorian Rock Lobster Fishery	Victorian Rock Lobster Association (VRLA)	Markus Nolle	Via SIV 03-96870673 Or 0414-602298	mnolle@bigpond.com
Victorian Giant Crab Fishery	Seafood Industry Victoria	Johnathon Davey	03-96870673	admin@siv.com.au
Victorian Rock Lobster Fishery Victorian Giant Crab	Seafood Industry Victoria	Johnathon Davey	03-96870673	admin@siv.com.au
Tasmanian Rock Lobster Fishery	Tasmanian Rock Lobster Fisherman's Association	John Sansom	03 6224 2890 0427 477284	johnsansom1@bigpond.com
Tasmanian Giant Crab Fishery	Tasmanian Seafood Industry Council	Julian Harrington	03-62242332	tsic@tsic.org.au
Tasmanian Scalefish Fishery	Tasmanian Seafood Industry Council	Julian Harrington	03-62242332	tsic@tsic.org.au
	Apollo Bay Cooperative	Pat Hutchins (Nick Polgeest?)	0418-367494	Phutch48@bigpond.com

Table 11 Contact details for some affected fishers, roughly in order of degree of potential effect on
(shaded = unknown if affected but possible based on address, port of domicile and/or method)

Sector	Name	Phone	Vessel	Email	Port of domicile
Tasmanian giant crab	Brian O'connor	0427 090 560			
Victorian Rock Lobster	David McCarthy	03 55236603			Portland, Vic
Victorian Rock Lobster	Don Edmonston	0428356 372			Portland, Vic
Rock Lobster?	Don Nattrass	0428 838 687			
Victorian Rock Lobster	Gary Kerr	0427 829 748			
Victorian Rock Lobster	Howard Sharp	0407 519578			Port Fairy, Vic
Victorian Rock Lobster	Bruce Carrison	03 5561 3019			Warrnambool, Vic
Victorian Rock Lobster	Gary Edwards	0428 529 955			Warrnambool, Vic
Victorian Rock Lobster	Gerhard Wilmink				Apollo Bay, Vic
Victorian Rock Lobster	Mick Astbury	0427 527 707			Warrnambool, Vic
Victorian Rock Lobster	Paul Armstrong	0428 681 528			Port Fairy, Vic
Victorian Giant Crab	Bill Tober	0427-234 971		kaktober@hotmail.com	
Victorian Giant Crab	Anthony Olver	0417-124053			Williamstown, Vic
CTS	Tom Bibby	0438-231581	Moira Elizabth	Bibby_58@bigpond.com	Portland, Vic
CTS	Robert White	0421-271911	Tullaberga		Lakes Entrance, Vic
CTS	Adam Guillot	0408-243900	Empress Pearl & Western Alliance	Adam.cae@eftel.net.au	Lakes Entrance, Vic
CTS	Brendan Alcote	0432-113036	Empress Pearl		Lakes Entrance, Vic
CTS	Russel Bradshaw	0428-553054	Empress Pearl		Lakes Entrance, Vic
CTS	Alec Harvey	0419-370564	Empress Pearl		Lakes Entrance, Vic
CTS	Michael Joseph	0423 911101	Western Alliance		Lakes Entrance, Vic
CTS	Bredan Mckewen	0408-003846	Western Alliance		Lakes Entrance, Vic
CTS	Greg Nietz	0467-543921	Saxon Progress		Portland, Vic
CTS	Daniel Hogan	0467-494044	Zeehan	zeehaan@toberfish.com.au	Portland, Vic
CTS	Sot Sotirakis	0411-072746		sot@sot.net.au	Portland, Vic
CTS	Joe Stevens	0428-302509	Vivean Jane	Jwstevens1@bigpond.com	Portland, Vic
CTS	Nick (Skipper)	0429-134633	Vivean Jane		Portland, Vic
CTS	Jamie Dunkley-Price	0428-949719	Saxon Onward	Jamie.dunkeyprice@gmail.com	Geogetown, Tas
CTS	Tony Muollo	0427-493332	Saxon Onward	tmuollo@transtasman.com.au	Sydney, NSW

Sector	Name	Phone	Vessel	Email	Port of domicile
CTS	Georgetown Seafoods	03 6382 3466		chris@georgetownsf.com.au	Georgetown, Tas
GHAT gillnet shark	Arthur Sifford	0427-567455			Devonport, Tas
GHaT shark gillnet	Ron Anthony	0427-341007	Daryl R	Ron.anthony@bigpond.com	San Remo, Vic
GHaT shark gillnet	Craig Davis	0400-079263	Challenger	danicraig@msn.com	Hobart, Tas
GHaT shark gillnet		0428-524356	Sandgroper	sandgroperjosh@hotmail.com	San Remo, Vic
GHaT shark gillnet		0400-986061	Instigator	Kristin.cruse@education.tas.gov.au	Esperence, Tas
GHaT shark gillnet		0404-052360	Pegasus IV	Pierre.landscape@bigpond.com	San Remo, Vic
GHaT shark gillnet	Paul Bone	0428-515432	Endeavour	wpu@bigpond.net.au	San Remo, Vic
GHaT shark gillnet		0429-811194	Gabo Bay	craiglawrie62@gmail.com	Robe, SA
GHaT shark gillnet		0423-649573	Mako		San Remo, Vic
GHaT shark gillnet	Peter Smith	0429-424470	Japara		Tasmania
GHaT shark gillnet	Gary Robertson	0428 682 686			Port Fairy, Vic
GHaT scalefish hook	Toni Clarke	0429-335050	Petuna Endevour	tc@psdf.com.au	Devonport, Tas
GHaT scalefish hook	Will Mure	0417-334742	Diana	will@mures.com.au	Hobart, Tas
GHaT scalefish hook	Mark Brown	0457-885781	Annadale		Gilston Bay, Tas
C'wealth SFR holder	ARTHUR N SIFFORD	0427 567 455		sifford@bigpond.com	Port Sorrell, Tas
C'wealth SFR holder	BRENDA I KLINGBERG	0409 682 591		biklingberg@gmail.com	Stanley, Tas
C'wealth SFR holder	C.A. HARRISS & J.A.	0438 111 166		jrow0368@bigpond.net.au	Devonport, Tas
C'wealth SFR holder	ERIC G TAYLOR	03 6427 8265		vaurena@bigpond.com	Devonport, Tas
C'wealth SFR holder	MICHAEL V HARDY	0488 670888		michael@topfishtas.com.au	Stanley, Tas
C'wealth SFR holder	NAUTILUS FISHING	0409 547 398		sam-ge86@hotmail.com	Strahan, Tas
C'wealth SFR holder	PAUL K VINEY	0419 882 445		shell1@iinet.net.au	Smithton, Tas

8. REFERENCES

AFMA. (2017a). http://www.afma.gov.au (Accessed 28/6/2017)

AFMA. (2017b). Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet 2017. Australian Fisheries Management Authority. Canberra ACT

Commonwealth of Australia. (2015). South-east marine region profile: A description of the ecosystems, conservation values and uses of the South-east Marine Region, Commonwealth of Australia

DAFF. (2007). Commonwealth Fisheries Harvest Strategy: policy and guidelines, DAFF, Canberra.

Department of Environment. (2014). Assessment of the Tasmanian Giant Crab Fishery July 2014. Department of Environment. Commonwealth of Australia.

Department of Environment and Heritage. (2004). Assessment of the Victorian Rock Lobster Fishery. Department of Environment and Heritage, Commonwealth of Australia.

Earth Resources. (2018) http://earthresources.vic.gov.au/earth-resources/victorias-earth-resources/petroleum/victorias-sedimentary-basins (Accessed 8/2/2018)

Emery, T., Hartmann, K. and Gardner, C. (2015). Tasmanian Giant Crab Fishery 2013/14. Institute for Marine and Antarctic Studies, University of Tasmania.

Emery, T., Lyle, J. and Hartmann, K. (2017). Tasmanian Scalefish Fishery Assessment 2015/16. Institute for Marine and Antarctic Studies, University of Tasmania.

Environment Australia. (2001). Assessment of the Tasmanian Rock Lobster Fishery against the Guidelines for the ecologically sustainable management of fisheries for the purposes of Part 13 and Part 13A of the Environment Protection and Biodiversity Conservation Act 1999. Environment Australia, Commonwealth of Australia.

Fisheries Victoria. (2010). Victorian Giant Crab Fishery Management Plan. Fisheries Victoria Management Report Series No. 79 November 2010. https://vfa.vic.gov.au/operational-policy/fisheries-management-plans/victorian-giant-crab-fishery/giant-crab-management-plan

Gomon, M., Bray, D. and Kuiter, R. (2008). Fishes of Australia's Southern Coast. Museum of Victoria, Victoria, Australia.

Hartmann, K., Gardner, C. and Hobday, D. (2013). Tasmanian Rock Lobster Fishery 2011/12. Institute for Marine and Antarctic Studies, Hobart, TAS.

Koopman, M.T., McCoy, P., Troynikov, V.S., Braccini, J.N. and Knuckey, I.A. (2010). Selectivity and bycatch reduction of Tiger Flathead and Eastern School Whiting nets in the Danish seine fishery. Final report to Fisheries Research and Development Corporation Project No. 2007/040. Department of Primary Industries, Queenscliff.

Larcombe, J., Brooks, K., Charalambou, C., Fenton, M., Fisher, M., Kinloch, M. and Summerson, R. (2002). Marine Matters - Atlas of marine activities and coastal communities in Australia's South-East Marine Region. Bureau of Rural Sciences, Canberra, A.C.T.

Mehin K and Kamel, M. (2002). Gas Resources of the Otway Basin in Victoria. Department of Natural Resources and Environment, State of Victoria.

Mills, D., Haddon, M. and Gardner, C. (2006). Tasmanian Giant Crab Fishery 2004/05. Fishery Assessment Report. Tasmanian Aquaculture and Fisheries Institute. Hobart.

National Parks. (2013). South-east Commonwealth Marine Reserves Network management plan 2013-23, Director of National Parks, Canberra.

Noble, A. (2006). Riggers Handbook. A. Noble and Sons LTD, Melbourne.

Patterson, H, Noriega, R, Georgeson, L, Larcombe, J and Curtotti, R. (2017). Fishery status reports 2017, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. CC BY 4.0.

Tomkin, J. (1998). *Commercial Fishing Methods in Victoria* http://pandora.nla.gov.au/pan/59217/20060524-0000/FN0105.pdf (Accessed June 2017)

Victorian Fisheries Authority. (2017a). Victorian Fisheries Authority Commercial Fish Production Information Bulletin, Victorian Fisheries Authority, Queenscliff, Victoria, Australia.

Victorian Fisheries Authority. (2017b). Victorian Rock Lobster Fishery Management Plan 2017, Victorian Fisheries Authority, Melbourne, Victoria, Australia.

9. Appendix 1. Statement of fisheries operating in the area of the proposed 3D Oil seismic survey.

The permitted fishing area of 10 Commonwealth managed fisheries/fishery sectors overlap with the area of interest and the ”Full Fold Area” (Table 12, Figure 43, Figure 44). Three of those fisheries only partly over-lap with those areas, while two that fully overlap are prohibited from fishing in the Zeehan Commonwealth Marine Reserve, which transects the Area of Operation. Of the 10 fisheries / sectors and based on broad scale maps of fishing effort (1 degree), there have been recent effort reported from within the Area of Operation by the SESSF Commonwealth Trawl Sector (both Danish seine and bottom trawl), SESSF Scalefish Hook Sector, SESSF Shark Gillnet Sector (CGS), SESSF Shark Hook Sector (CHS) (Table 12, Figure 46). Of those with no recent effort in the area, historical effort available (1997–99) was only recorded for the Bass Strait Central Zone Scallop Fishery.

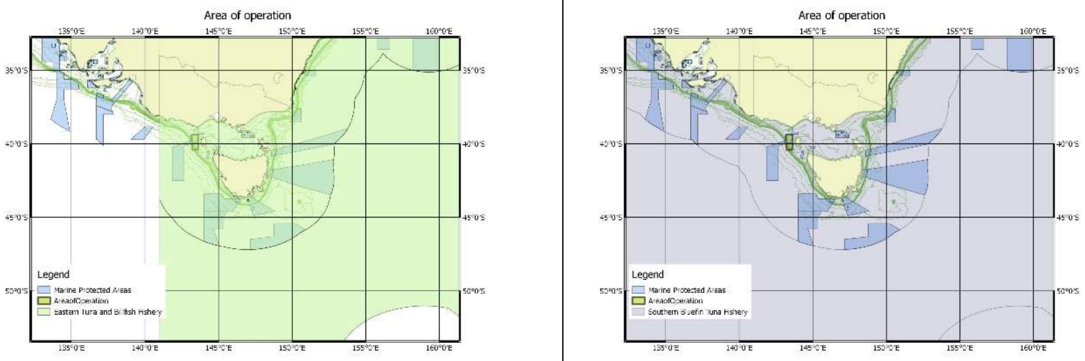
The only two Victorian managed fisheries permitted to operate in the Area of Interest are the Rock Lobster and Giant Crab fisheries (Table 12, Figure 43, Figure 44). They both partially overlap the area and are permitted to fish in the area of the Zeehan Commonwealth Marine Reserve. There are recent records of effort from the area from both fisheries (Table 12).

Three Tasmanian managed fisheries are permitted to operate in the Area of Interest, the Rock Lobster, Giant Crab and Tasmanian Scalefish fisheries (Table 12, Figure 43, Figure 44). They both partially overlap the area, but do not overlap with the Zeehan Commonwealth Marine Reserve. There are recent records of effort from the area from all three fisheries (Table 12).

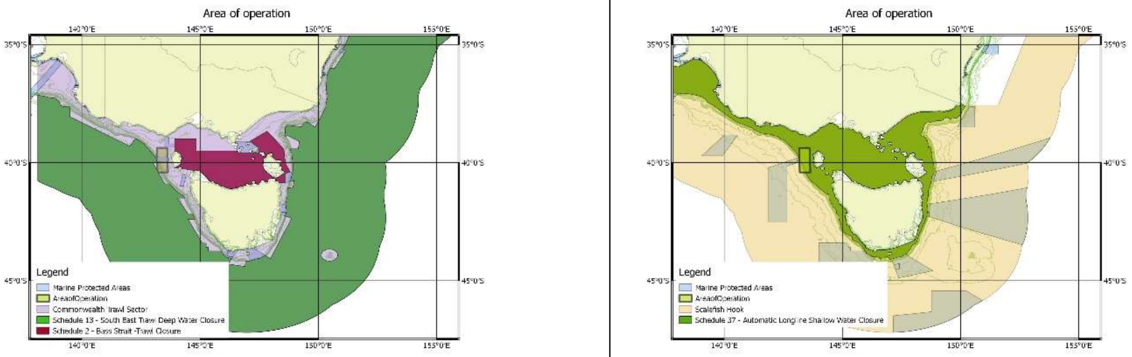
Table 12. Fisheries that overlap the area of the Full Fold Area and Area of Operation. Green -= complete overlap, orange = partial overlap, red = no overlap. * Other ocean base Victorian commercial fisheries are restricted to operating in “Marine Waters” which extend to 20 nm offshore[21]. X denotes fisheries / sectors that ARE NOT, and ✓ denotes fisheries / sectors that ARE permitted to fish inside the Zeehan Commonwealth Marine Reserve

State	Fishery / sector	Full Fold Area	Area of Operation	Recent effort (2015-16)	Historic effort from Butler et al., (2002)	Shapefile
Commonwealth	Eastern Tuna and Billfish Fishery (ETBF)	🟩 ✓	🟩 ✓	No		etbf
	Southern Bluefin Tuna Fishery (SBTF)	🟩 ✓	🟩 ✓	No		sbtf
	SESSF Commonwealth Trawl Sector (CTS)	🟩 X	🟩 X	Danish seiner – Yes Bottom Trawl - Yes		sess_cts
	SESSF Scalefish Hook Sector (CSHS)	🟧 ✓	🟧 ✓	Yes		sess_cshs
	SESSF Shark Gillnet Sector (CGS)	🟧 ✓	🟧 ✓	Yes	Yes (1997-99)	sess_cgs
	SESSF Shark Hook Sector (CHS)	🟧 ✓	🟧 ✓	Yes		sess_cgs
	Skipjack Tuna Fishery (SKJF)	🟩 ✓	🟩 ✓	No fishing in 2015–16 season		esf
	Small Pelagic Fishery (SPF)	🟩 ✓	🟩 ✓	No		spf
	Bass Strait Central Zone Scallop Fishery (BSCZSF)	🟩 X	🟩 X	No	Yes (1995-99)	bsczsf
	Southern Squid Jig Fishery (SSJF)	🟩 ✓	🟩 ✓	No. But a very small amount in 2017.		ssjf

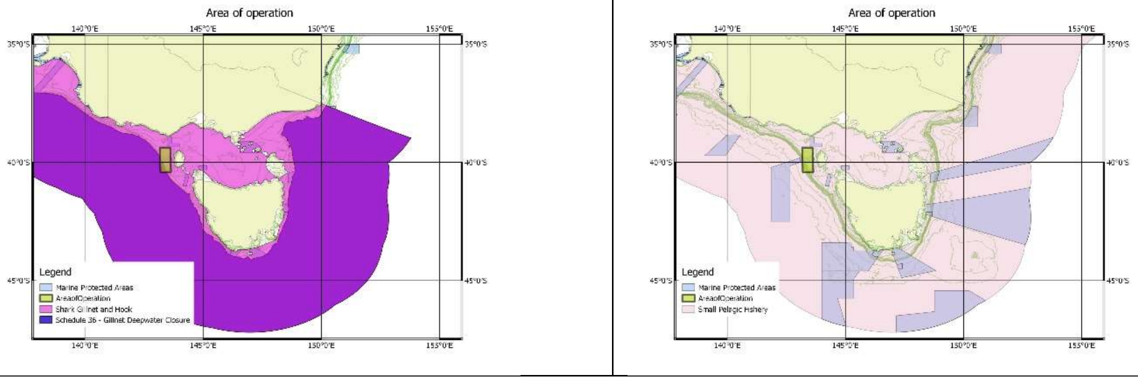
Victoria[22]	Giant Crab Fishery	✓	✓	Yes (2014-15[23])		Rl_areas_new
	Rock Lobster Fishery	✓	✓	Yes (2014-15[24])	Yes (1997-99)	Rl_areas_new
Tasmania	Giant Crab Fishery	✓	✓	Yes (2014-15[23])		RLOCS
	Rock Lobster Fishery	✓	✓	Yes (2014-15[24])	Yes (1997-99)	
	Tasmanian Scalefish Fishery	✓	✓	Yes		


a) Eastern Tuna and Billfish Fishery

b) Southern Bluefin Tuna Fishery (2015)


c) SESSF Commonwealth Trawl Sector

d) SESSF Scalefish Hook Sector


e) SESSF Shark Gillnet and Shark Hook sectors

f) Small Pelagic Fishery

Figure 43. Area of operation of fisheries that can operate in the area of the proposed seismic survey (green polygon).

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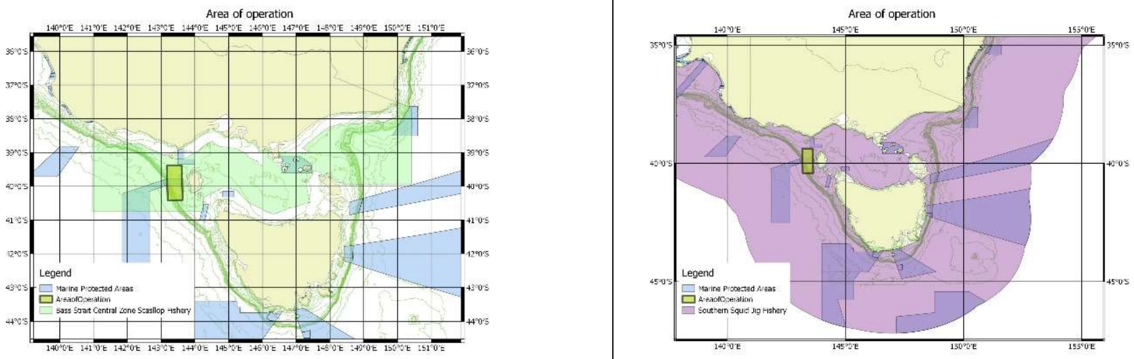
[22] Fisheries Regulations 2009 (http://www8.austlii.edu.au/cgi-bin/viewdb/au/legis/vic/consol_reg/fr2009219/ (Accessed 06/02/2018)

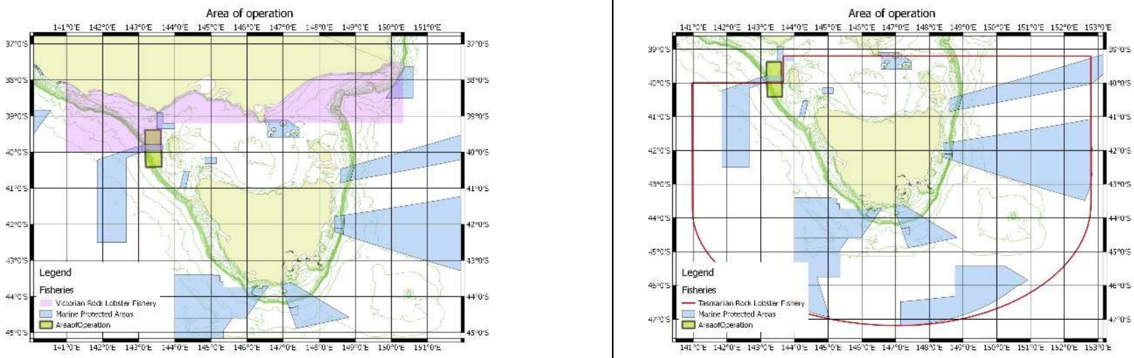
[23] http://fish.gov.au/report/29-Giant-Crab-2016 (Accessed 06/02/2018)

[24] http://fish.gov.au/report/65-Southern-Rock-Lobster-2016 (Accessed 06/02/2018)



a) Bass Strait Central Zone Scallop Fishery

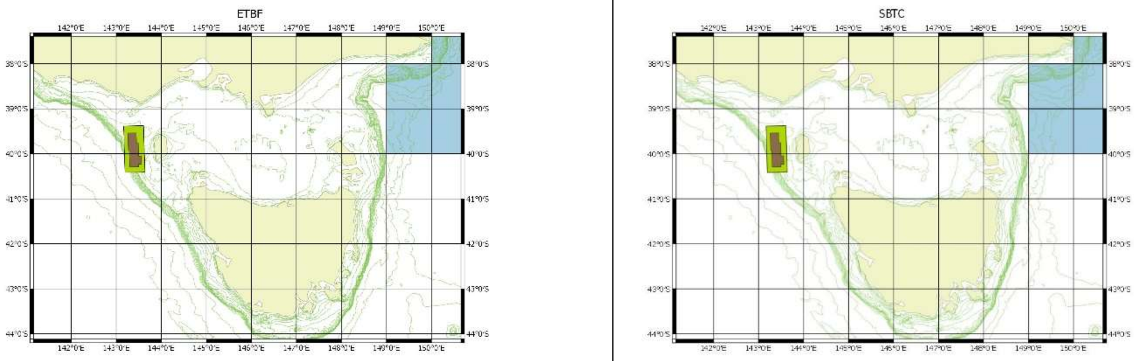
b) Southern Squid Jig Fishery



c) Victorian Rock Lobster and Giant Crab Fisheries

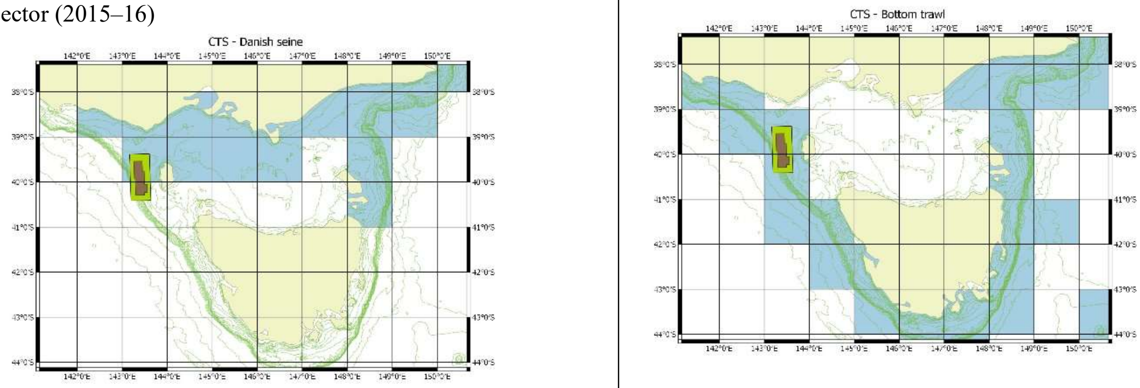
d) Tasmanian Rock Lobster and Giant Crab Fisheries

Figure 44. Area of operation of fisheries that can operate in the area of the proposed seismic survey (green polygon).



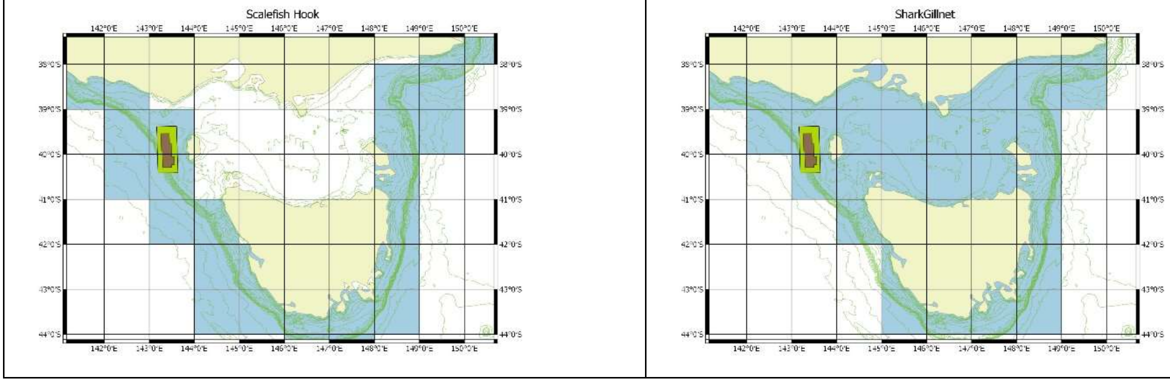
a) Eastern Tuna and Billfish Fishery (2015)

b) Southern Bluefin Tuna Fishery (2015)



c) SESSF Commonwealth Trawl Sector Danish Seine sub-sector (2015–16)

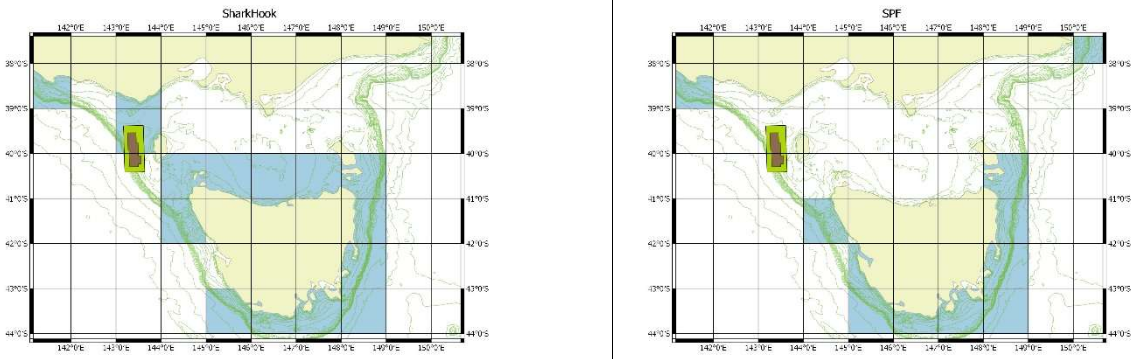
d) SESSF Commonwealth Trawl Sector (2015–16)



e) SESSF Scalefish Hook Sector (2015–16)

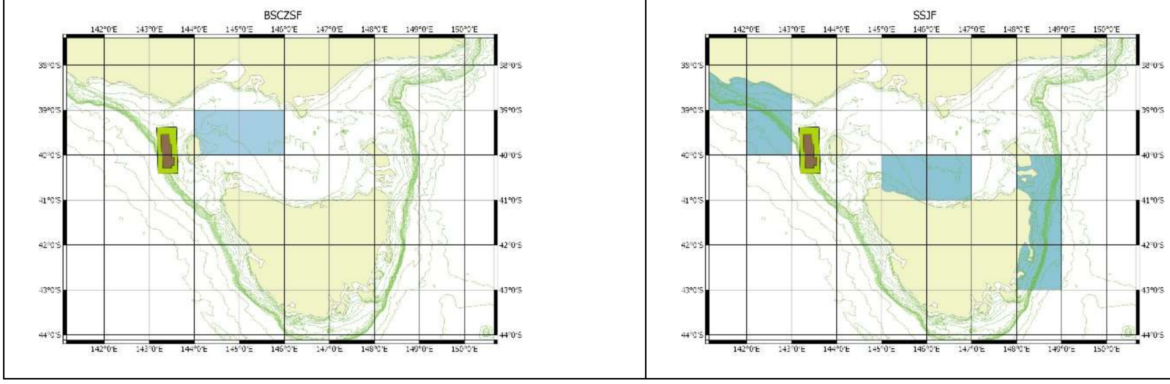
f) SESSF Shark Gillnet Sector (2015–16)

Figure 45. Distribution of fishing effort (shaded blue in 1-degree blocks) for Commonwealth managed fisheries that can operate in the area of the proposed seismic survey (green polygon). Note that these figures have not been filtered for the confidentiality policy because they are of sufficiently coarse spatial scale. Data provided by Rupert Summerson (ABARES).



a) SESSF Shark Hook Sector (2015–16)

b) Small Pelagic Fishery (2015–16)



c) Bass Strait Central Zone Scallop Fishery (2015)

d) Southern Squid Jig Fishery (2015)

Figure 46. Distribution of fishing effort (shaded blue in 1-degree blocks) for Commonwealth managed fisheries that can operate in the area of the proposed seismic survey (green polygon). Note that these figures have not been filtered for the confidentiality policy because they are of sufficiently coarse spatial scale. Data provided by Rupert Summerson (ABARES).

SEQUOIA 3D MARINE SEISMIC SURVEY

Oil Spill Modelling

MAQ0953J
Sequoia 3D Marine Seismic
Survey Oil Spill Modelling
Rev1
17 November 2020

rpsgroup.com

Document status

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Internal	Draft issued for internal review	Jeremie Bernard Jordan Glen	Jeremie Bernard		
Rev 0	Draft issued for client review		Dr. Sasha Zigic	Dr. Sasha Zigic	8 September 2020
Rev 1	Final report sent to client		Dr. Fernando Alvarez Jeremie Bernard	Dr. Sasha Zigic	17 November 2020

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Prepared by:	Prepared for:
RPS	**Aventus Consulting Pty Ltd**
Jeremie Bernard	Giulio Pinzone
Senior Coastal Engineer	Principal Environmental Consultant
Suite E1, Level 4, 140 Bundall Road	Suite 307/75 Tulip Street
Bundall QLD 4217	Cheltenham VIC 3192
T +61 7 5574 1112	T +61 409 772 170
E Jeremie.bernard@rpsgroup.com	E g.pinzone@aventusconsulting.com.au

Contents

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Figures

TERMS AND ABBREVIATIONS

°	Degrees
‘	Minutes
“	Seconds
µm	Micrometre (unit of length; 1 µm = 0.001 mm)
MSS	Marine Seismic Survey
Actionable oil	Oil which is thick enough for the effective use of mitigation strategies
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
API	American Petroleum Institute gravity. A measure of how heavy or light a petroleum liquid is compared to water.
ASTM	American Society for Testing and Materials
Bonn Agreement	An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union.
Biodegradation	Decomposition of organic material by microorganism
BTEX	Benzene, toluene, ethylbenzene, and xylenes
°C	degree Celsius (unit of temperature)
CDC	Climate Diagnostics Center
CFSR	Climate Forecast System Reanalysis
COP Sequoia	ConocoPhillips Australia SH1 Pty Limited (COP Sequoia) is a subsidiary company of ConocoPhillips Company (United States entity). COP Sequoia is a joint titleholder (80%) and operator of T/49P.
cP	Centipoise (unit of dynamic viscosity)
Decay	The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions.
Dissolved hydrocarbons	Hydrocarbon droplets which are dissolved in water.
Dynamic viscosity	The dynamic viscosity of a fluid expresses its resistance to shearing flows, where adjacent layers move parallel to each other with different speeds.
EMBA	Environment that may be affected
Entrained hydrocarbons	Hydrocarbon droplets that are suspended into the water column, though not dissolved.
Evaporation	The process whereby components of the oil mixture are transferred from the sea-surface to the atmosphere as vapours.
g/m^2	Grams per square meter (unit of surface area density)

GCS WGS 1984	Geographic Coordinate System World Geodetic System 1984 (WGS84); reference coordinate system
GODAE	Global Ocean Data Assimilation Experiment
HYCOM	Hybrid Coordinate Ocean Model. A data-assimilative, three-dimensional ocean model.
HYDROMAP	Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction.
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IBRA	Interim Biogeographic Regionalisation of Australia
IOA	Index of Agreement. Statistical measure of model performance
Isopycnal layer	Water layer characterised by the same density
km	Kilometre (unit of length)
km^2	Square Kilometres (unit of area)
KEF	Key Ecological Feature
Knots	unit of speed (1 knot = 0.514 m/s)
KP	Kilometre post. Refers to the surveyed distance along the main line or lateral line of a pipeline.
LC_{50}	Median lethal dose required for mortality of 50% of a tested population after a specified exposure duration.
LGA	Local Government Area
m	Meter (unit of length)
m/s	Meter per Second (unit of speed)
m^2	Square metre
m^3	Cubic meter (unit of volume)
MAHs	Monoaromatic hydrocarbons
MAE	Mean Absolute Error. Statistical measure of model performance
MDO	Marine Diesel Oil
MNP	Marine National Park
MNR	Marine Nature Reserve
MP	Marine Park
MPA	Marine Protected Area
MSL	Mean Sea Level
MSS	Marine Seismic Survey
NASA	National Aeronautics and Space Administration
NCEP	National Centres for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NP	National Park
NR	Nature Reserve
NRC	National Research Council

Oil	The oil type used for this assessment was a marine diesel oil (MDO). It may be referred to in this report as oil or MDO.
PAHs	Polynuclear aromatic hydrocarbons
ppb	parts per billion (concentration)
Pour Point	The pour point of a liquid is the temperature below which the liquid loses its flow characteristics.
PSU	Practical salinity units
Ramsar site	A site listed under the Ramsar Convention on wetlands which is an international intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.
RSB	Reefs, shoals and banks
Sea surface exposure	Contact by floating oil on the sea surface at concentrations equal to or exceeding defined threshold concentrations. The consequence will vary depending on the threshold and the receptors.
Shoreline contact	Arrival of oil at or near shorelines at on-water concentrations equal to or exceeding defined threshold concentrations. Shoreline contact is judged for floating oil arriving within a 1 km buffer zone from any shoreline as a conservative measure
SIMAP	Spill Impact Mapping Analysis Program. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for surface or subsea releases
Single Oil spill modelling	Oil spill modelling involving a computer simulation of a single hypothetical oil spill event subject to a single sequence of wind, current and other sea conditions over time. Single oil spill modelling, also referred to as “deterministic modelling” provides a simulation of one possible outcome of a given spill scenario, subject to the metocean conditions that are imposed. Single oil spill modelling is commonly used to consider the fate and effects of ‘worst-case’ oil spill scenarios that are carefully selected in consideration of the nature and scale of the offshore petroleum activity and the local environment (NOPSEMA, 2018). Because the outcomes of a single oil spill simulation can only represent the outcome of that scenario under one sequence of metocean conditions, worst-case conditions are often identified from stochastic modelling. It is impossible to calculate the likelihood of any outcome from a single oil spill simulation. Single oil spill modelling is generally used for response planning, preparedness planning and for supporting oil spill response operations in the event of an actual spill.
State waters	Low water mark seaward for three nautical miles
Stochastic Oil spill modelling	Stochastic oil spill modelling is created by overlaying and statistically analysing the outcomes of many single oil-spill simulations of a defined spill scenario, where each simulation was subject to a different sequence of metocean conditions, selected objectively (typically by random selection) from a long sequence of historic conditions for the study area. Analysis of this larger set of simulations provides a more accurate indication of the environment that maybe affected (EMBA) and also indicates which particular locations are more likely to be affected (as well as other statistics). Stochastic oil spill modelling avoids biases that affect single oil spill modelling (due to the reliance on only one possible sequence of conditions). However, when interpreting stochastic modelling, which is based on a wide range of potential conditions that might happen to occur, it is essential to understand that calculations for the EMBA will cover a much larger area than could be affected in any single spill event, where a more limited set of conditions will occur. Consequently, it is misleading to imply that the EMBA contours derived from stochastic modelling indicate the outcomes expected from a single spill event (NOPSEMA, 2018). Stochastic modelling is generally used for risk assessment and preparedness planning by indicating locations that could be exposed and may require response or subsequent impact assessment.
Sub-LGA	Sub-Local Government Area
TOPEX/Poseidon	A joint satellite mission between NASA and CNES to map ocean surface topography using an array of satellites equipped with detailed altimeters
Weathered oil	Oil that no longer contains volatile or soluble components
WOA13	The World Ocean Atlas 2013

EXECUTIVE SUMMARY

ConocoPhillips Australia SH1 Pty Ltd (COP Sequoia) is planning to undertake the Sequoia three-dimensional (3D) Marine Seismic Survey (the Sequoia 3D MSS) within exploration permit T/49P situated in the Otway Basin, west of King Island. The Sequoia 3D MSS operational area extends over 4,089 km^2 with its closest boundary situated approximately 26 km south of the tip of Cape Otway (Victoria) and 24.5 km east of the western coastline of King Island (Tasmania).

To support the development of the Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP), a detailed oil spill modelling study was undertaken that examined a 373 m^3 surface release of marine diesel oil (MDO) over 6 hours to represent a survey vessel tank rupture during the operation. Results are based on an annual assessment.

Methodology

The modelling study was carried out in several stages. Firstly, a nine-year current dataset (2009–2017 inclusive) that includes the combined influence of large-scale ocean and nearshore tidal currents was developed. Secondly, the currents, local winds and detailed hydrocarbon characteristics were used as inputs in the three-dimensional oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled MDO.

As spills can occur during any set of wind and current conditions, modelling was conducted using a stochastic (or statistical) approach. Due to the large size of the MSS operational area, the 100 spills were modelled within the operational area from 100 randomly selected release locations situated approximately 5.5 - 10 km apart. Each spill simulation had the same information (i.e. spill volume, duration and oil composition), though different start times and location. This ensured that a range of wind and current conditions were accounted for across the operational area and in turn, movement and weathering of the MDO. Once all 100 simulations were run, the model combined the results to determine the combined risk and potential exposure/contact to the surrounding waters and shorelines and specific sensitive resources.

Oil Characteristics and Weathering Behaviour

Marine diesel oil has a density of 829.1 kg/m^3 (API gravity of 37.6) and a dynamic viscosity of 4.0 cP at 25ºC, classifying it as a Group II light persistent oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and USEPA/USCG classifications. It is characterised by a high percentage of volatile components (95%), which will evaporate when on the sea surface. It also contains 5% persistent hydrocarbons, which will not evaporate but will breakdown over time due to decay. It is important to note that some heavy components contained in the MDO have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves though can re-float to the surface if these energies abate.

Summary of the Stochastic Assessment Results

Surface Release of 373 m^3 of Marine Diesel over 6 Hours

Stochastic Analysis

- Exposure from floating oil at the low (1-10 g/m^2) threshold was predicted at a range of sensitive receptors, including two (2) Australian Marine Parks ((AMP) Apollo and Zeehan), one (1) Key Ecological Feature ((KEF) West Tasmania Canyons) and one (1) Marine National Park ((MNP) Point Addis). The predicted minimum time before floating oil exposure at or above the low threshold ranged between 0.04 day (1 hour) for receptors situated within the Sequoia 3D MSS operational area (i.e. Apollo AMP, Zeehan AMP and West Tasmania Canyons KEF) to 6.67 days (Wilsons Promontory Marine Reserve National Park (NP));
- The probability of contact to any shoreline at, or above, the low (10-100 g/m^2) threshold from a spill originating within the Sequoia 3D MSS operational area was 16%. The minimum time before shoreline contact was approximately 1.67 days (40 hours) while the greatest volume of MDO ashore was predicted as 27.6 m^3. Additionally, the greatest length of shoreline contacted by MDO at, or above the low threshold was 37.5 km (across several shoreline receptors).
- Entrained hydrocarbon exposure at, or above the low threshold (10-100 ppb) could potentially travel up to a maximum distance of 742 km (east-northeast) from the centre of the operational area. This distance decreased to 236 km (east) for the high exposure (≥100 ppb) threshold;
  - In the surface layer (0-10m), entrained hydrocarbon exposure at or above the low threshold was predicted for a range of receptors, including five (5) AMPs, four (4) KEFs and six (6) Reef Shoals and Banks (RSB);
- Dissolved hydrocarbon concentrations at, or above the low (10-50 ppb) threshold could potentially drift up a maximum distance of 251 km (east-northeast) from the centre of the Sequoia 3D MSS operational area. This distance was reduced to 211 km (east-northeast) at the moderate threshold while no exposure was predicted at or above the high (≥ 400 ppb) threshold; and
  - In the surface layer (0-10m), dissolved hydrocarbon exposure at or above the low threshold was predicted at three (3) AMPs, one (1) KEF and one (1) RSB. Additionally, low dissolved exposure was shown to extend to isolated sites in nearshore waters between Port Campbell and Cape Paterson.

Deterministic analysis

- The maximum area of coverage of visible floating oil was ~32 km^2. The low (1-10 g/m^2) floating oil exposure was predicted to extend a maximum of ~48 km northeast from the release site while moderate (10-50 g/m^2) and high (≥50 g/m^2) floating oil exposure extended a maximum of ~26 km north and 3.3 km northeast from the release location, respectively.
- The minimum time before shoreline contact above 10 g/m^2 was 40 hours near Cape Otway.
- The maximum volume accumulated on the nearby shorelines ashore was 27.6 m^3.
- The maximum length of shoreline contacted by oil above the moderate threshold was 8.4 km.

1 INTRODUCTION

1.1 Background

ConocoPhillips Australia SH1 Pty Ltd (COP Sequoia) is planning to undertake the Sequoia three-dimensional (3D) Marine Seismic Survey (the Sequoia 3D MSS) within exploration permit T/49P situated in the Otway Basin, west of King Island. The Sequoia 3D MSS operational area extends over 4,089 km^2 with its closest boundary situated approximately 26 km south of tip of Cape Otway (Victoria) and 24.5 km east of the western coastline of King Island (Tasmania). The operational area is illustrated in Figure 1.1 and the coordinates of each corner point are listed in Table 1.1.

To support the development of the Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP), RPS was commissioned by Aventus Consulting Pty Ltd (Aventus) on behalf of COP Sequoia, to undertake a detailed oil spill modelling study. The study examined a 373 m^3 surface release of marine diesel over 6 hours to represent a survey vessel tank rupture during the survey.

Due to the size of the operational area, the 100 spills were modelled within the operational area from 100 randomly selected release locations situated approximately 5.5 - 10 km apart.

The purpose of the modelling is to improve understanding of a conservative ‘outer envelope’ of the potential area that may be affected in the unlikely event of hydrocarbon release. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill. Therefore, the modelling results represent the maximum extent that the released hydrocarbon may influence. To understand the potential area that might be affected during an isolated (single) spill event, the results for single simulations were also presented, which will serve as a basis for developing plans for a realistic spill response.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Mapping Analysis Program (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties.

Note that the oil spill model, the method and analysis presented herein uses modelling algorithms that have been anonymously peer reviewed and published in international journals. Furthermore, RPS warrants that this work meets and exceeds the American Society for Testing and Materials (ASTM) Standard F2067-13 “*Standard Practice for Development and Use of Oil Spill Models*”.

Table 1.1 Coordinates of each corner point of the Sequoia Marine Seismic Survey operational area.

Corner	Latitude	Longitude
A	40° 28' 31.82" S	143° 15' 54.00" E
B	39° 05' 52.85" S	143° 13' 12.91" E
C	39° 05' 33.17" S	143° 29' 26.23" E
D	39° 21' 09.79" S	143° 29' 59.41" E
E	39° 21' 06.07" S	143° 32' 50.56" E
F	40° 28' 07.30" S	143° 35' 20.83" E

The WGS84 Geographic projection is used throughout the report.

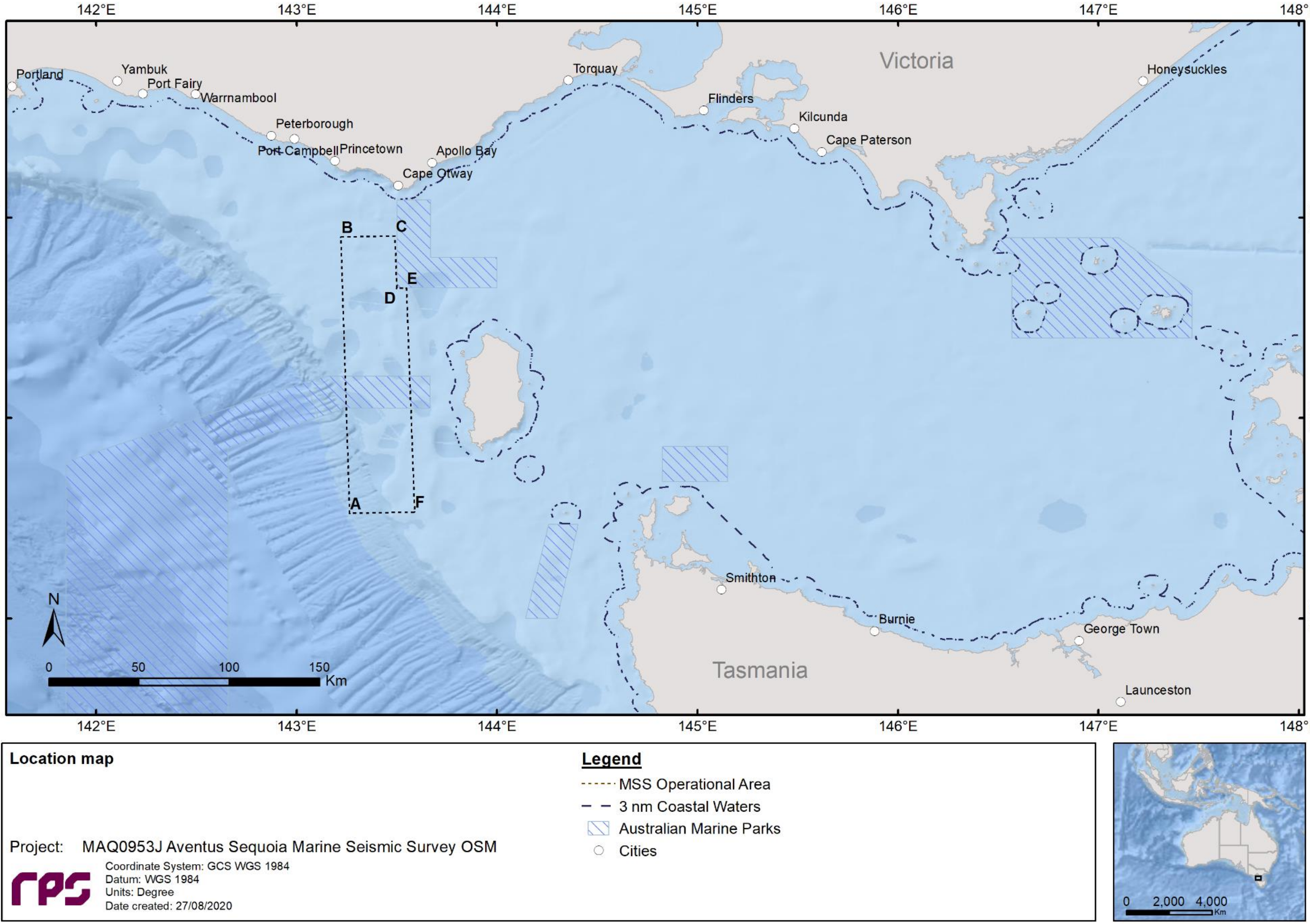


Figure 1.1 Map of the Sequoia Marine Seismic Survey operational area.

1.2 What is Oil Spill Modelling?

Oil spill modelling is a valuable tool widely used for risk assessment, emergency response and contingency planning where it can be particularly helpful to proponents and decision makers. By modelling a series of the most likely oil spill scenarios, decisions concerning suitable response measures and strategic locations for deploying equipment and materials can be made, and the locations at most risk can be identified. The two types of oil spill modelling often used are stochastic (Section 1.2.1) and deterministic (Section 0) modelling.

1.2.1 Stochastic Modelling (Multiple Spill Simulations)

Stochastic oil spill modelling is created by overlaying a great number (100 or more) of individual, computer-simulated hypothetical spills (NOPSEMA, 2018; Figure 1.2).

Stochastic modelling is a common means of assessing the potential risks from oil spills related to new projects and facilities. Stochastic modelling typically utilises hydrodynamic data for the location in combination with historic wind data. Typically, iterations of the model will be run utilising the data that is most relevant to the season or timing of the project.

Probabilities included in this report have been calculated based on spills randomly located within the MSS operational area and with different starting times during the study period (2009-2017).

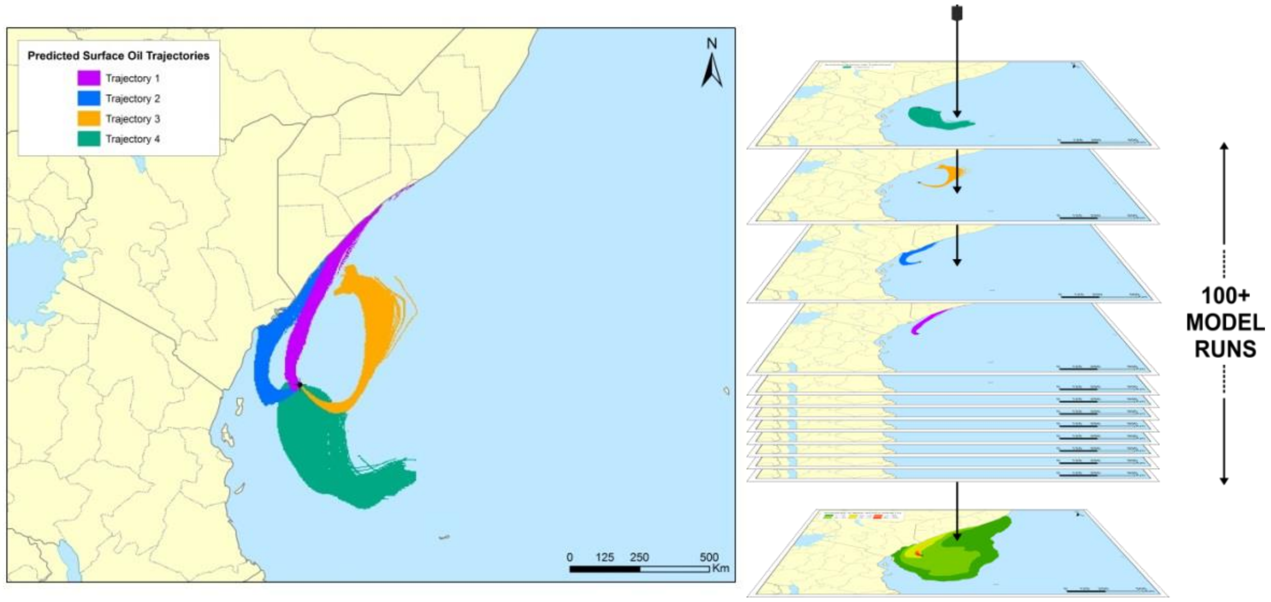


Figure 1.2 Examples of four individual spill trajectories (four replicate simulations) predicted by SIMAP for a spill scenario. The frequency of contact with given locations is used to calculate the probability of impacts during a spill. Essentially, all model runs are overlain (shown as the stacked runs on the right) and the number of times that trajectories contact a given location at a concentration is used to calculate the probability.

1.2.2 Deterministic Modelling (Single Spill Simulation)

Deterministic modelling is the predictive modelling of a single incident subject to a single sample of wind and weather conditions over time (NOPSEMA, 2018; Figure 1.3).

Deterministic modelling is often paired with stochastic modelling to place the large stochastic footprint into perspective. This deterministic analysis is generally a single run selected from the stochastic analysis and serves as the basis for developing the plans and equipment needs for a realistic spill response. Deterministic spills can be selected on several basis such as minimum time to shoreline contact, largest swept area, maximum volume ashore and longest length of shoreline contacted by oil.

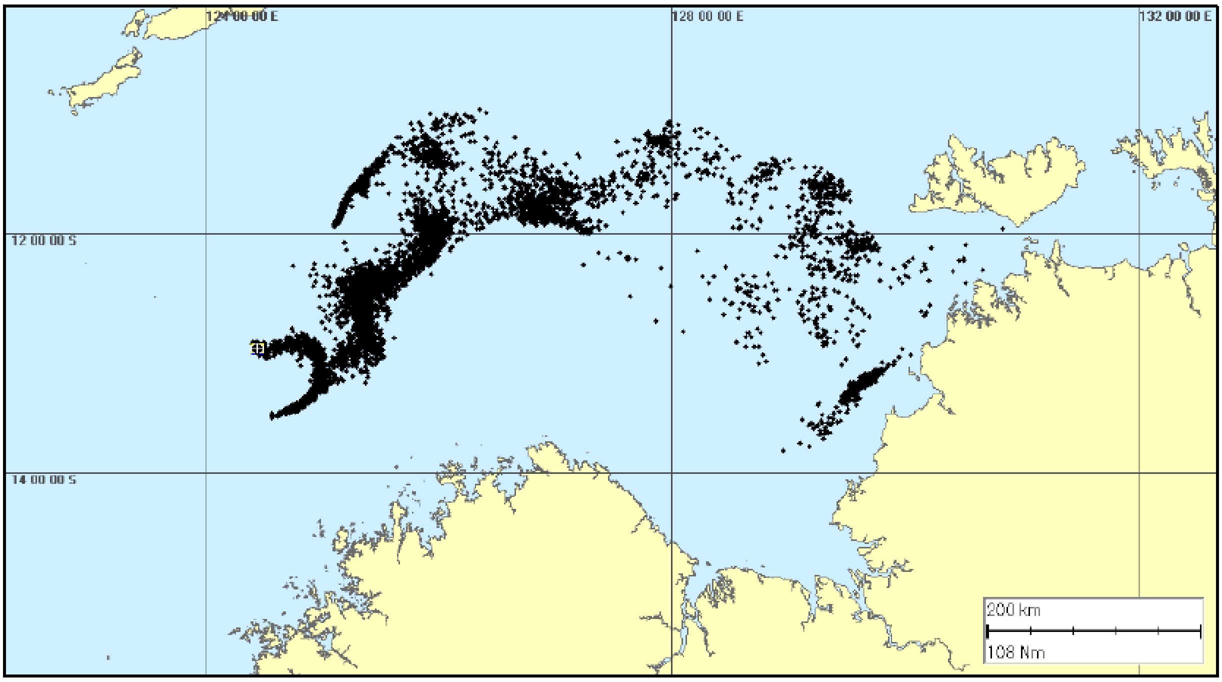


Figure 1.3 Example of an individual spill trajectory predicted by SIMAP for a spill scenario. Note, this image represents surface oil as spillets and do not take any thresholds into consideration.

2 SCOPE OF WORK

The scope of work included the following components:

1. Generate nine years (2009 to 2017, inclusive) of current data (see Section 2.2.1) and wind data (see Section 2.2.2). The 3D current data includes the combined influence of ocean and tidal currents;

2. Use the high-resolution wind, aggregated current data and hydrocarbon characteristics as input into the 3D oil spill model to simulate the movement, spreading, entrainment and weathering of the oil over time;

3. Use SIMAP's stochastic model to calculate exposure to surrounding waters (sea surface and water column) and contact to shorelines. This involved running 100 spills from random release locations within the operational area using the same information (i.e. spill volume, duration and oil composition), though different start times. This ensured that each spill trajectory was subject to unique wind and current conditions and that the spatial extent across the operational area.

4. Combine the 100 spill trajectories to determine the exposure by floating oil and in the water column, in addition to contact to shorelines (for a defined low, moderate and high threshold); and

5. From the 100 spill trajectories simulated, identify four (4) deterministic spill trajectories based on the following metrics:

    i. largest volume of oil ashore;

    ii. longest length of shoreline contact above 100 g/m^2;

    iii. minimum time before shoreline contact above 10 g/m^2; and

    iv. largest swept area of oil on the sea surface above 1 g/m^2 (visible sea surface oil).

2.1 Calculation of Exposure Risk

The stochastic model within SIMAP performs a large number of simulations for a given spill site, randomly varying the spill time for each simulation. The model uses the spill time to select samples of current and wind data from a long time series of wind and current data for the area. Hence, the transport and weathering of each slick will be subject to a different sample of wind and current conditions.

This stochastic sampling approach provides an objective measure of the possible outcomes of a spill because environmental conditions will be selected at a rate that is proportional to the frequency that these conditions occur over the study region. More simulations will tend to use the most commonly occurring conditions, while conditions that are more unusual (e.g., storms) will be represented less frequently.

During each simulation, the SIMAP model records the location (by latitude, longitude and depth) of each of the particles (representing a given mass of oil) on or in the water column, at regular time steps. For any particles that contact a shoreline, the model records the accumulation of oil mass that arrives on each section of shoreline over time, less any mass that is lost to evaporation and/or subsequent removal by current and wind forces.

The collective records from all simulations are then analysed by dividing the study region into a 3D grid. For oil particles that are classified as being at the water surface (floating oil), the sum of the mass in all oil particles (including accounting for spreading and dispersion effects) located within a grid cell, divided by the area of the cell provides estimates of the concentration of oil in that grid cell, at each time step. For entrained and dissolved oil particles, concentrations are calculated at each time step by summing the mass of particles within a grid cell and dividing by the volume of the grid cell.

The concentrations of oil calculated for each grid cell, at each time step, are then analysed to determine whether concentration estimates exceed defined threshold concentrations over time.

Risks are then summarised as follows:

- The minimum potential time to a shoreline location is calculated by the shortest time over which oil at a concentration above a threshold was calculated to travel from the source to the location in any of the replicate simulations.
- The maximum potential concentration of oil predicted for each shoreline section is the greatest mass per square metre (m^2) of shoreline calculated to strand at any location within that section during any of the replicate simulations.
- Similar treatments are undertaken for entrained oil and dissolved aromatic hydrocarbons.

Thus, the minimum time to shoreline and the maximum potential concentration estimates indicate the worst potential outcome of the modelled spill scenario for each section of shoreline.

Note also that results quoted for sections of shoreline are derived for any individual location within that section, as a conservative estimate. Locations will represent shoreline lengths of the order of ~1 km, while sections or regions will represent shorelines spanning tens to hundreds of kilometres and it is not implied that the maximum potential concentrations quoted will occur over the full extent of each section. The maximum concentration estimates should not be multiplied by the full area of the section because this will greatly overestimate the total volume expected on that section.

The maximum entrained hydrocarbon and maximum dissolved aromatic hydrocarbon concentration are calculated for water locations surrounding each defined shoreline (refer to as Sub-LGAs and nearshore waters - Figure 3.6 to Figure 3.9). These zones are defined to provide a buffer area around shallow (<10 m) water habitats to allow for spatial errors in model forecasts. The greatest calculated value at any time step during any replicate simulation is listed. These values therefore represent worst-case localised estimates (within a grid cell).

2.2 Inputs to the Risk Assessment

2.2.1 Current Data

2.2.1.1 Background

The Bass Strait is a sea strait separating Tasmania from the southern Australian mainland. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. The Bass Strait region has a reputation for high winds and strong tidal currents (Jones, 1980). Currents within the strait are primarily driven by tides, winds and density driven flows. During winter the South Australian current moves dense, salty water eastward from the Great Australian Bight into the western margin of the Bass Strait (Sandery and Kampf, 2007). In winter and spring, waters within the strait are well mixed with no obvious stratification, while during summer the central regions of the strait become stratified (Baines and Fandry, 1983; Middleton and Black, 1994).

The varied geography and bathymetry of the region, in addition to the forcing of the south-eastern Indian Ocean and local meteorology lead to complex shelf and slope circulation patterns (Middleton and Bye, 2007).

In the offshore regions towards the Gippsland or Otway Basin where water depths exceed 100-200 m, large-scale drift currents can be relatively strong (1-2 knots) and complex, manifesting as a series of eddies, meandering currents and connecting flows. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals) and thus will have greater influence upon the net trajectory of slicks over time scales exceeding a few hours.

Wind shear on the water surface also generates local-scale currents that can persist for extended periods (hours to days) and result in long trajectories. Hence, the current-induced transport of oil can be variably affected by combinations of tidal, wind-induced and density-induced drift currents. Depending on their local influence, it is critical to consider all these potential advective mechanisms to rigorously understand patterns of potential transport from a given spill location.

To appropriately allow for temporal and spatial variation in the current field, spill modelling requires the current speed and direction over a spatial grid covering the potential migration of oil. As measured current data is not available for simultaneous periods over a network of locations covering the wide area of this study, the analysis relied upon hindcasts of the circulation generated by numerical modelling. Estimates of the net currents were derived by combining predictions of the drift currents, available from mesoscale ocean models, with estimates of the tidal currents generated by an RPS model set up for the study area.

2.2.1.2 Mesoscale Circulation Model

Data describing the flow of ocean currents was obtained from HYCOM (Hybrid Coordinate Ocean Model, (Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, 3D ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12th of a degree) over the region, at a frequency of once per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas. Figure 2.1 shows the monthly surface ocean current distributions derived from the HYCOM data point in the centre of the operational area.

Note the convention for defining current direction throughout this report is the direction the current flows towards. Each branch of the current rose distribution represents the currents flowing to that direction, with north to the top of the diagram. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are predominantly used in these current roses. The length of each coloured segment within a branch is proportional to the frequency of currents flowing within the corresponding speed and direction.

The current roses indicated that in the vicinity of the operational area, large-scale ocean currents flow predominantly towards the southeast during the winter months and demonstrated no particular trend during summer. The higher average current speeds were characteristic of the May to September period, with the highest monthly average speeds (0.24 m/s) occurring in July, August and September. Lower average current speeds were more common during October to April period, with the lowest monthly average speeds (0.15 m/s) occurring in February. Peak current speed across all months was 0.97 m/s and occurred in July.

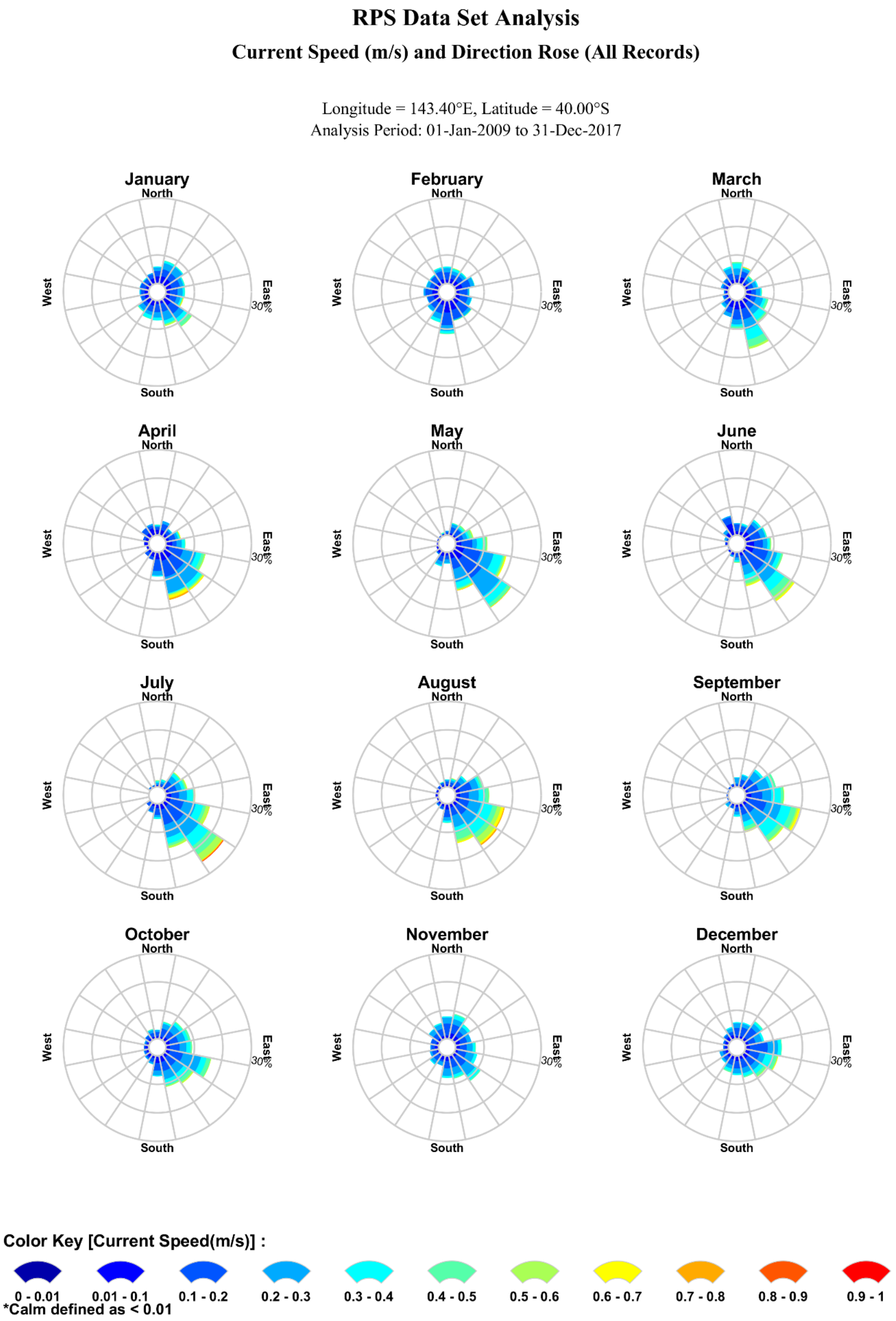


Figure 2.1 **Monthly surface ocean current distribution (2009-2017, inclusive) derived from the HYCOM database in the centre of the Sequoia Survey operational area. The colour key shows the current magnitude, the compass direction provides the direction towards which the current is flowing, and the size of the wedge gives the percentage of the record.**

2.2.1.3 Tidal Circulation Model

2.2.1.3.1 Description of Tidal Model: HYDROMAP

As the HYCOM model does not include tidal forcing, and because the data is only available at a daily frequency, a tidal model was developed for the study region using RPS' three-dimensional hydrodynamic model, HYDROMAP.

The model formulations and output (current speed, direction and sea level) of this model have been validated through field measurements around the world for more than 25 years (Isaji & Spaulding, 1984, 1986; Isaji et al., 2001; Zigic et al., 2003). HYDROMAP current data has also been widely used as input to forecasts and hindcasts of oil spill migrations in Australian waters. This modelling system forms part of the National Marine Oil Spill Contingency Plan for the Australian Maritime Safety Authority (AMSA, 2020).

HYDROMAP simulates the flow of tidal currents within a model region due to forcing by astronomical tides, wind stress and bottom friction. The model employs a sophisticated dynamically nested-gridding strategy, supporting up to six levels of spatial resolution within a single domain. This allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, or of particular interest to a study.

The numerical solution methodology of HYDROMAP follows that of Davies (1977a, 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji & Spaulding (1984).

2.2.1.3.2 Model Grid Setup

The tidal model domain has been sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids were allocated in a stepwise fashion to more accurately resolve flows along the coastline, around islands and over regions with more complex bathymetry. Figure 2.2 shows the tidal model grid covering the study domain.

A combination of datasets was used and merged to describe the three-dimensional shape of the seabed within the grid domain (Figure 2.3). These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

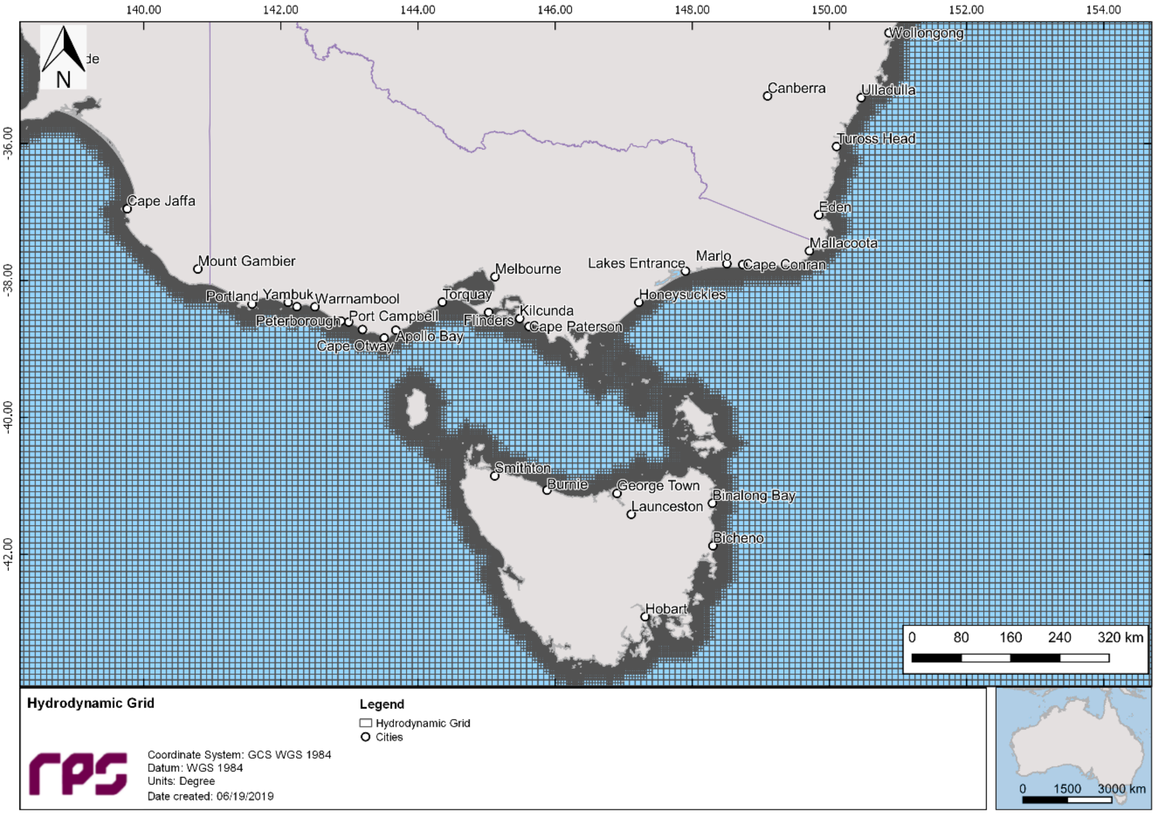


Figure 2.2 Map showing the tidal model grid resolution. The darker regions are indicative of sub-gridding.

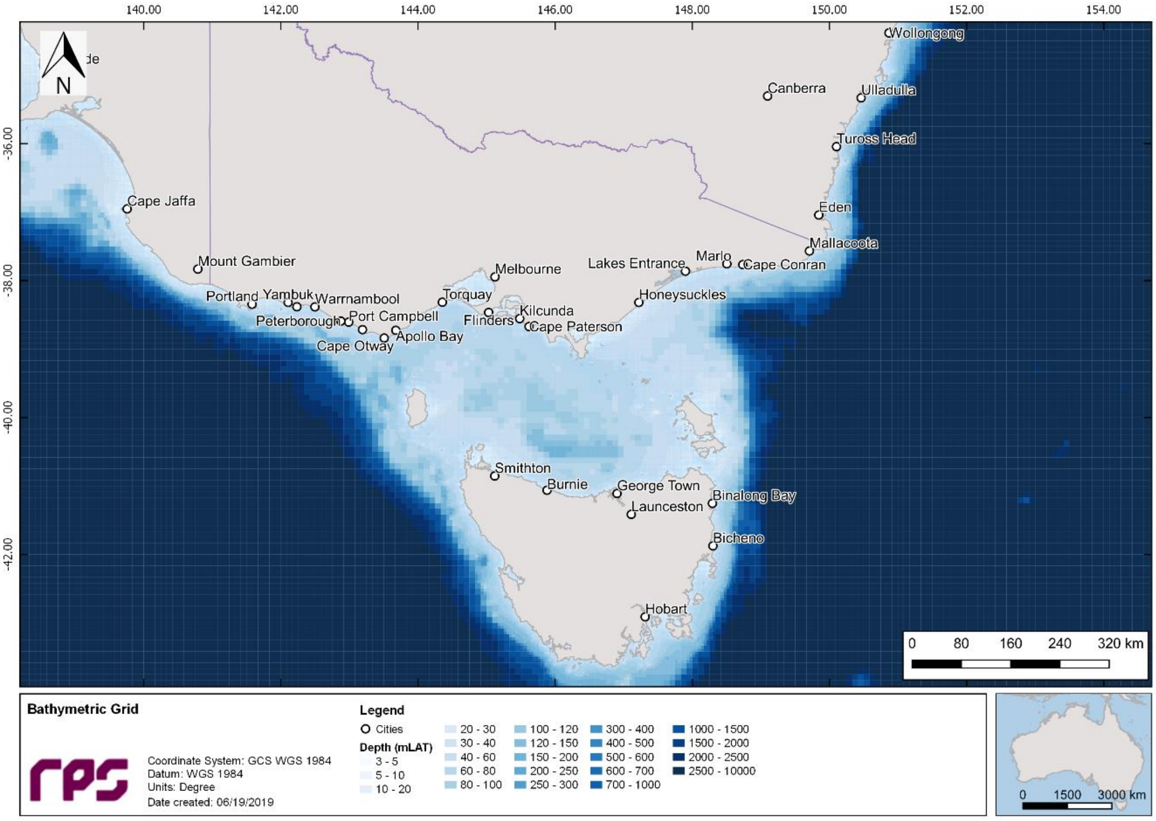


Figure 2.3 Bathymetry defined throughout the tidal model domain.

2.2.1.3.3 Model Boundary Conditions

Ocean boundary data for the HYDROMAP model was obtained from the TOPEX/Poseidon global tidal database (TPXO7.2) of satellite-measured altimetry data, which provided estimates of tidal amplitudes and phases for the eight dominant tidal constituents (designated as K_2, S_2, M_2, N_2, K_1, P_1, O_1 and Q_1) at a horizontal scale of approximately 0.25°. Using the tidal data, sea surface heights are firstly calculated along the open boundaries at each time step in the model.

The TOPEX/Poseidon satellite data is produced, and quality controlled by the US National Atmospheric and Space Agency (NASA). The satellites, equipped with two highly accurate altimeters capable of taking sea level measurements accurate to less than ±5 cm, measured oceanic surface elevations (and the resultant tides) for over 13 years (1992-2005). In total, these satellites carried out more than 62,000 orbits of the planet. The TOPEX/Poseidon tidal data has been widely used amongst the oceanographic community, being the subject of more than 2,100 research publications (e.g. Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk & Tangdong, 2004; Qiu & Chen, 2010). As such, the TOPEX/Poseidon tidal data is considered suitably accurate for this study.

2.2.1.3.4 Tidal Elevation Validation

To ensure that tidal predictions were accurate, predicted surface elevations were compared to data observed at five locations (see Table 2.1 and Figure 2.4).

To provide a statistical measure of the model performance, the Index of Agreement (IOA - Willmott (1981)) and the Mean Absolute Error (MAE - Willmott (1982) and Willmott and Matsuura (2005)) were used.

The MAE (Eq.1) is simply the average of the absolute values of the difference between the model-predicted (P) and observed (O) variables. It is a more natural measure of the average error (Willmott and Matsuura, 2005) and more readily understood. The MAE is determined by:

$$MAE = N^{-1} \sum_{i=1}^{N} |P_i - O_i| \qquad \text{Eq.1}$$

Where: N = Number of observations
P_i = Model predicted surface elevation
O_i = Observed surface elevation

The Index of Agreement (IOA; Eq. 2) in contrast, gives a non-dimensional measure of model accuracy or performance. A perfect agreement between the model predicted and observed surface elevations exists if the index gives an agreement value of 1, and complete disagreement between model and observed surface elevations will produce an index measure of 0 (Willmott, 1981). Willmott et al (1985) also suggests that values larger than 0.5 may represent good model performance. The IOA is determined by:

$$IOA = 1 - \frac{\sum |X_{model} - X_{obs}|^2}{\sum (|X_{model} - \overline{X_{obs}}| + |X_{obs} - \overline{X_{obs}}|)^2} \qquad \text{Eq.2}$$

Where: X_{model} = Model predicted surface elevation
X_{obs} = Observed surface elevation

Clearly, a greater IOA and lower MAE represent a better model performance.

Figure 2.5 and Figure 2.6 illustrate a comparison of the predicted and observed surface elevations for each location for January 2014. All comparisons show that the model produces a very good match to the known tidal behaviour for a wide range of tidal amplitudes and clearly represents the varying diurnal and semi-diurnal nature of the tidal signal.

Figure 2.7 shows the monthly distributions of the predicted tidal current speeds and directions at the centre of the operational area. Note, this rose distribution only illustrates tidal currents at a single location and does not represent the current patterns throughout the operational area. Tidal and ocean currents may vary throughout the operational area and as a result high-resolution time-, space- and depth-varying current dataset was used for the oil spill trajectory modelling.

Table 2.1 Statistical comparison between the observed and predicted surface elevations. (A greater IOA and lower MAE represent better model performance)

Tidal Station	IOA	MAE (m)
Gabo Island	0.98	0.08
Port MacDonnell	0.98	0.05
Port Welshpool	0.92	0.30
Portland	0.97	0.07
Stack Island	0.96	0.22

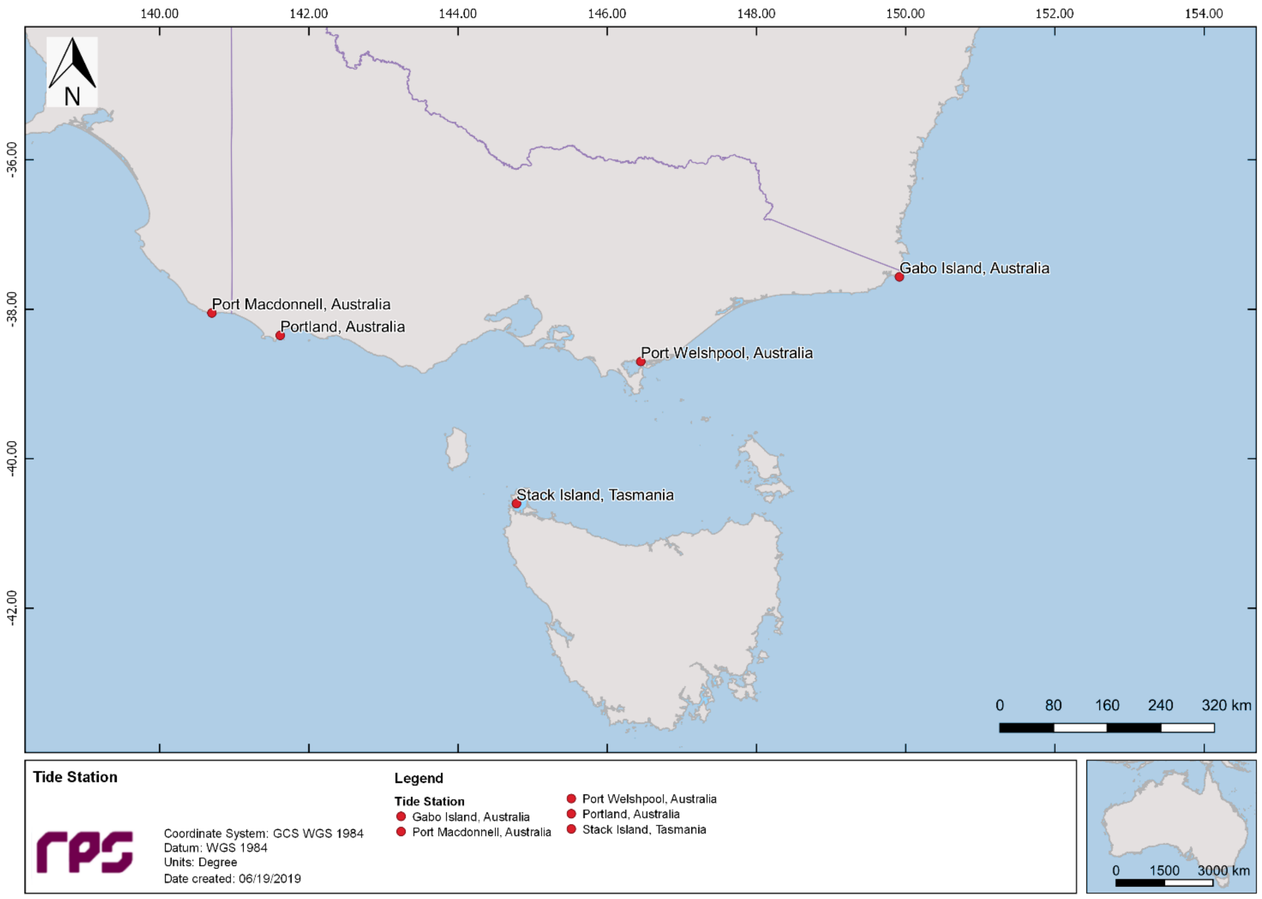


Figure 2.4 Tide stations used to calibrate surface elevation within the model.

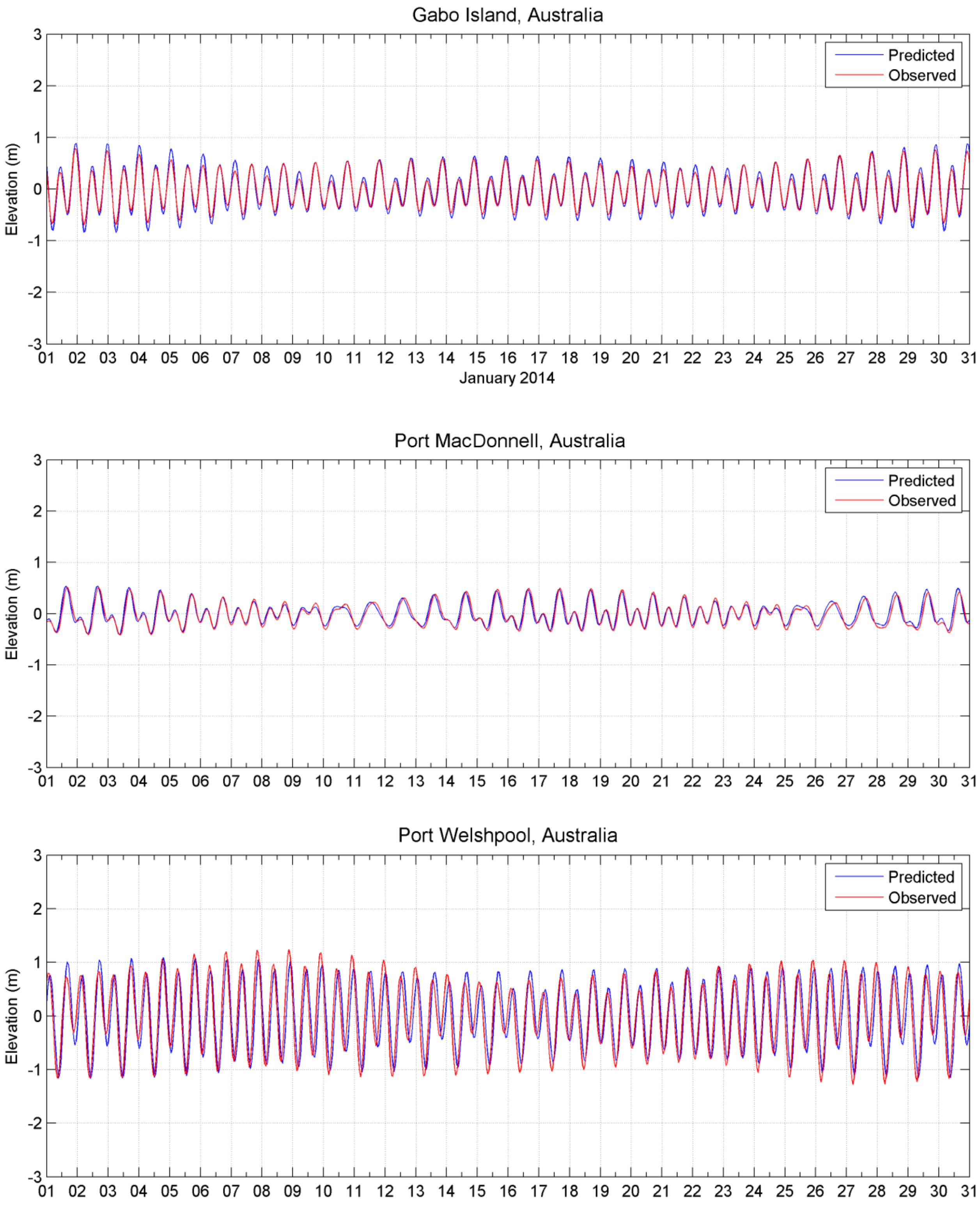


Figure 2.5 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation.

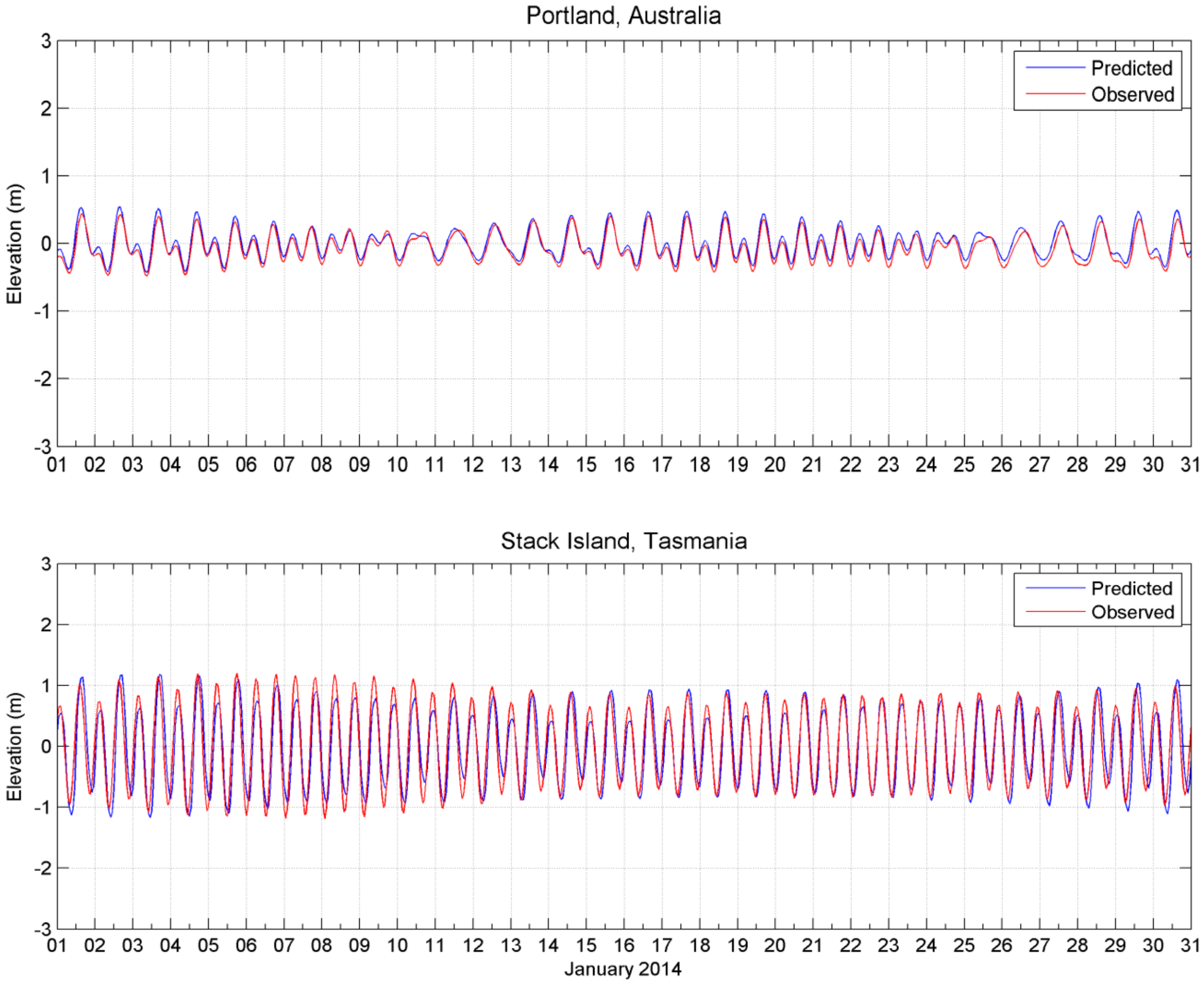


Figure 2.6 Comparison between HYDROMAP predicted (blue line) and observed (red line) surface elevation.

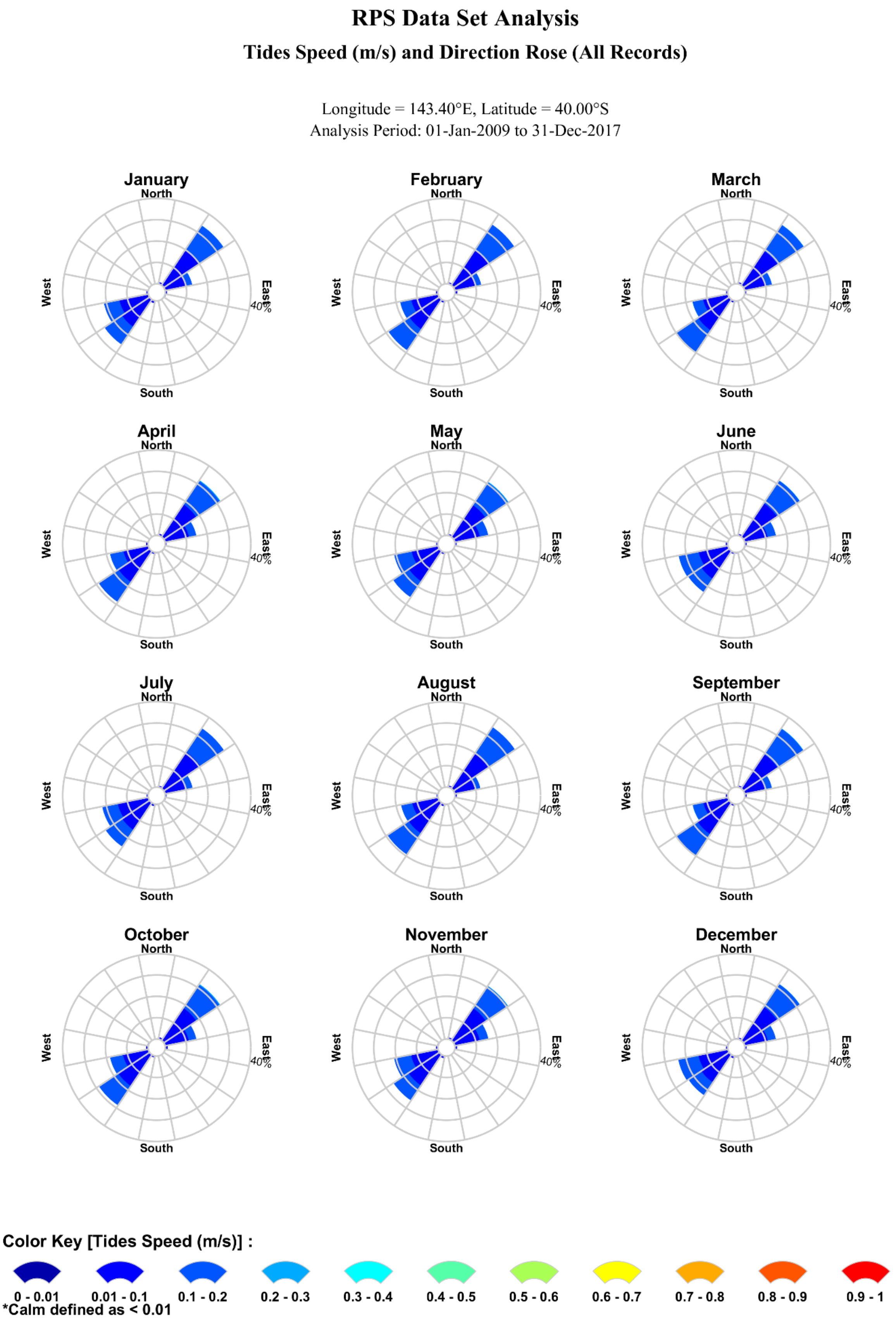


Figure 2.7 **Monthly current distribution (2009-2017, inclusive) derived from the HYDROMAP databases at the centre of the Sequoia Survey operational area. The colour key shows the current magnitude, the compass direction provides the direction towards which the current is flowing, and the size of the wedge gives the percentage of the record.**

2.2.1.4 Surface Currents at the Site

Table 2.2 displays the predicted average and maximum surface current speeds at the centre of the operational area. Figure 2.8 shows the monthly combined current rose distributions (2009-2017 inclusive) derived by aggregating the HYCOM ocean current data (described in Section 2.2.1.2) and HYDROMAP tidal data (described in Section 2.2.1.3).

The combined data (ocean plus tides) showed that the surface currents flow most frequently towards the southeast during April and August which is also when the strongest currents typically occur. Average monthly surface current speeds ranged from 0.17 m/s to 0.26 m/s, while the maximum speeds were between 0.55 m/s (November) and 0.97 m/s (July).

Table 2.2 Predicted average and maximum surface current speeds at the centre of the operational area. Data derived by combining HYCOM ocean data and HYDROMAP high resolution tidal data from 2009-2017 (inclusive).

Month	Average current speed (m/s)	Maximum current speed (m/s)	General Direction (towards)
January	0.20	0.69	Variable
February	0.17	0.75	Variable
March	0.22	0.74	Variable
April	0.20	0.84	Southeast
May	0.23	0.78	Southeast
June	0.22	0.72	Southeast
July	0.26	0.97	Southeast
August	0.26	0.84	Southeast
September	0.25	0.74	East - Southeast
October	0.22	0.65	East (variable)
November	0.20	0.55	Variable
December	0.21	0.70	Variable
Minimum	**0.17**	**0.55**	
Maximum	**0.26**	**0.97**	

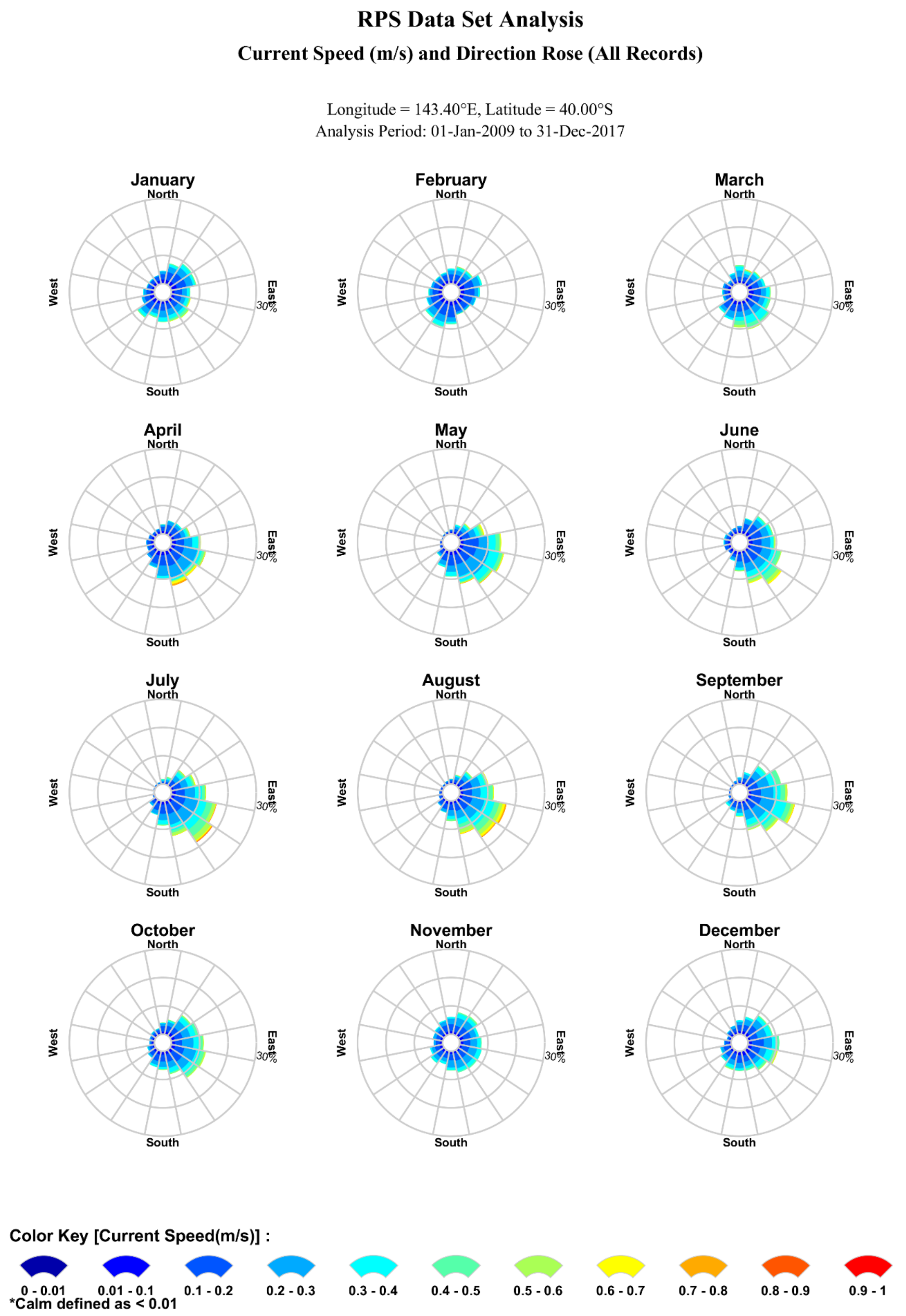


Figure 2.8 Monthly surface current distribution at the centre of the operational area (derived by combining the HYDROMAP tidal currents and HYCOM ocean currents for 2009 to 2017, inclusive). The colour key shows the current magnitude, the compass direction provides the direction towards which the current is flowing, and the size of the wedge gives the percentage of the record.

2.2.2 Wind Data

To account for the influence of the wind on surface-bound oil, the spatial wind data (2009-2017, inclusive) was sourced from the National Center for Environmental Prediction (NCEP), NOAA-CIRES Climate Diagnostics Center in Boulder, Colorado, USA. The NCEP Climate Forecast System Reanalysis (CFSR; Saha *et al.*, 2010) is a fully-coupled, data-assimilative hindcast model representing the interaction between the Earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals.

The data was assumed to be a suitably representative sample of the wind conditions over the study area for future years.

Figure 2.9 shows the monthly distribution of wind speed and direction for the CFSR data point closest to the centre of the Sequoia Survey operational area (40.0° S, 143.4° E). Note, this rose distribution only illustrates winds at a single location and does not represent the wind patterns throughout the operational area. Winds may vary throughout the operational area and as a result high-resolution time- and space-varying wind dataset was used for the oil spill trajectory modelling.

The monthly wind rose distribution indicated that wind speeds typically fluctuate from a maximum of 39 knots in November to 50 knots in May and September, with a dominant westerly wind direction during April to October and more variable west-southwest and east-northeast winds during November through to March. The average annual wind speeds vary between 15 knots and 20 knots (Table 2.3).

In the absence of any water current effects, the wind acting on surface oil during most months will tend to result in initial trajectories heading towards the east throughout the year. Note that the actual trajectories of surface oil will be the net result of a combination of the prevailing wind and current vectors acting at a given time and location.

Table 2.3 Predicted average and maximum winds for the wind node closest to the centre of the Sequoia Survey operational area. Data derived from CFSR hindcast model from 2009 to 2017 (inclusive).

Month	Average wind (knots)	Maximum wind (knots)	General Direction (From)
January	15	43	Southwest
February	15	46	South-southwest and East-northeast
March	15	41	West-southwest and northeast
April	15	49	West (Variable)
May	17	50	West (Variable)
June	18	46	West (Variable)
July	19	45	West - Northwest
August	20	47	West - Northwest
September	18	50	West
October	17	45	West
November	15	39	West
December	15	41	West
Minimum	**15**	**39**	
Maximum	**20**	**50**	

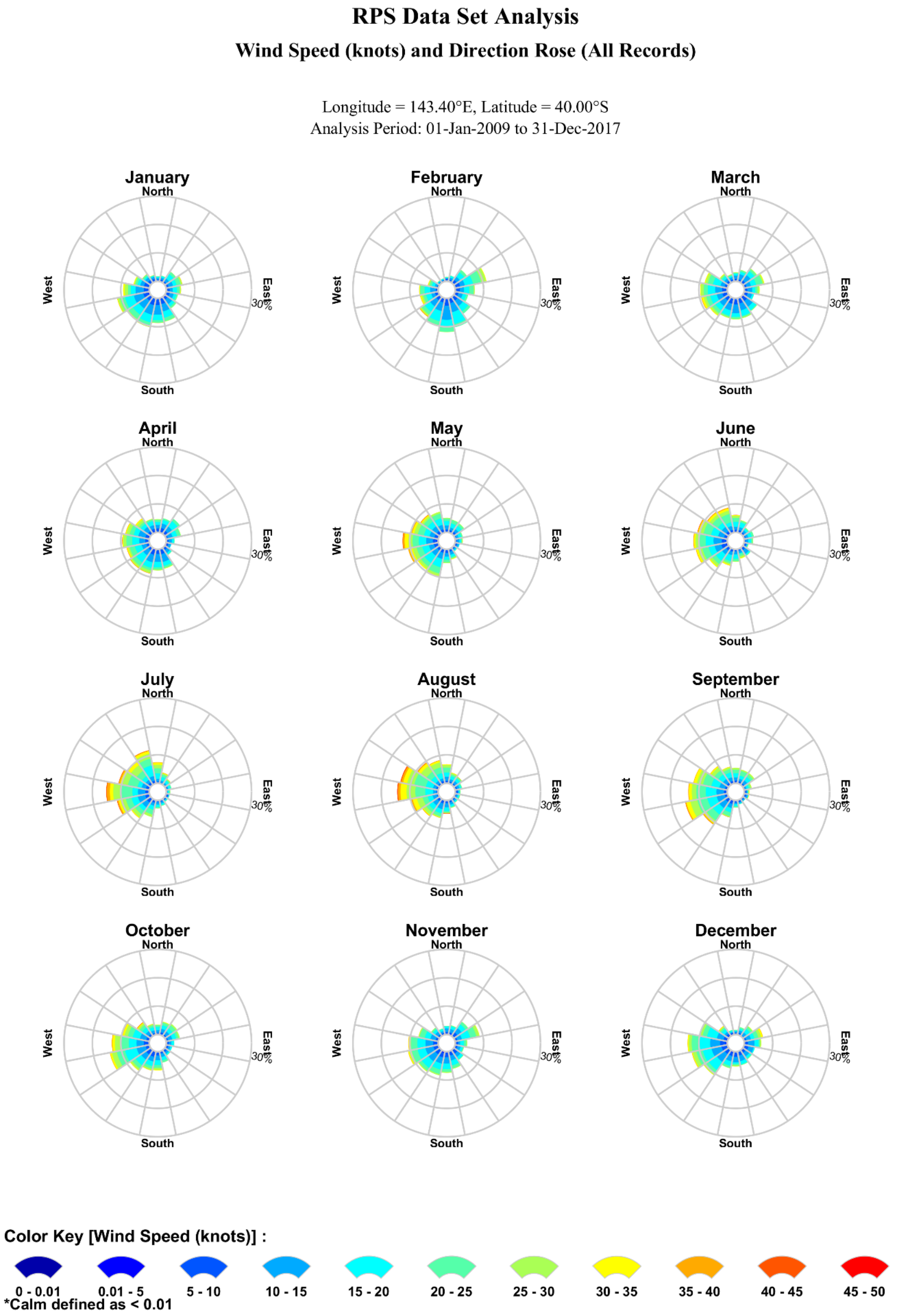


Figure 2.9 **Monthly wind distribution (2009-2017, inclusive) derived from the CFSR wind node closest to the centre of the Sequoia Survey operational area. The colour key shows the wind magnitude, the compass direction provides the direction from which the wind is blowing, and the size of the wedge gives the percentage of the record.**

2.2.3 Water Temperature and Salinity Data

The World Ocean Atlas 2013 (WOA13) is provided by NOAA and is a hindcast model of the climatological fields of in situ temperature, salinity, and a number of additional variables (NOAA, 2013a). WOA13 has a 0.25° resolution and has standard depth levels ranging from the water surface to 5,500 m (Locarnini *et al.*, 2013; Zweng *et al.*, 2013). The WOA13 monthly vertical profiles of sea temperature and salinity were used as input for to SIMAP.

Figure 2.10 shows the variation in water temperature and salinity both seasonally and over depth for the data point closest to the Sequoia 3D MSS operational area.

In the vicinity of the MSS operational area , the top 30 m of the water column appears to be relatively well mixed. The average temperature over the upper 30 m of the water column varies between approximately 13-17°C across the year, while the average salinity over this depth range remains at approximately 35 PSU year-round.

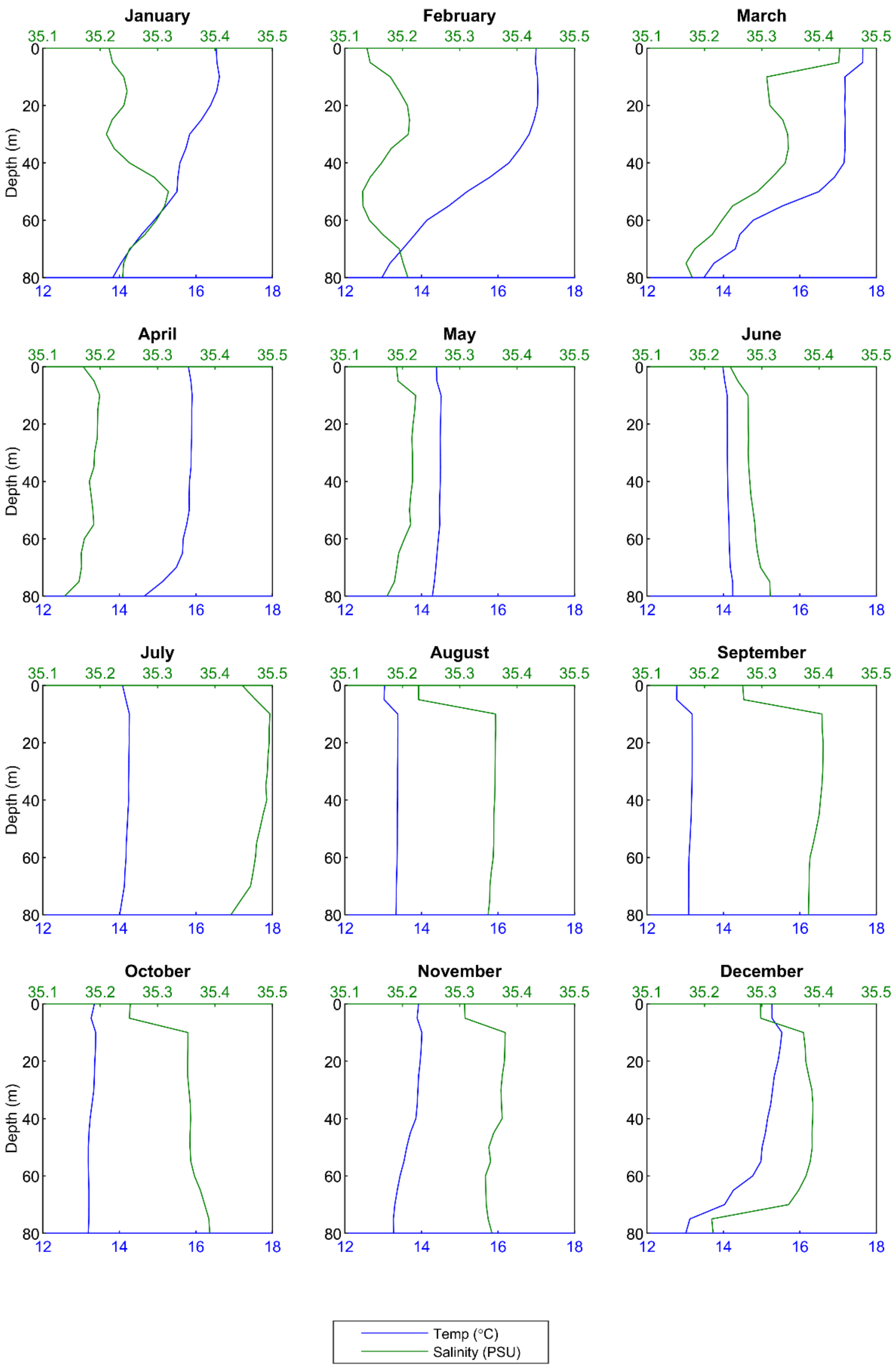


Figure 2.10 **Temperature (blue line) and salinity (green line) profiles derived from the WOA13 database near the centre of the operational area. Depth of 0 m is the water surface.**

3 OIL SPILL MODEL - SIMAP

The spill modelling was carried out using a purpose-developed oil spill trajectory and fates model, SIMAP (Spill Impact Mapping Analysis Program). This model is designed to simulate the transport and weathering processes that affect the outcomes of hydrocarbon spills to the sea, accounting for the specific oil type, spill scenario, and prevailing wind and current circulation patterns.

SIMAP is the evolution of the United States Environmental Protection Agency (US EPA) Natural Resource Damage Assessment model (French & Rines, 1997; French, 1998; French *et al.*, 1999) and is designed to simulate the fate and effects of spilled oils and fuels for both the surface slick and the three-dimensional plume that is generated in the water column. SIMAP includes algorithms to account for both physical transport and weathering processes. The latter are important for accounting for the partitioning of the spilled mass over time between the water surface (surface slick), water column (entrained oil and dissolved compounds), atmosphere (evaporated compounds) and land (stranded oil). The model also accounts for the interaction between weathering and transport processes.

The physical algorithms calculate transport and spreading by physical forces, including surface tension, gravity and wind and current forces for both surface slicks and oil within the water column. The fates algorithms calculate all the weathering processes known to be important for oil spilled to marine waters. These include droplet and slick formation, entrainment by wave action, emulsification, dissolution of soluble components, sedimentation, evaporation, bacterial and photo-chemical decay and shoreline interactions. These algorithms account for the specific oil type being considered.

Entrainment is the physical process where globules of oil are transported from the sea surface into the water column by wind and wave-induced turbulence or are generated subsea by a pressurised discharge at depth. It has been observed that entrained oil is broken into droplets of varying sizes. Small droplets spread and diffuse into the water column, while larger ones rise rapidly back to the surface (Delvigne & Sweeney, 1988; Delvigne, 1991).

Dissolution is the process by which soluble hydrocarbons enter the water from a surface slick or from entrained droplets. The lower molecular weight hydrocarbons tend to be both more volatile and more soluble than those of higher molecular weight.

The formation of water-in-oil emulsions, or mousse, which is termed ‘emulsification’, depends on oil composition and sea state. Emulsified oil can contain as much as 80% water in the form of micrometre-sized droplets dispersed within a continuous phase of oil (Wheeler, 1978; Daling & Brandvik, 1991; Bobra, 1991; Daling et al., 1997; Fingas, 1995; Fingas, 1997).

Evaporation can result in the transfer of large proportions of spilled oil from the sea surface to the atmosphere, depending on the type of oil (Gundlach & Boehm, 1981).

Evaporation rates vary over space and time dependent on the prevailing sea temperatures, wind and current speeds, the surface area of the slick and entrained droplets that are exposed to the atmosphere as well as the state of weathering of the oil. Evaporation rates will decrease over time, depending on the calculated rate of loss of the more volatile compounds. By this process, the model can differentiate between the fates of different oil types.

Decay (degradation) of hydrocarbons may occur as the result of photolysis, which is a chemical process energised by ultraviolet light form the sun, and by biological breakdown, termed biodegradation. Many types of marine organisms ingest, metabolise and utilise oil as a carbon source, producing carbon dioxide and water as by-products.

Many types of marine organisms ingest, metabolise and utilise oil as a carbon source, producing carbon dioxide and water as by-products. The biodegradable portion of various crude oils range from 11 to 90% (NRC, 1985, 1989).

Entrainment, dissolution and emulsification rates are correlated to wave energy, which is accounted for by estimating wave heights from the sustained wind speed, direction and fetch (i.e. distance downwind from land barriers) at different locations in the domain. Dissolution rates are dependent upon the proportion of soluble, short-chained hydrocarbon compounds, and the surface area at the oil/water interface of slicks. Dissolution rates are also strongly affected by the level of turbulence. For example, dissolution rates will be relatively high at the site of the release for a deep-sea discharge at high pressure.

In contrast, the release of hydrocarbons onto the water surface will not generate high concentrations of soluble compounds. However, subsequent exposure of the surface slick to breaking waves will enhance entrainment of oil into the upper water column as oil droplets, which will enhance dissolution of the soluble components. Because the compounds that have high solubility also have high volatility, the processes of evaporation and dissolution will be in dynamic competition with the balance dictated by the nature of the release and the weather conditions that affect the oil after release. The SIMAP weathering algorithms include terms to represent these dynamic processes. Technical descriptions of the algorithms used in SIMAP and validations against real spill events are provided in French (1998), French et al. (1999) and French-McCay (2004).

Input specifications for oil types include the density, viscosity, pour-point, distillation curve (volume of oil distilled off versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges. The model calculates a distribution of the oil by mass into the following components:

- Surface-bound or floating oil.
- Entrained oil (non-dissolved oil droplets that are physically entrained by wave action).
- Dissolved hydrocarbons (principally the aromatic and short-chained aliphatic compounds).
- Evaporated hydrocarbons.
- Sedimented hydrocarbons.
- Decayed hydrocarbons.

3.1 Hydrocarbon Properties

3.1.1 Marine Diesel Oil

An MDO was modelled for this study. Table 3.1 and Table 3.2 outline the physical characteristics and boiling point (BP) ranges for the MDO, respectively, which determine the way it behaves in the marine environment.

MDO has a density of 829.1 kg/m^3 (API gravity of 37.6) and a dynamic viscosity of 4.0 cP at 25ºC, classifying it as a Group II oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and USEPA/USCG classifications. The aromatic content is approximately 3%.

Table 3.1 Physical properties of the MDO used in this study.

Characteristic	MDO
Density (kg/m^3)	829.1 (at 15°C)
API	37.6
Dynamic viscosity (cP)	4.0 (at 25°C)
Pour point (°C)	-14
Hydrocarbon property category	Group II
Hydrocarbon property classification	Light persistent

Table 3.2 Boiling point ranges of the MDO used in this study.

Characteristics	**Non-Persistent**			**Persistent**
	Volatile (%)	*Semi-volatile (%)*	*Low-volatility (%)*	*Residual (%)*
Boiling point (°C)	*<180*	*180-265*	*265-380*	*>380*
MDO	6.0	34.6	54.4	5.0

The boiling points are dictated by the length of the carbon chains, with the longer and more complex compounds having a higher boiling point, and therefore lower volatility and evaporation rate.

Atmospheric weathering will commence when oil droplets float to the water surface. Typical evaporation times once the hydrocarbons reach the surface and is exposed to the atmosphere are around:

- Up to 12 hours for the C_4 to C_{10} compounds (or less than 180°C BP) for 6% of the MDO mass;
- Up to 24 hours for the C_{11} to C_{15} compounds (180 – 265°C BP) for 35% of the MDO mass;
- Several days for the C_{16} to C_{20} compounds (265 – 380°C BP) for 54% of the MDO mass; and
- N/A for the residual compounds (BP>380°C) (5% of the MDO mass), which will resist evaporation, persist in the marine environment for longer periods, and be subject to relatively slow degradation.

The heavier (low volatility) components of the oil tend to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-waves abate. Therefore, the heavier components of this oil can remain entrained or on the sea surface for an extended period, with associated potential for dissolution of the soluble aromatic fraction.

3.1.2 Weathering Characteristics

To illustrate the behaviour of the MDO, generalised weathering test were conducted based on the simulation of the following conditions:

- A 50 m^3 release of MDO over 1 hour on the sea surface under calm wind conditions (constant 5 knots), assuming a water temperature of 15°C and average air temperature of 25°C. Slick also subject to ambient tidal and drift currents.

- A 50 m^3 release of MDO over 1 hour on the sea surface under variable wind conditions (0-30 knots, drawn from representative data files), assuming a water temperature of 15°C and average air temperature of 25°C. Slick also subject to ambient tidal and drift currents.

The first case is indicative of calm conditions that would not generate entrainment, while the second case may represent conditions that could cause a high degree of entrainment.

The constant 5 knot wind case (Figure 3.1) shows that approximately 41% of the oil was predicted to evaporate within 36 hours. Under the calm conditions the majority of the remaining oil on the water surface is predicted to weather at a slower rate due to 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 3.2), where the winds are of greater strength, entrainment into the water column is shown to be significant. Approximately 6 hours after the simulated spill started, around 73% of the oil mass was forecast to have entrained and 26% had evaporated, leaving only a tiny small proportion 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 or 12 knots).

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 oil and oil droplets in the water column occurs at an approximate rate of 0.43% per day with an accumulated total of ~4.3% after 10 days, in comparison to a rate of ~0.1% per day and an accumulated total of 1.3% after 10 days in the constant-wind case. Given the large proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay and/or evaporate over time scales of several weeks to a few months.

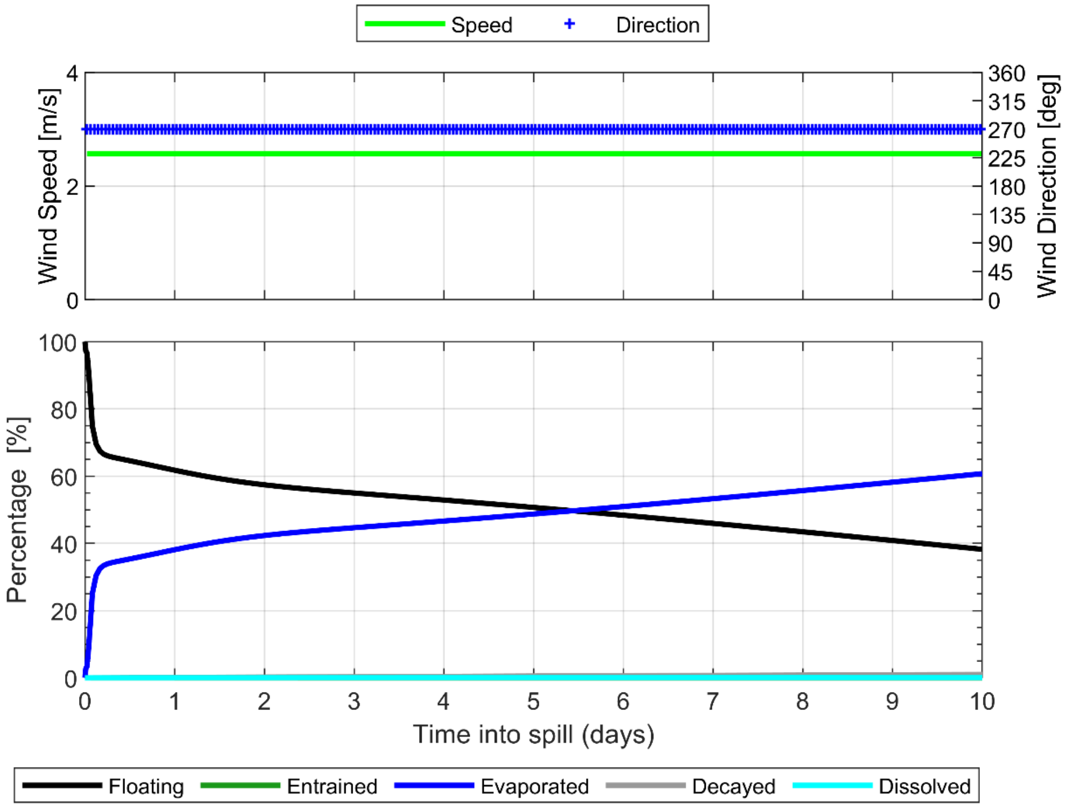


Figure 3.1 Proportional mass balance plot representing the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1 hour) and subject to a constant 5 knots (2.6 m/s) wind at 15 °C water temperature and 25 °C air temperature.

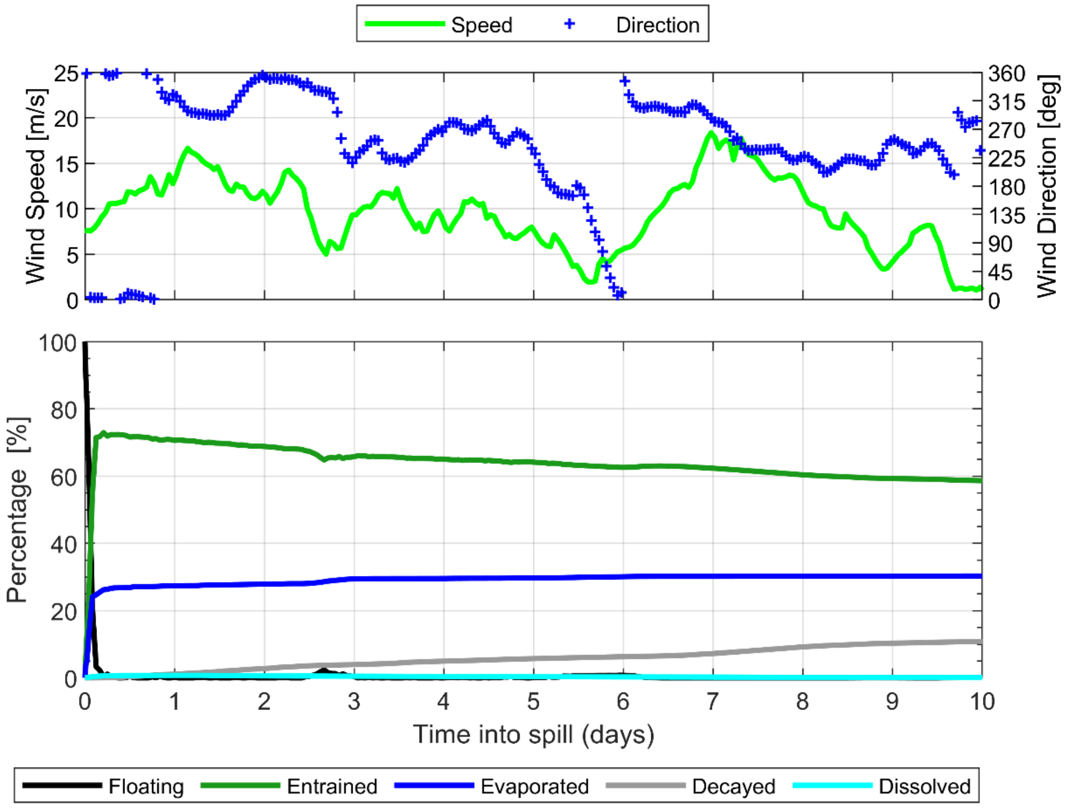


Figure 3.2 **Proportional mass balance plot representing the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1 hour) and subject to variable wind at 15 °C water temperature and 25 °C air temperature.**

3.2 Sea-surface, Shoreline and In-Water Thresholds

The thresholds described below for surface, shoreline, and in-water (entrained and dissolved) oil have been adopted according to low, moderate and high thresholds, based on increasing concentrations:

- ***Low thresholds*** are unlikely to affect marine life but would be visible and detectable by instrumentation and may trigger socio-economic impacts, such as temporary closures of fishing grounds as a precautionary measure.
- ***Moderate thresholds*** represent concentrations of oil exposure/contact, which are anticipated to result in behavioural changes and sub-lethal effects to biota (effects that may result in changes in reproduction or growth) and are unlikely to result in lethal effects (death of individuals), although lethality may occur if ingestion occurs.
- ***High thresholds*** represent concentrations of oil that are expected to result in sub-lethal and lethal effects to at least some species (death or potential death of individuals).

Reporting threshold values (based on the scientific literature) represent potential effects ranging from possible social and economic effects, degradation of water quality as well as possible effects on the behaviour, survival and recruitment success on biota. The changes in the state of the oil over time, in addition to a wide range of sensitivities and in turn potential effects on marine life, does not make it possible to strictly assign single specific effect thresholds. Instead, the analysis presented herein is presented for ranges of low, moderate and high threshold levels, with separate analysis for oil floating at the sea surface, stranded on shoreline, dissolved in the water column and suspended in the water column.

Moderate levels were defined based on available evidence that indicated the potential for low-level sub-lethal effects on some biota, or else evidence of reduced survival rates of sensitive species. This level can be considered a lower ecological threshold. The higher threshold was defined on the assumption that there would be more potential for reduced survivorship of less sensitive species.

The thresholds used herein are based on the NOPSEMA Environment Bulletin – Oil spill modelling (NOPSEMA 2019).

3.2.1 Sea-surface Exposure Thresholds

As a conservative approach, the same reporting thresholds for fresh and weathered oil exposure on the sea surface were applied in this study (Table 3.3). As the effects of fresh oil are better understood than for weathered oil, appropriate effects thresholds for fresh oil are more readily identifiable. Exposure pathways of species to weathered oil (i.e. smothering and potential ingestion for some species) are less likely to result in adverse effects.

Table 3.3 Oil exposure thresholds on the sea surface used in this report (in alignment with NOPSEMA 2019).

Exposure level	Floating oil threshold (g/m^2)	Description
Low	1	Approximates range of socio-economic effects and establishes planning area for scientific monitoring
Moderate	10*	Approximates lower limit for harmful exposures to birds and marine mammals
High	50	Approximates surface oil slick and informs response planning

* 10 g/m^2 also used to define the threshold for actionable sea surface oil.

Background information informing the use of these thresholds is presented below:

- Lowest threshold (1 g/m^2) – equates approximately to an average thickness of 1 µm, referred to as visible oil. Oil of this thickness is described as rainbow sheen in appearance, according to the Bonn Agreement Oil Appearance Code (Bonn Agreement 2009) (see Table 3.4). This threshold is considered below levels that cause environmental harm and it is more indicative of the areas perceived to be affected due to its visibility on the sea surface and potential to trigger temporary closures of areas (i.e. fishing grounds) as a precautionary measure. Table 3.4 provides a description of the appearance in relation to exposure zone thresholds used to classify the zones of sea surface exposure.

- Moderate threshold (10 g/m^2) – this is equivalent to a film thickness of approximately 10 µm or 0.01 mm. Ecological impact has been estimated to occur at this threshold according to French et al. (1996) and French-McCay (2009), as this level of fresh oiling has been observed to mortally impact some birds through adhesion of oil to their feathers, exposing them to secondary effects such as hypothermia. The appearance of oil at this average thickness has been described as a metallic sheen (Bonn Agreement, 2009).

- High threshold (25 g/m^2 or greater) – Scholten et al. (1996) and Koops et al. (2004) indicated that these oil concentrations on the sea surface would be harmful for all birds that have landed in an oil film due to potential contamination of their feathers, with secondary effects such as loss of temperature regulation and ingestion of oil through preening. The appearance of oil at this thickness is also described as metallic sheen (Bonn Agreement, 2009). For this study, the high exposure threshold was set to 50 g/m^2 and above based on NOPSEMA (2019) and because it is an appropriate threshold for spill response planning, as it is more suitable for targeted spill response strategies such as containment and recovery.

Figure 3.3 shows examples of the differences between oil colour and corresponding thickness on the sea surface. Hydrocarbons in the marine environment may appear differently due the ambient environmental conditions (wind and wave action).

Table 3.4 The Bonn Agreement Oil Appearance Code.

Code	Description/Appearance	Layer Thickness Interval (g/m^2 or µm)	Litres per km^2
1	Sheen (silvery/grey)	0.04 – 0.30	40 – 300
2	Rainbow	0.30 – 5.0	300 – 5,000
3	Metallic	5.0 – 50	5,000 – 50,000
4	Discontinuous True Oil Colour	50 – 200	50,000 – 200,000
5	Continuous True Oil Colour	≥ 200	≥ 200,000

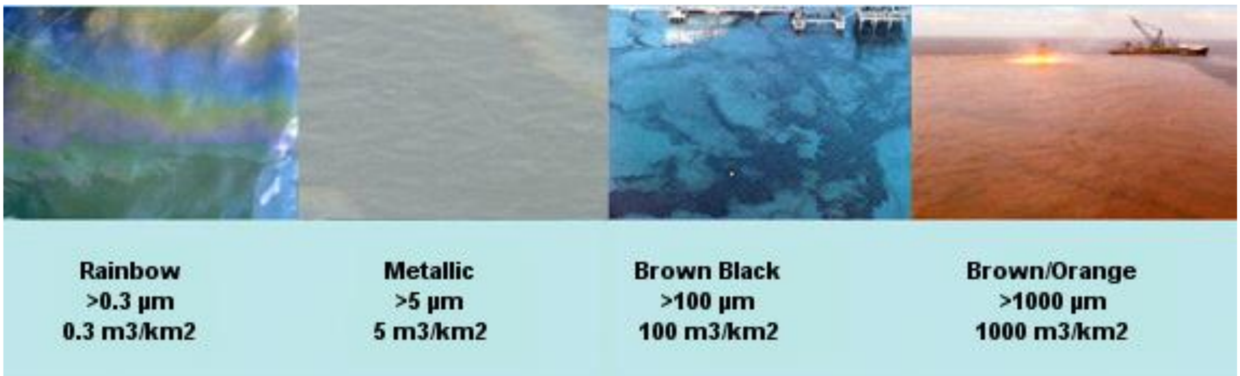


Figure 3.3 Photographs showing the difference between oil colour and thickness on the sea surface (source: adapted from Oil Spill Solutions.org, 2015).

3.2.2 Shoreline Contact Threshold

The minimum thresholds for shoreline contact were 10 g/m^2 (low), 100 g/m^2 (moderate) and above 1,000 g/m^2 (high) (Table 3.5). Background information informing the use of these thresholds is presented below:

- Lowest threshold (10 g/m^2) – this threshold may trigger socio-economic impact, such as temporary closures of beaches to recreation or fishing, or closure of commercial fisheries and might trigger attempts for shore clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.). French-McCay et al. (2005a; 2005b) used a threshold of 10 g/m^2, equating to approximately two teaspoons of oil per square meter of shoreline, as a low impact threshold when assessing the potential for shoreline contact.

- Moderate threshold (100 g/m^2) – French et al. (1996) and French-McCay (2009) use this shoreline oil threshold to define potential harm to shorebirds and wildlife (fur-bearing aquatic mammals and marine reptiles on or along the shore) based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004, French-McCay et al., 2011; 2012; NOAA, 2013). A shoreline concentration of 100 g/m^2 or higher is the minimum limit that the oil can be effectively cleaned according the AMSA (2015) guideline. This threshold equates to approximately ½ a cup of oil per square meter of shoreline contacted. The appearance is described as a thin oil coat.

- High threshold (1,000 g/m^2) and above – informs locations that might receive oil accumulation levels that could have a higher potential for ecological effect. Observations by Lin & Mendelssohn (1996) demonstrated that loadings of more than 1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (Grant et al., 1993; Suprayogi & Murray, 1999). This concentration equates to approximately 1 litre or 4 ¼ cups of fresh oil per square meter of shoreline contacted. The appearance is described as an oil cover.

Table 3.5 Thresholds for oil accumulation on shorelines.

Exposure level	Shoreline oil threshold (g/m^2)	Description
Low	10	Predicts potential for some socio-economic impact
Moderate	100*	Loading predicts area likely to require clean-up effort
High	1,000	Loading predicts area likely to require intensive clean-up effort

* 100 g/m^2 also used to define the threshold for actionable shoreline oil.

3.2.3 Dissolved and Entrained Hydrocarbon Thresholds

Oil is a mixture of thousands of hydrocarbons of varying physical, chemical, and toxicological characteristics, and therefore has varying fates and impacts on organisms. As such, for in-water exposure, the SIMAP model provides separate outputs for dissolved and entrained hydrocarbons from oil droplets. The consequences of exposure to dissolved and entrained components will differ because they have different modes and magnitudes of effect.

Entrained hydrocarbon concentrations were calculated based on oil droplets that are suspended in the water column, though not dissolved. The composition of this oil would vary with the state of weathering (oil age) and may contain soluble hydrocarbons when the oil is fresh. Calculations for dissolved hydrocarbons specifically calculates oil components which are dissolved in water, which are known to be the primary source of toxicity exerted by oil.

3.2.3.1 Dissolved Hydrocarbons

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan & Speece, 1988; Blum & Speece, 1990; McCarty, 1986; McCarty et al., 1992a, 1992b; Mackay et al., 1992; McCarty & Mackay, 1993; Verhaar et al., 1992, 1999; Swartz et al., 1995; French-McCay, 2002; McGrath et al., 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polycyclic aromatic hydrocarbons (PAHs) containing 2-3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality (LC_{50}) between 6 and 400 ppb total PAH concentration after 96 hrs exposure, with an average of 50 ppb. Hence, concentrations lower than 6 ppb total PAH value should be protective of 97.5% of species and life stages even with exposure periods of days (at least 96 hours). Early life-history stages of fish appear to be more sensitive than older fish stages and invertebrates.

Exceedances of 10, 50 or 400 ppb over a 1 hour timestep (see Table 3.6) were applied to indicate increasing potential for sub-lethal to lethal toxic effects (or low to high), in alignment with the commonly used exposure values for oil spill modelling presented in NOPSEMA (2019).

3.2.3.2 Entrained Hydrocarbons

Entrained hydrocarbons consist of insoluble oil droplets that are suspended in the water column. As such, insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, hence are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2003).

The 10-ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC (2000) water quality guidelines. Due to the requirement for relatively long exposure times (≥ 24 hours) for these concentrations to be significant, they are likely to be more meaningful for juvenile fish, larvae and planktonic organisms that might be entrained (or otherwise moving) within the entrained plumes, or when entrained hydrocarbons adhere to organisms or when they are trapped against a shoreline for periods of several days or more.

Exposure to entrained oil at 10 ppb is not considered to be of significant biological impact and is therefore outside the adverse exposure zone. This exposure zone represents the area contacted by the spill. This area does not define the area of influence as it is considered that the environment will not be affected by the entrained hydrocarbon at this level.

Thresholds of 10 ppb and 100 ppb were applied over a 1 hour time exposure (Table 3.6), to cover the range of thresholds outlined in the ANZECC/ARMCANZ (2000) water quality guidelines, the incremental change for greater potential effect and is per NOPSEMA (2019).

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

Table 3.6 Dissolved and entrained hydrocarbon instantaneous exposure thresholds used in this report (in alignment with NOPSEMA, 2019).

	Exposure level	In-water threshold (ppb)	Description
Dissolved hydrocarbons	Low	10	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers
	Moderate	50	Approximates potential toxic effects, particularly sublethal effects to sensitive species
	High	400	Approximates toxic effects including lethal effects to sensitive species
Entrained hydrocarbons	Low	10	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers
	High	100	As appropriate given oil characteristics for informing risk evaluation

3.3 Dispersion

A horizontal dispersion coefficient of 10 m^2/s was used to account for dispersive processes acting at the surface that are below the scale of resolution of the input current field, based on typical values for open waters (Okubo, 1971). Dispersion rates within the water column (applicable for entrained and dissolved plumes of hydrocarbons) were specified at 1 m^2/s, based on empirical data for the dispersion of hydrocarbon plumes (King & McAllister, 1998).

3.4 Sensitive Receptors

A range of receptors were assessed for potential exposure/contact (see Figure 3.11 to Figure 3.9). Receptor categories (see Table 3.7) include sections of shorelines defined by local government areas (LGAs) and offshore islands; and submerged reefs, rocks and banks (RRB). All other sensitive receptors were sourced from the Protected Matters Search Tool within the http://www.environment.gov.au/ website. Risks of exposure were separately calculated for each sensitive receptor and have been tabulated throughout Section 5.

Table 3.7 Summary of receptors used to assess surface, shoreline and in-water exposure to hydrocarbons.

Receptor Category	Acronym	Hydrocarbon Exposure Assessment		
		Water Column	Sea Surface	Shoreline
Australian Marine Park	AMP	✓	✓	×
Marine National Park	MNP	✓	✓	×
National Park	NP	✓	✓	×
Nature Reserve	NR	✓	✓	×
Key Ecological Feature	KEF	✓	✓	×
Ramsar	Ramsar	✓	✓	×
State Waters	State Waters	✓	✓	×
Sub-Local Government Areas	Sub-LGA	✓ (Reported as: Sub-LGA Nearshore Waters)	✓ (Reported as: Sub-LGA Nearshore Waters)	✓ (Reported as: Shore)
Shoreline (LGA)	Shore & Nearshore Waters	✓ (Reported as: LGA Nearshore Waters)	✓ (Reported as: LGA Nearshore Waters)	✓ (Reported as: Shore)

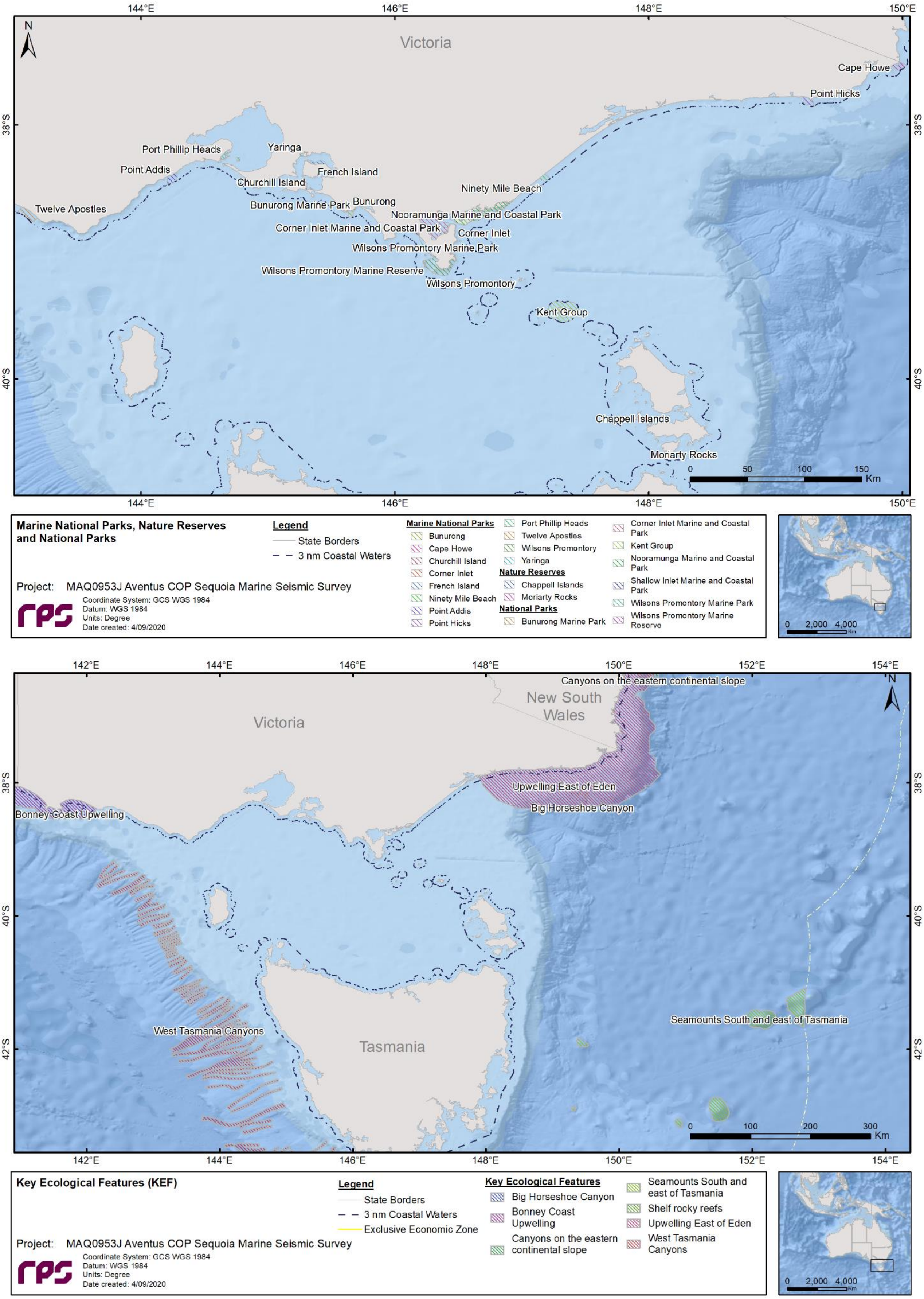


Figure 3.4 Receptor maps for Marine National Parks (MNP), Nature Reserves (NR) and National Parks (NP; top) and Key Ecological Features (KEF; bottom).

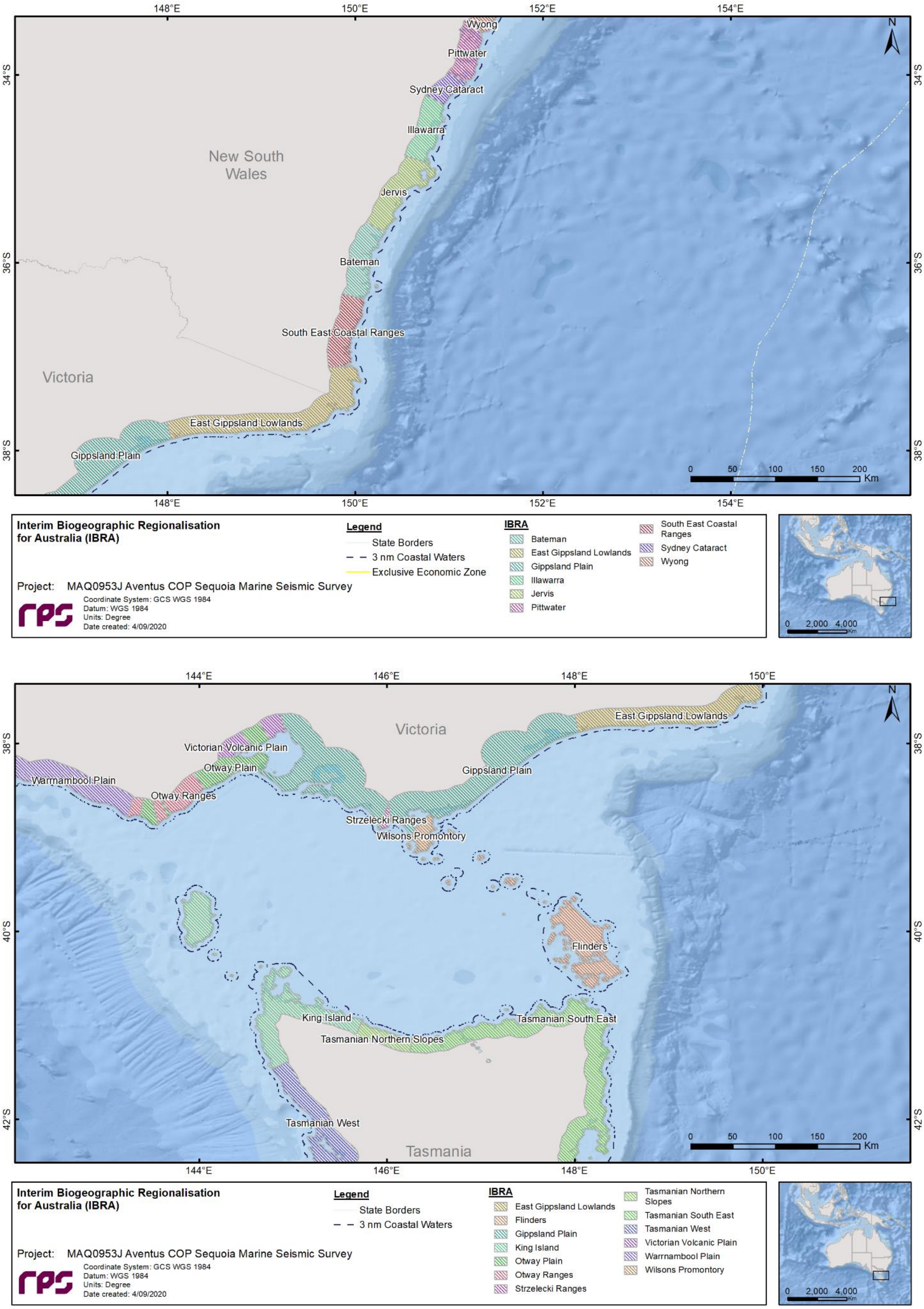


Figure 3.5 Receptor maps for Interim Biogeographic Regionalisation for Australia (IBRA).

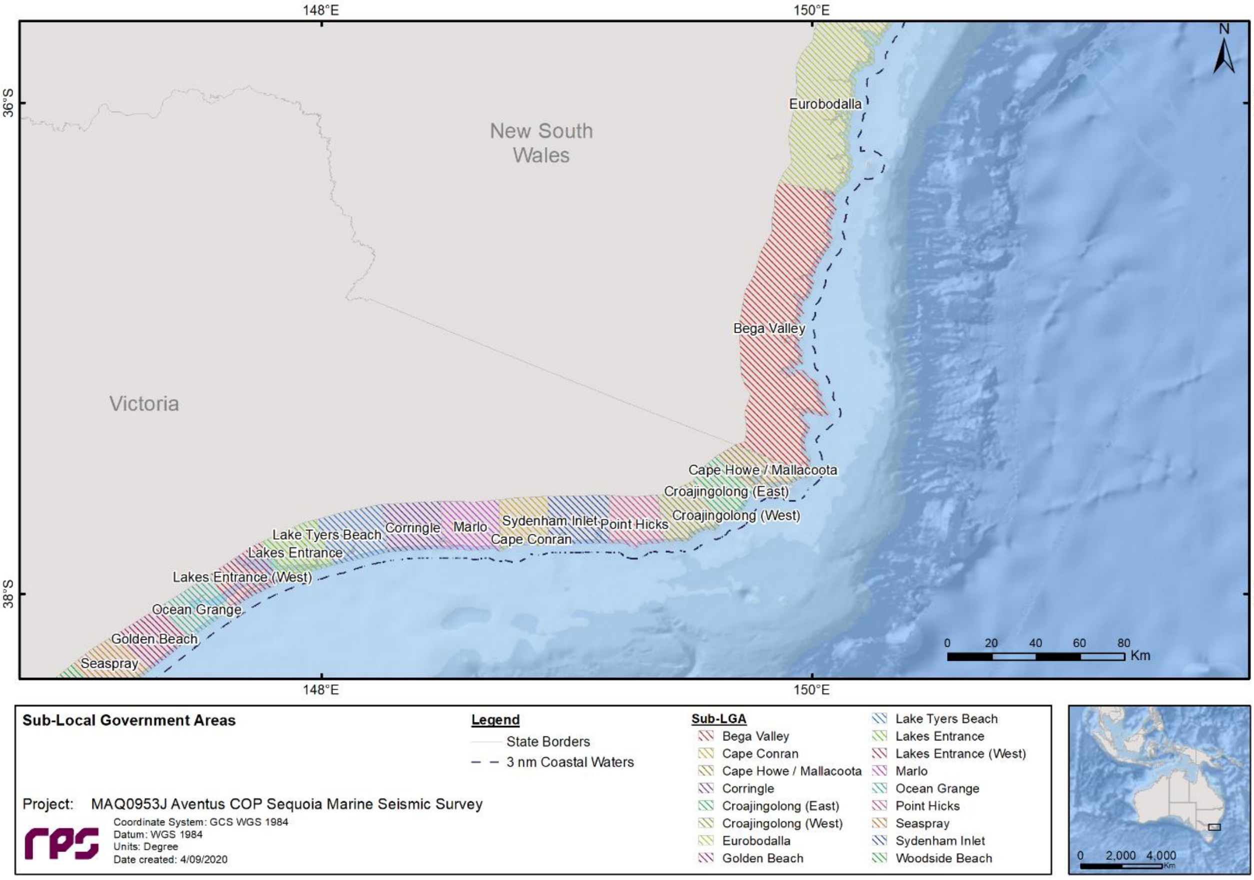
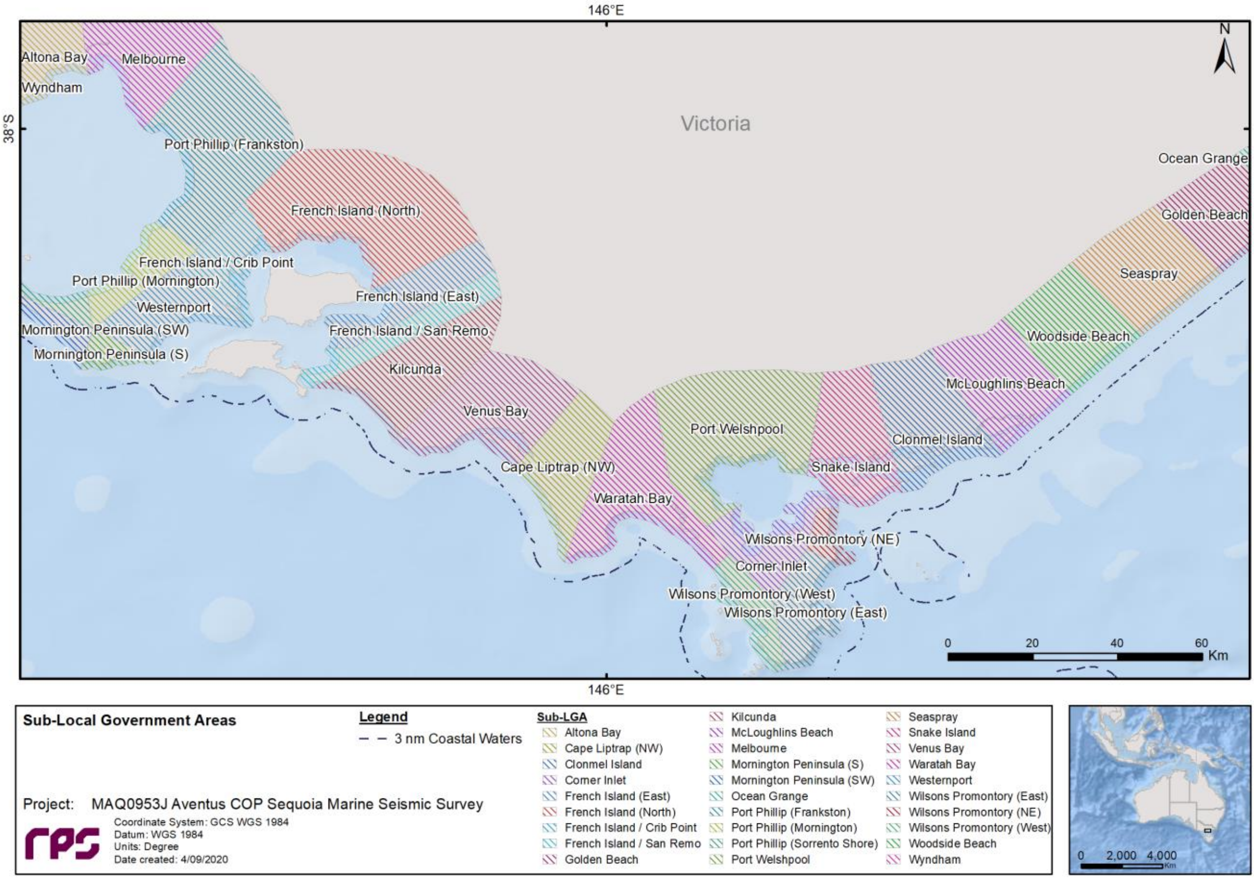


Figure 3.6 Receptor maps for Sub-Local Government Areas (Sub-LGAs).



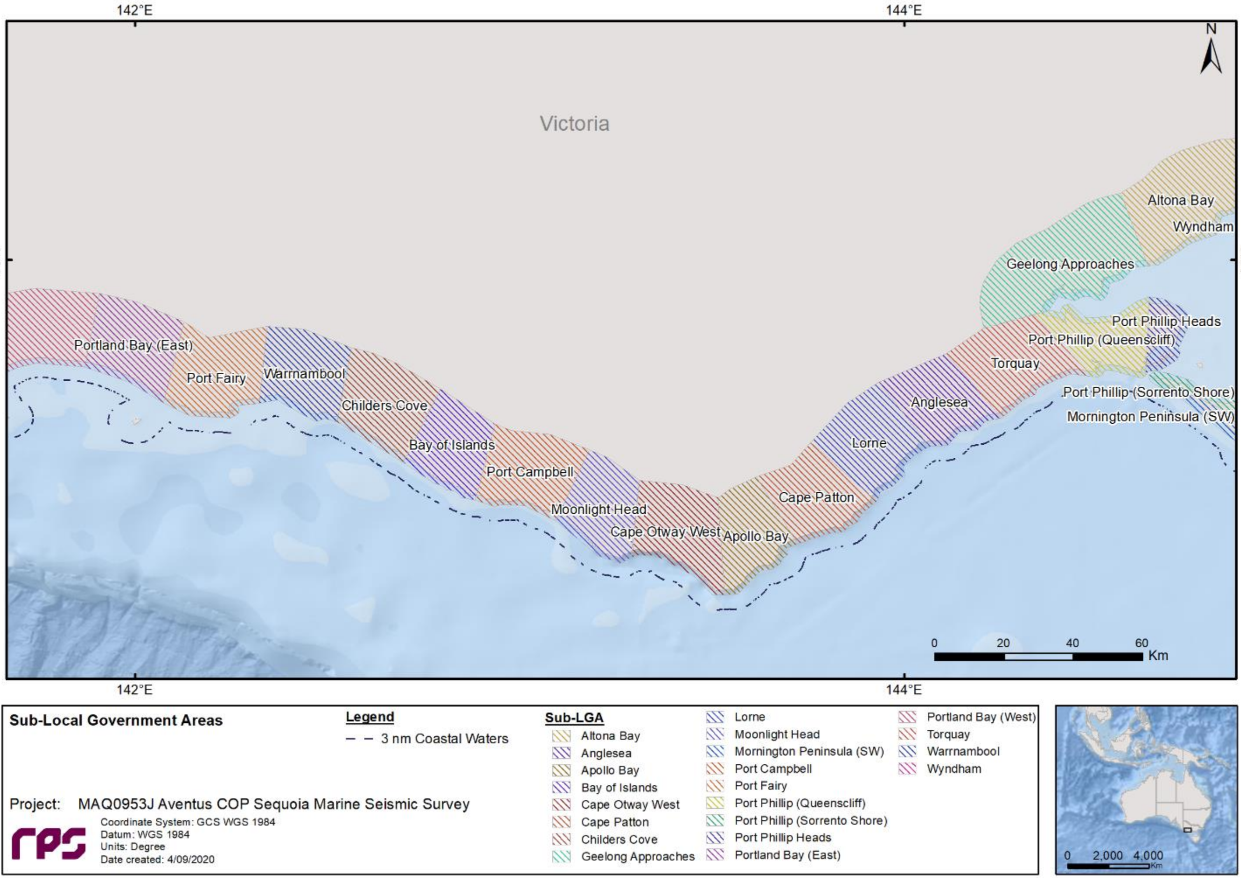
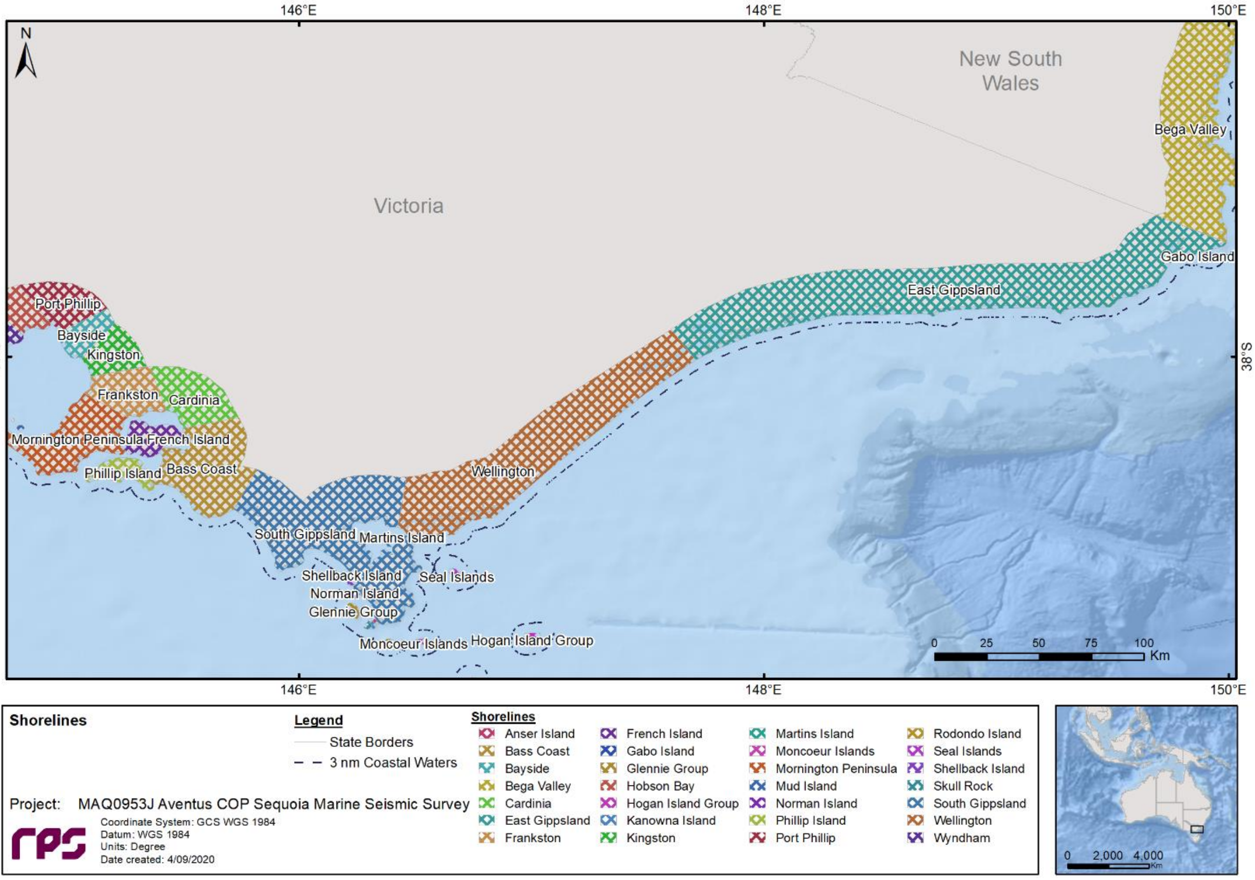


Figure 3.7 Receptor maps for Sub-Local Government Areas (Sub-LGAs).



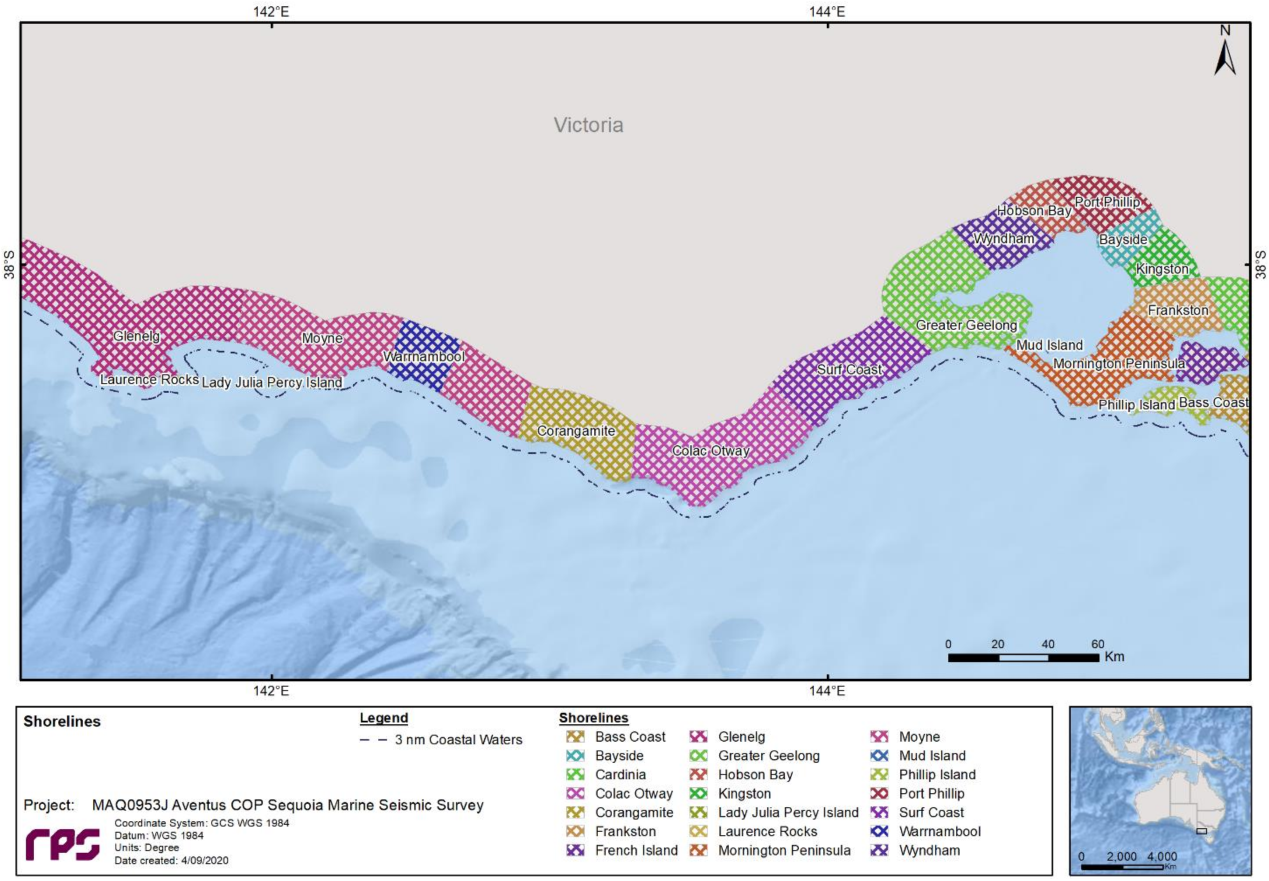
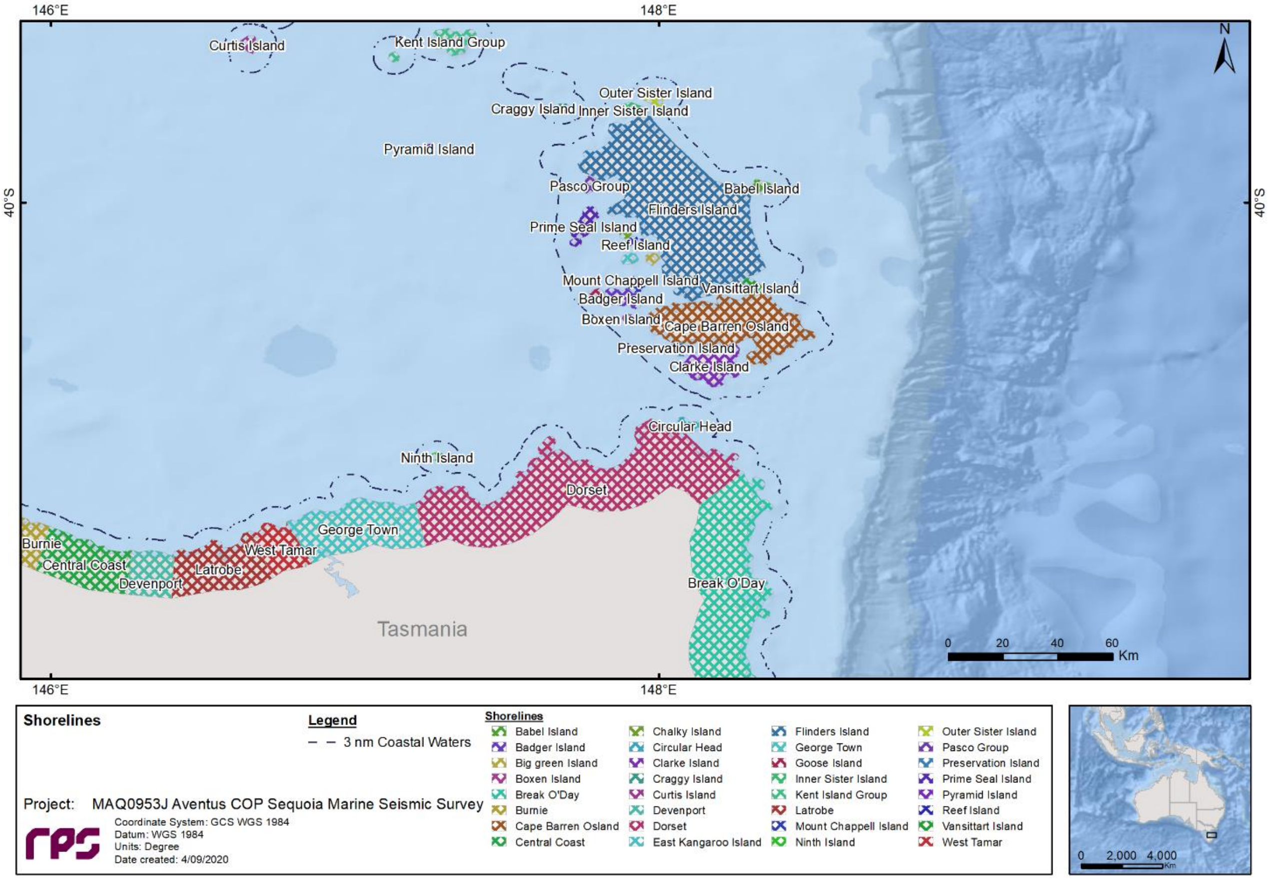


Figure 3.8 Receptor maps for Shorelines.



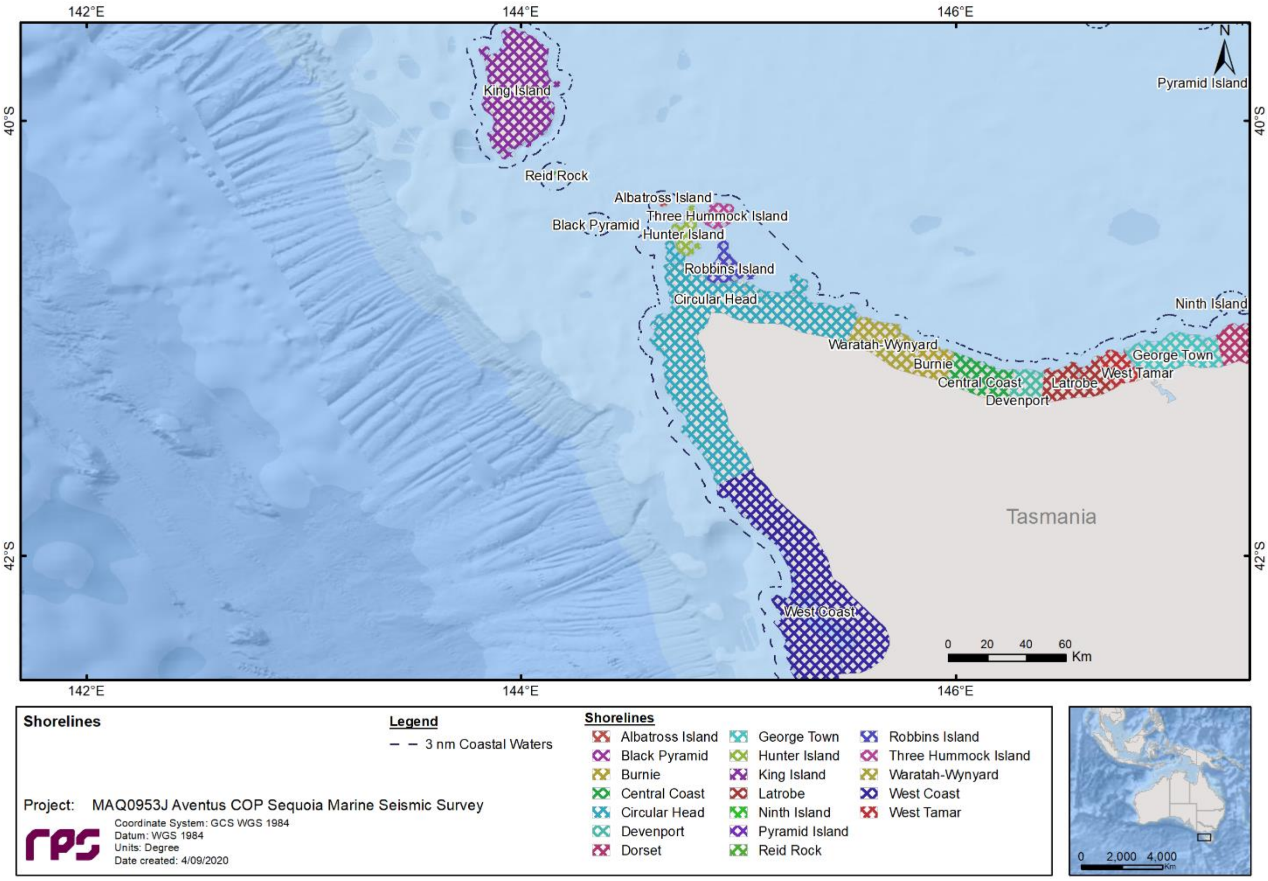


Figure 3.9 Receptor maps for Shorelines.

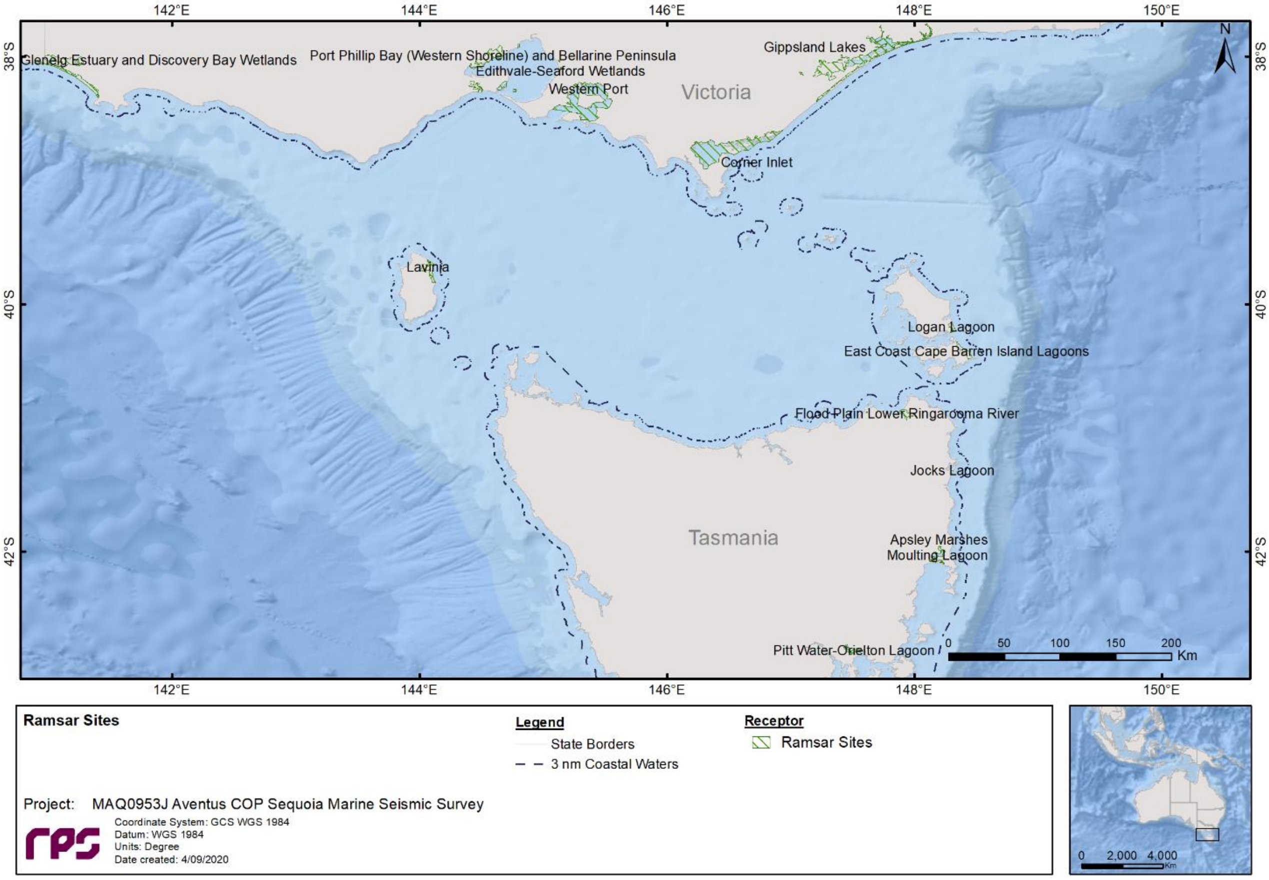


Figure 3.10 Receptor maps for Ramsar Sites.

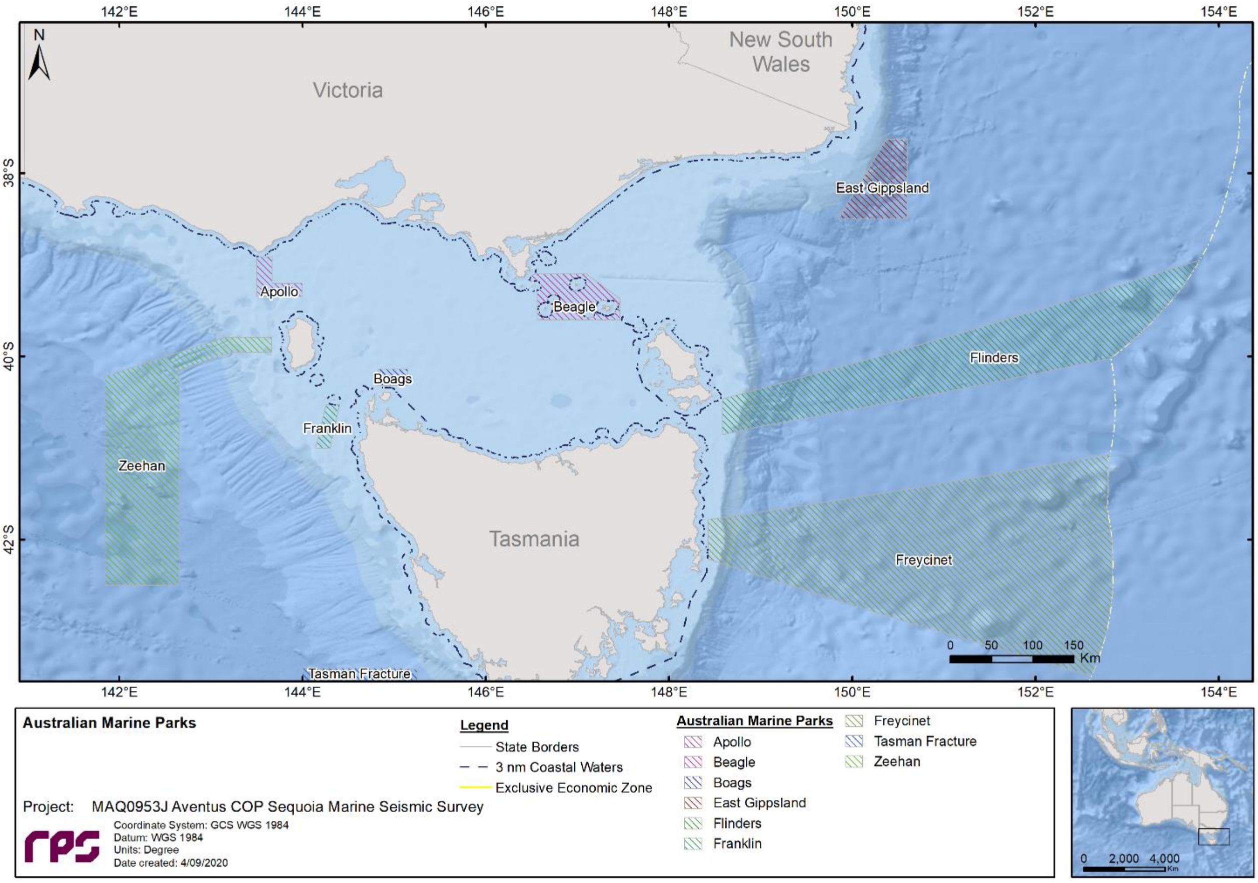


Figure 3.11 Receptor map for Australian Marine Parks (AMP).

4 MODEL SETTINGS

Table 4.1 provides a summary of the oil spill model settings. The table also shows the thresholds that were used to assess the oil spill modelling results.

The simulation length was carefully selected based on extensive sensitivity testing. During the sensitivity testing process, sample spill simulations were run for longer than intended durations. Upon completion of the spill simulations, the results were carefully assessed to examine the persistence of the hydrocarbon (i.e. whether the maximum evaporative loss has been achieved for the period of time modelled; and whether a substantial volume of hydrocarbons remain in the water column (if any)) in conjunction with the extent of floating oil exposure based on reporting thresholds. Once there was agreement between the two factors (i.e. the final fate of hydrocarbon is accounted for and the full exposure area is identified) the simulation length was deemed appropriate.

Table 4.1 Summary of the oil spill model settings used in this assessment.

Input Parameters	Scenario
Scenario Description	loss from the survey vessel tank
Location	random locations within operational area
Number of randomly selected spill start times	100
Oil type	Marine diesel oil
Total volume released	373 m^3
Release duration	6 hours
Release depth	Surface
Simulation length	28 days
Seasons assessed	Annual
Surface thresholds (g/m^2)	1 (low exposure)
	10 (moderate exposure)
	50 (high exposure)
Shoreline accumulation thresholds (g/m^2)	10 (low exposure)
	100 (moderate exposure)
	1,000 (high exposure)
Dissolved hydrocarbon exposure thresholds (ppb)	10 (low exposure)
	50 (moderate exposure)
	400 (high exposure)
Entrained hydrocarbon exposure thresholds (ppb)	10 (low exposure)
	100 (high exposure)

5 MODELLING RESULTS

5.1 Vessel fuel tank rupture – Surface Release of 373 m^3 of Marine Diesel over 6 Hours

This scenario examined a 373 m^3 surface release of marine diesel over 6 hours, tracked for 28 days to represent a vessel fuel tank rupture during the Sequoia 3D MSS operations. A total of 100 spill trajectories were simulated during annual conditions.

Section 5.1.1 presents the overview of the EMBA and Section 5.1.2 shows the annual stochastic analysis, while Section 5.1.3 presents the deterministic analysis results.

5.1.1 Overview

Figure 5.1 is a map of the EMBA (the extent of the low threshold for surface, shoreline, dissolved and entrained MDO). This is an amalgamation of 100 spill simulations with different metocean conditions and is not representative of a single spill simulation. It represents the outer limit within which any single spill simulation may occur.

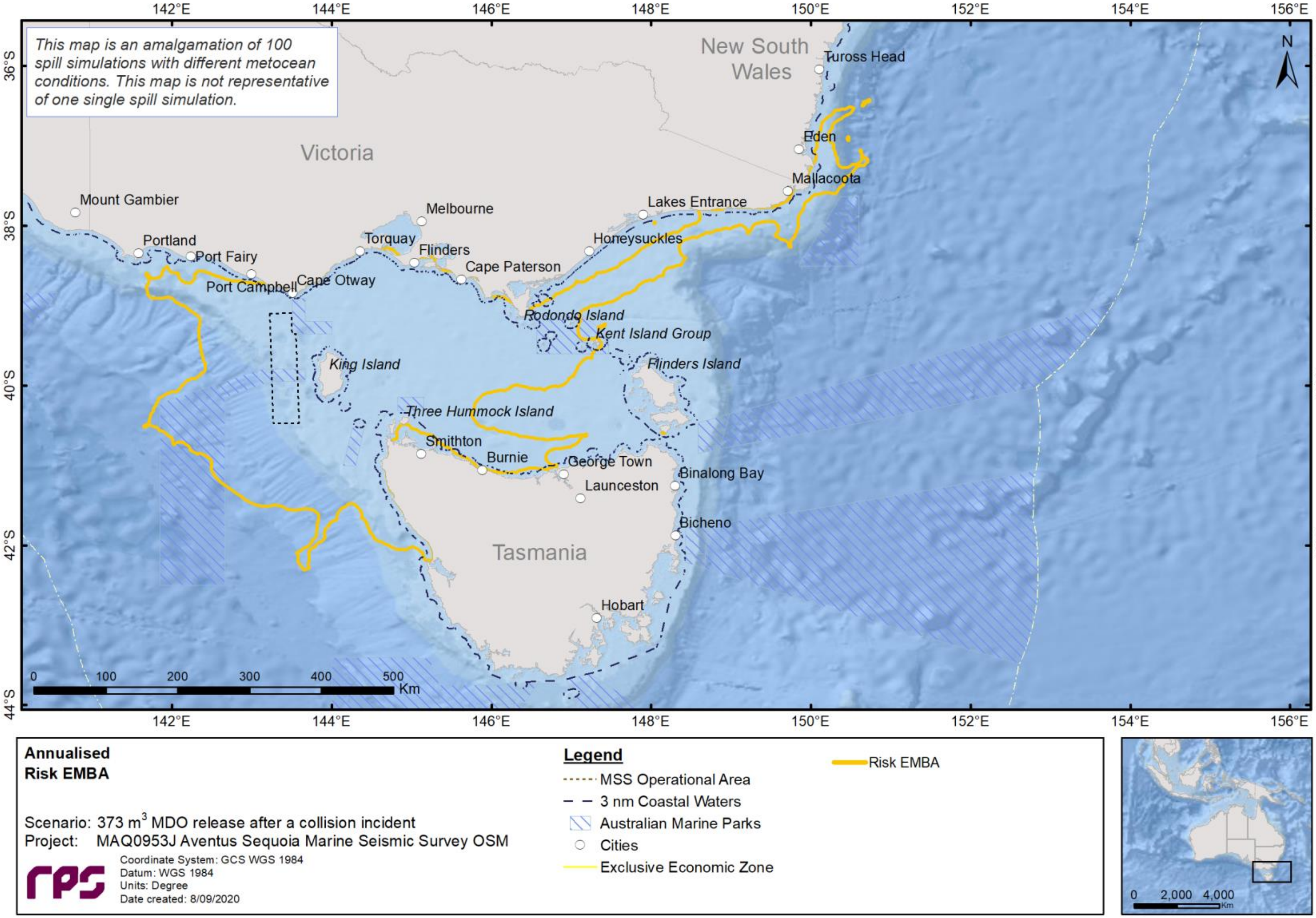


Figure 5.1 **Predicted risk EMBA resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories and tracked for 28 days.**

5.1.2 Annual Stochastic Analysis

5.1.2.1 Floating Oil Exposure

Table 5.1 summarises the potential floating oil exposure to individual receptors. Floating oil at the low threshold was predicted at two (2) AMPs (Apollo and Zehan), one (1) KEF (West Tasmania Canyons) and (1) MNP (Point Addis), amongst a range of other sensitive receptors.

Note that the predicted minimum time before floating oil exposure at or above the low threshold ranged between 0.04 day (1 hour) for receptors situated within the operational area (i.e. Apollo AMP, Zeehan AMP and West Tasmania Canyons KEF) to 6.67 days (Wilsons Promontory Marine Reserve NP).

The annual zones of potential floating oil exposure at low, moderate and high thresholds are depicted in Figure 5.2.

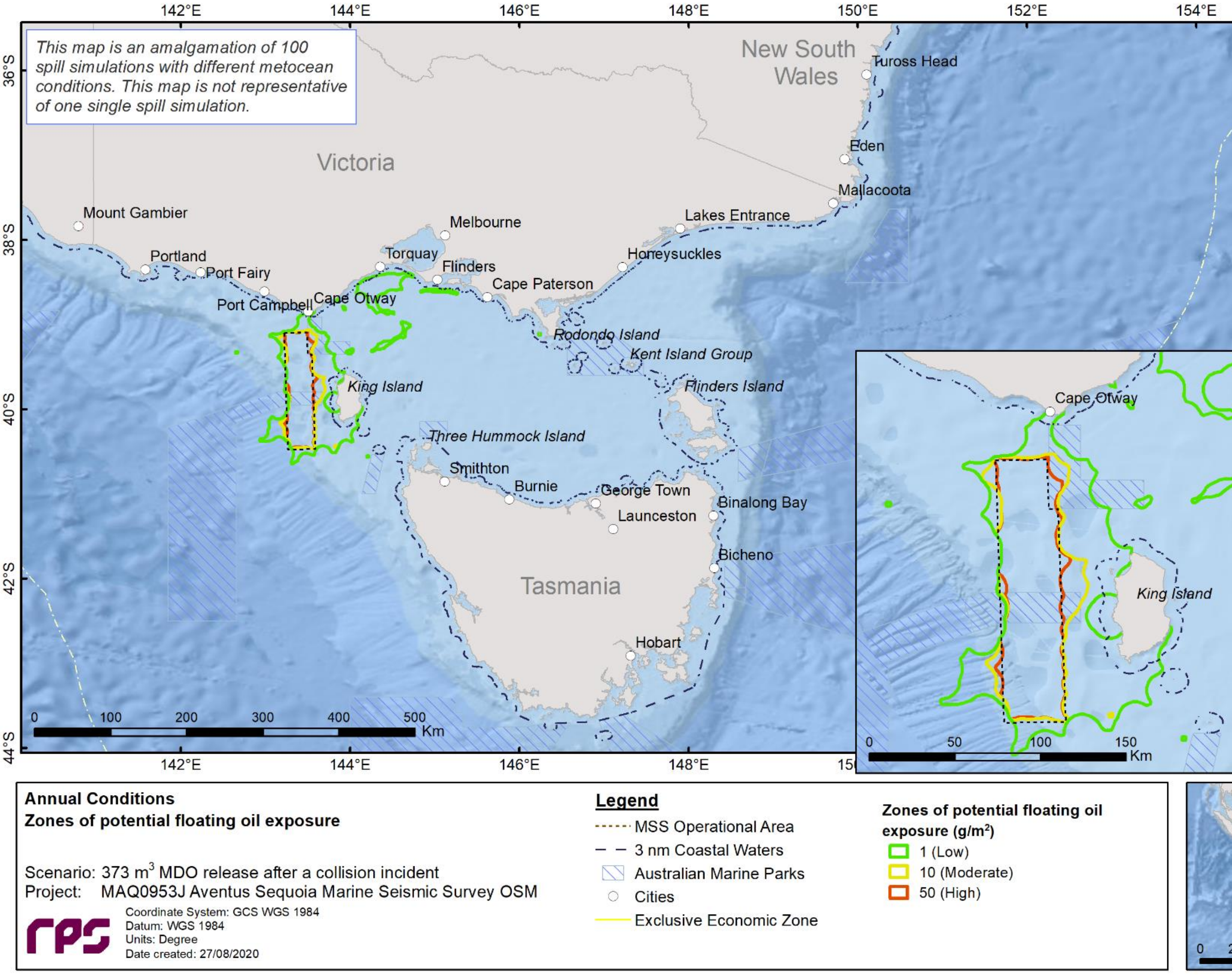


Table 5.1 Summary of the potential floating oil exposure to individual receptors. Results are based on a 373 m^3 surface release of marine diesel over 6 hours, in the event of a vessel fuel

tank rupture during the Sequoia 3D MSS operations. The results were calculated from 100 spill trajectories randomly spaced within the operational area.

Receptor		Probability of floating oil exposure (%)			Minimum time before floating oil exposure (days)		
		Low (1-10 g/m²)	Moderate (10-50 g/m²)	High (≥50 g/m²)	Low (1-10 g/m²)	Moderate (10-50 g/m²)	High (≥50 g/m²)
AMP	Apollo	14	2	1	0.13	0.42	0.42
	Zeehan	23	14	14	0.04	0.04	0.04
KEF	West Tasmania Canyons	12	10	9	0.04	0.04	0.04
MNP	Point Addis	1	-	-	4.75	-	-
NP	Bunurong Marine Park	1	-	-	4.00	-	-
	Wilsons Promontory Marine Reserve	1	-	-	6.67	-	-
LGA Nearshore	Bass Coast	1	-	-	4.00	-	-
	Colac Otway	2	-	-	1.63	-	-
	Glennie Group	1	-	-	6.67	-	-
	King Island	7	-	-	1.79	-	-
Sub-LGA Nearshore	Apollo Bay	1	-	-	1.75	-	-
	Cape Otway West	1	-	-	1.63	-	-
	Cape Patton	1	-	-	1.96	-	-
	Venus Bay	1	-	-	4.00	-	-
State Waters	Tasmania State Waters	7	-	-	1.63	-	-
	Victoria State Waters	5	-	-	1.63	-	-

(*) Probabilities based on spills originating from any locations within the MSS operation area.

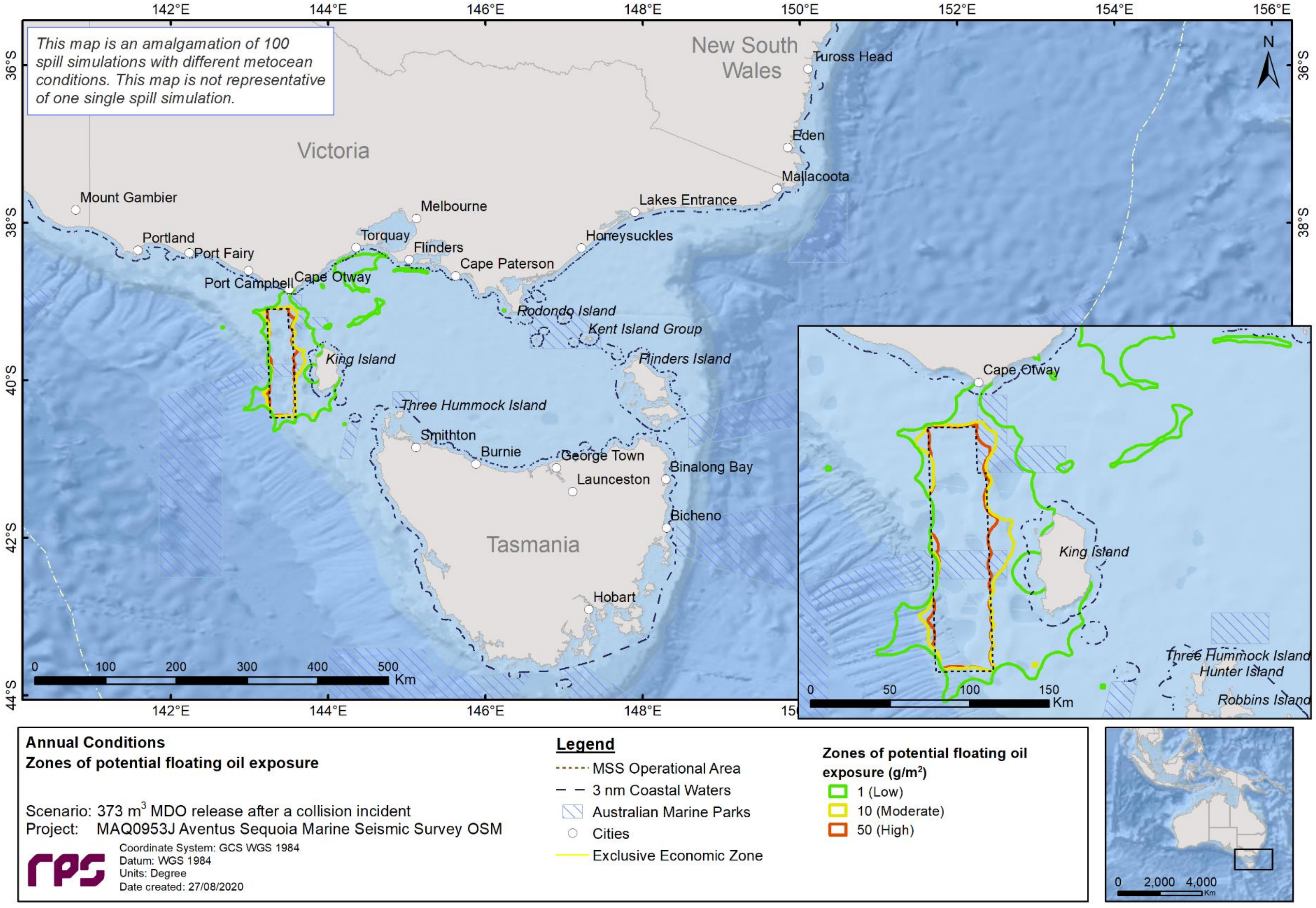


Figure 5.2 Predicted zones of potential floating oil exposure resulting from a 373 m3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

5.1.2.2 Shoreline contact

Table 5.2 presents a summary of the predicted shoreline contact. The probability of contact to any shoreline at, or above, the low threshold (10-100 g/m^2) from a spill originating within the Sequoia 3D MSS operational area was 16%. The minimum time before shoreline contact was approximately 1.67 days (40 hours) while the greatest volume of oil ashore was predicted as 27.6 m^3. Additionally, the greatest length of shoreline contacted by oil at, or above the low thresholds was 37.5 km.

Table 5.3 summarises the contact to individual shoreline receptors. The stochastic modelling demonstrated potential oil accumulation on the western and south-eastern coastline of King Island and isolated spots along the Port Campbell, Cape Otway, Wilson Promontory (West) coastline sectors. The quickest time before shoreline accumulation was predicted as 1.67 days (40 hours) at Cape Otway West. King Island (west coast) was predicted to have the longest length of shoreline contacted above the low threshold (18.5 km).

The annual maximum potential shoreline loading at low, moderate and high contact thresholds are depicted in Figure 5.3.

Table 5.2 Summary of oil contact to any shorelines. Results are based on a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories.

Shoreline Statistics	Annual
Probability of contact to any shoreline at, or above **10 g/m^2** (%)	16
Minimum time before shoreline contact at, or above **10 g/m^2** (days)	1.67
Maximum volume of oil ashore (m^3)	27.6
Average volume of oil ashore (m^3)	9.6
Maximum length of shoreline contact, at or above **10 g/m^2** (km)	37.5
Average length of shoreline contact, at or above **10 g/m^2** (km)	8.9
Maximum length of shoreline contact, at or above **100 g/m^2** (km)	8.4
Average length of shoreline contact, at or above **100 g/m^2** (km)	2.5
Maximum length of shoreline contact, at or above **1,000 g/m^2** (km)	-
Average length of shoreline contact, at or above **1,000 g/m^2** (km)	-

Table 5.3 **Summary of oil contact to individual shorelines. Results are based on a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.**

Shoreline receptor	Maximum probability of shoreline loading (%)			Minimum time before shoreline accumulation (days)			Load on shoreline (g/m^2)		Volume on shoreline (m^3)		Maximum length of shoreline contact (km)		
	Low	Mod.	High	Low	Mod.	High	Mean	Peak	Mean	Peak	Low	Mod.	High
Anser Island	1	-	-	6.50	-	-	n/a	97.4	n/a	1.2	1.5	-	-
Bass Coast	1	-	-	3.96	-	-	n/a	82.0	n/a	4.5	1.5	-	-
Circular Head	1	-	-	10.67	-	-	n/a	37.5	n/a	3.6	1.5	-	-
Colac Otway	3	3	-	1.67	2.00	-	n/a	869.3	n/a	27.6	16.0	8.4	-
Corangamite	1	1	-	7.13	10.25	-	n/a	112.3	n/a	2.8	3.5	0.5	-
Glennie Group	1	1	-	6.33	6.83	-	n/a	140.6	n/a	5.1	5.5	1.5	-
Kanowna Island	1	-	-	6.50	-	-	n/a	97.4	n/a	1.9	3.0	-	-
King Island	9	5	-	2.08	3.04	-	n/a	882.8	n/a	20.8	18.5	4.0	-
Skull Rock	1	-	-	6.13	-	-	n/a	72.8	n/a	1.1	2.0	-	-
South Gippsland	2	1	-	11.00	11.13	-	n/a	219.0	n/a	5.7	2.0	1.0	-
Surf Coast	1	1	-	8.96	9.83	-	n/a	179.0	n/a	4.1	0.5	0.5	-
Anglesea	1	1	-	8.96	9.83	-	n/a	179.0	n/a	2.6	0.5	0.5	-
Apollo Bay	1	1	-	1.75	2.08	-	n/a	344.7	n/a	12.8	8.5	4.5	-
Cape Liptrap (NW)	1	-	-	11.67	-	-	n/a	42.3	n/a	2.2	1.0	-	-
Cape Otway West	2	2	-	1.67	2.00	-	n/a	869.3	n/a	14.7	7.5	5.0	-
Cape Patton	1	1	-	1.92	2.21	-	n/a	266.2	n/a	3.7	2.0	1.5	-
Moonlight Head	1	1	-	7.58	10.25	-	n/a	112.3	n/a	2.8	3.5	0.5	-
Venus Bay	1	-	-	3.96	-	-	n/a	82.0	n/a	9.4	1.5	-	-
Wilsons Promontory (West)	1	1	-	11.00	11.13	-	n/a	219.0	n/a	4.4	2.0	1.0	-

(*) Probabilities based on spills originating from any locations within the MSS operation area.

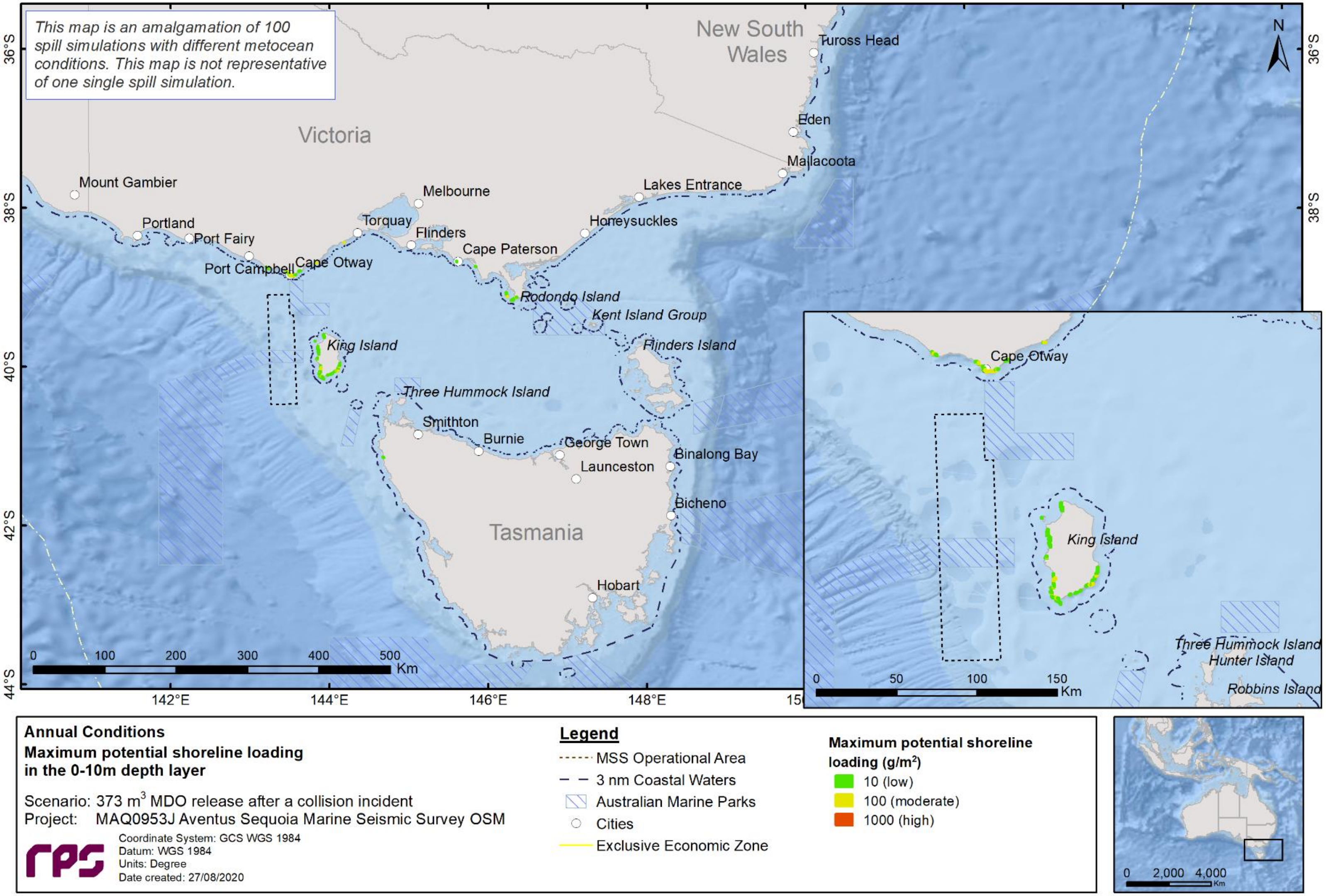


Figure 5.3 Predicted maximum shoreline loading resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

5.1.2.3 Entrained Hydrocarbons

The zones of potential entrained hydrocarbon exposure at the low (10-100 ppb) and high (≥ 100 ppb) thresholds for the 0-10 m and 10-20 m water depth layers are depicted in Figure 5.4 and Figure 5.5. The low threshold was predicted to occur up to a maximum distance of 742 km (east-northeast) from the centre of the Sequoia 3D MSS operational area. This distance decreased to 236 km (east) for the high exposure threshold.

Table 5.4 summarises the instantaneous entrained hydrocarbon exposure to individual receptors in the 0-10 m depth layer, at the low and high exposure thresholds.

In the surface layer (0-10m), entrained hydrocarbon exposure at or above the low threshold was predicted at a wide range of receptors, including five (5) AMPs and four (4) KEFs.

The highest instantaneous entrained hydrocarbon concentrations (>10,000 ppb) were calculated for the Zeehan AMP (13,381 ppb), with the corresponding minimum time before exposure being 0.04 days (1 hour).

Table 5.4 Probability of exposure to individual receptors from instantaneous entrained hydrocarbons in the 0-10 m depth layer. Results are based on a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

Receptors		Probability (%) of entrained hydrocarbon concentration contact		Minimum time to receptor waters (days) at		Maximum entrained hydrocarbon concentration (ppb)
		Low 10-100 ppb	High ≥ 100 ppb	Low 10-100 ppb	High ≥ 100 ppb	for a single simulation at any depth
AMP	Apollo	22	10	0.04	0.04	5,168
	Beagle	6	-	7.46	-	53
	Boags	7	-	6.17	-	58
	Franklin	8	1	2.71	3.00	242
	Zeehan	24	13	0.04	0.04	13,381
KEF	Bonney Coast Upwelling	1	-	25.58	-	11
	Canyons on the eastern continental slope	1	-	27.38	-	10
	Upwelling East of Eden	4	-	14.50	-	35
	West Tasmania Canyons	14	6	0.04	0.04	8,160
MNP	Bunurong	2	1	3.13	3.33	161
	Cape Howe	3	-	17.79	-	32
	Point Addis	7	1	2.63	2.75	115
	Point Hicks	1	-	19.63	-	18
	Port Phillip Heads	1	-	13.71	-	13
	Twelve Apostles	2	-	6.38	-	20
	Wilsons Promontory	8	-	5.46	-	53
MS	Barwon Bluff	1	-	24.83	-	16
	Marengo Reefs	5	-	1.71	-	42
	Mushroom Reef	1	-	7.17	-	21
	Point Danger	1	-	16.67	-	21
NP	Kent Group	2	-	16.29	-	15
	Bunurong Marine Park	3	-	3.00	-	90
	Wilsons Promontory Marine Park	3	-	5.79	-	29
	Wilsons Promontory Marine Reserve	5	-	5.46	-	56
RAMSAR	Lavinia	2	-	5.29	-	17
	Port Phillip Bay (Western Shoreline) and Bellarine Peninsula	1	-	24.79	-	16
	Western Port	1	-	7.63	-	22
LGA Nearshore	Albatross Island	4	-	11.29	-	22
	Anser Island	8	-	5.79	-	50
	Bass Coast	3	-	2.96	-	96
	Bega Valley	2	-	17.92	-	21

Receptors		Probability (%) of entrained hydrocarbon concentration contact		Minimum time to receptor waters (days) at		Maximum entrained hydrocarbon concentration (ppb)
		Low 10-100 ppb	High ≥ 100 ppb	Low 10-100 ppb	High ≥ 100 ppb	for a single simulation at any depth
	Black Pyramid	8	1	3.17	3.71	105
	Circular Head	3	-	5.58	-	46
	Clarke Island	1	-	23.58	-	10
	Colac Otway	9	1	1.08	1.17	708
	Corangamite	3	-	4.04	-	48
	Curtis Island	4	-	8.00	-	29
	East Gippsland	3	-	17.79	-	34
	French Island	1	-	8.67	-	12
	Gabo Island	3	-	17.71	-	35
	Glennie Group	6	-	5.29	-	59
	Greater Geelong	3	-	15.33	-	21
	Hogan Island Group	2	-	12.17	-	16
	Hunter Island	3	-	6.29	-	29
	Kanowna Island	7	-	5.71	-	49
	Kent Island Group	2	-	16.25	-	15
	King Island	16	3	1.33	1.42	466
	Moncoeur Islands	6	-	10.83	-	19
	Mornington Peninsula	4	-	4.63	-	42
	Norman Island	4	-	5.67	-	34
	Phillip Island	3	-	7.29	-	57
	Reid Rock	15	2	2.58	3.29	177
	Rodondo Island	7	-	9.50	-	26
	Seal Islands	2	-	11.25	-	15
	Shellback Island	2	-	6.13	-	18
	Skull Rock	7	-	5.67	-	45
	South Gippsland	6	-	4.17	-	68
	Surf Coast	7	1	2.13	2.25	104
	Three Hummock Island	5	-	9.33	-	23
	Waratah-Wynyard	1	-	16.29	-	10
	West Coast	2	-	11.75	-	25
Sub-LGA Nearshore	Anglesea	6	-	2.79	-	49
	Apollo Bay	9	1	1.17	1.21	618
	Bega Valley	2	-	17.92	-	21
	Cape Conran	1	-	20.21	-	11
	Cape Howe / Mallacoota	3	-	17.75	-	34
	Cape Liptrap (NW)	5	-	5.29	-	63
	Cape Otway West	9	1	1.08	1.17	708

Receptors		Probability (%) of entrained hydrocarbon concentration contact		Minimum time to receptor waters (days) at		Maximum entrained hydrocarbon concentration (ppb)
		Low 10-100 ppb	High ≥ 100 ppb	Low 10-100 ppb	High ≥ 100 ppb	for a single simulation at any depth
	Cape Patton	8	1	1.75	1.92	178
	Croajingolong (West)	1	-	20.71	-	11
	French Island / Crib Point	1	-	8.17	-	13
	Kilcunda	3	-	3.00	-	51
	Lorne	7	1	2.08	2.17	113
	Marlo	1	-	19.96	-	13
	Moonlight Head	3	-	4.08	-	48
	Mornington Peninsula (S)	4	-	5.88	-	42
	Mornington Peninsula (SW)	4	-	4.63	-	40
	Point Hicks	1	-	19.75	-	18
	Port Phillip (Queenscliff)	2	-	20.38	-	19
	Port Phillip (Sorrento Shore)	2	-	13.08	-	21
	Sydenham Inlet	1	-	25.08	-	14
	Torquay	5	-	2.79	-	34
	Venus Bay	3	-	2.96	-	96
	Waratah Bay	5	-	5.67	-	21
	Westernport	1	-	7.29	-	28
	Wilsons Promontory (East)	5	-	8.13	-	39
	Wilsons Promontory (West)	6	-	5.96	-	53
State Waters	New South Wales	3	-	18.29	-	18
	Tasmania State Waters	18	3	0.96	1.00	933
	Victoria State Waters	11	2	0.75	0.79	708

(*) Probabilities based on spills originating from any locations within the MSS operation area.

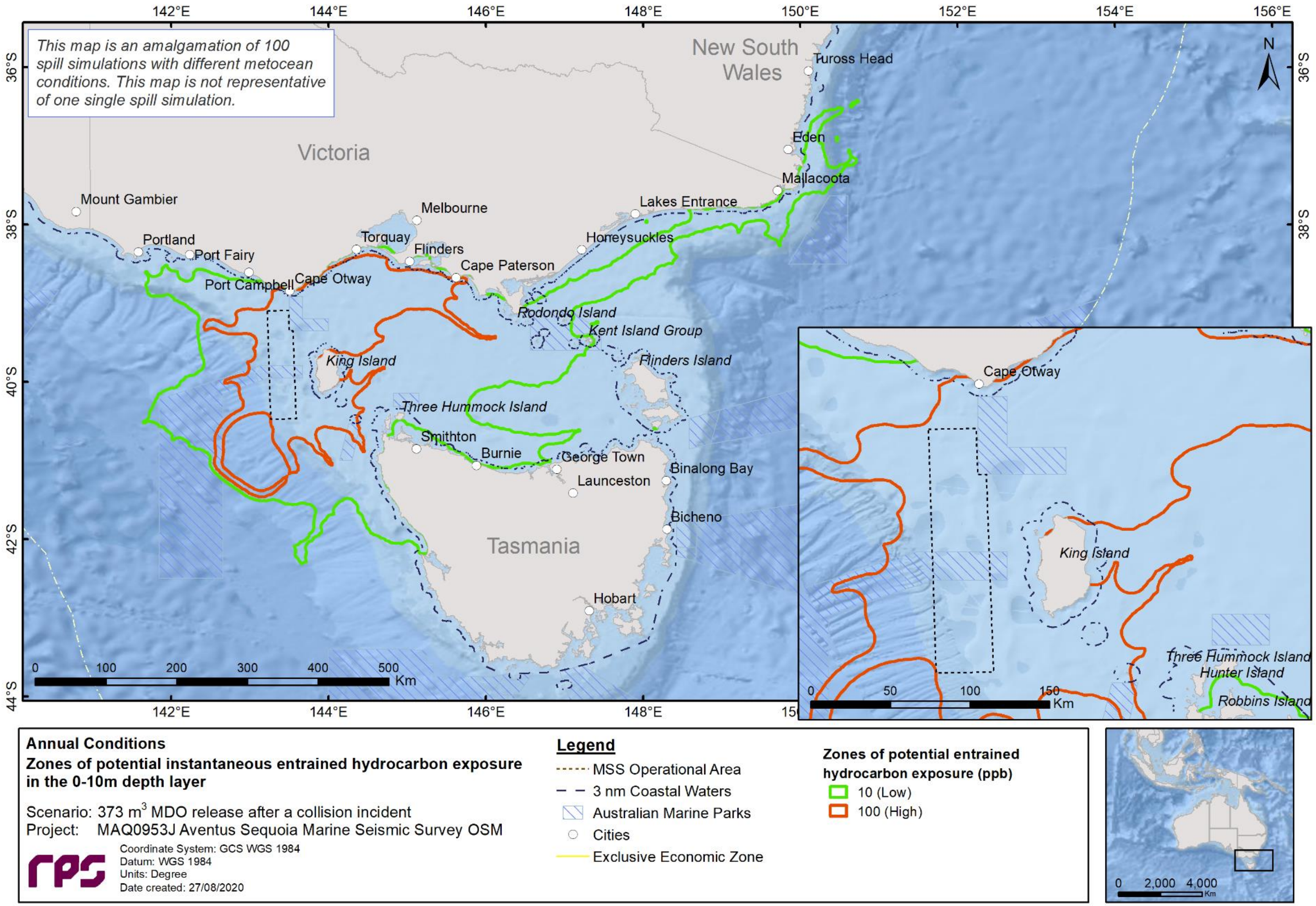


Figure 5.4 Predicted zones of potential entrained hydrocarbon exposure in the 0-10 m depth layer resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

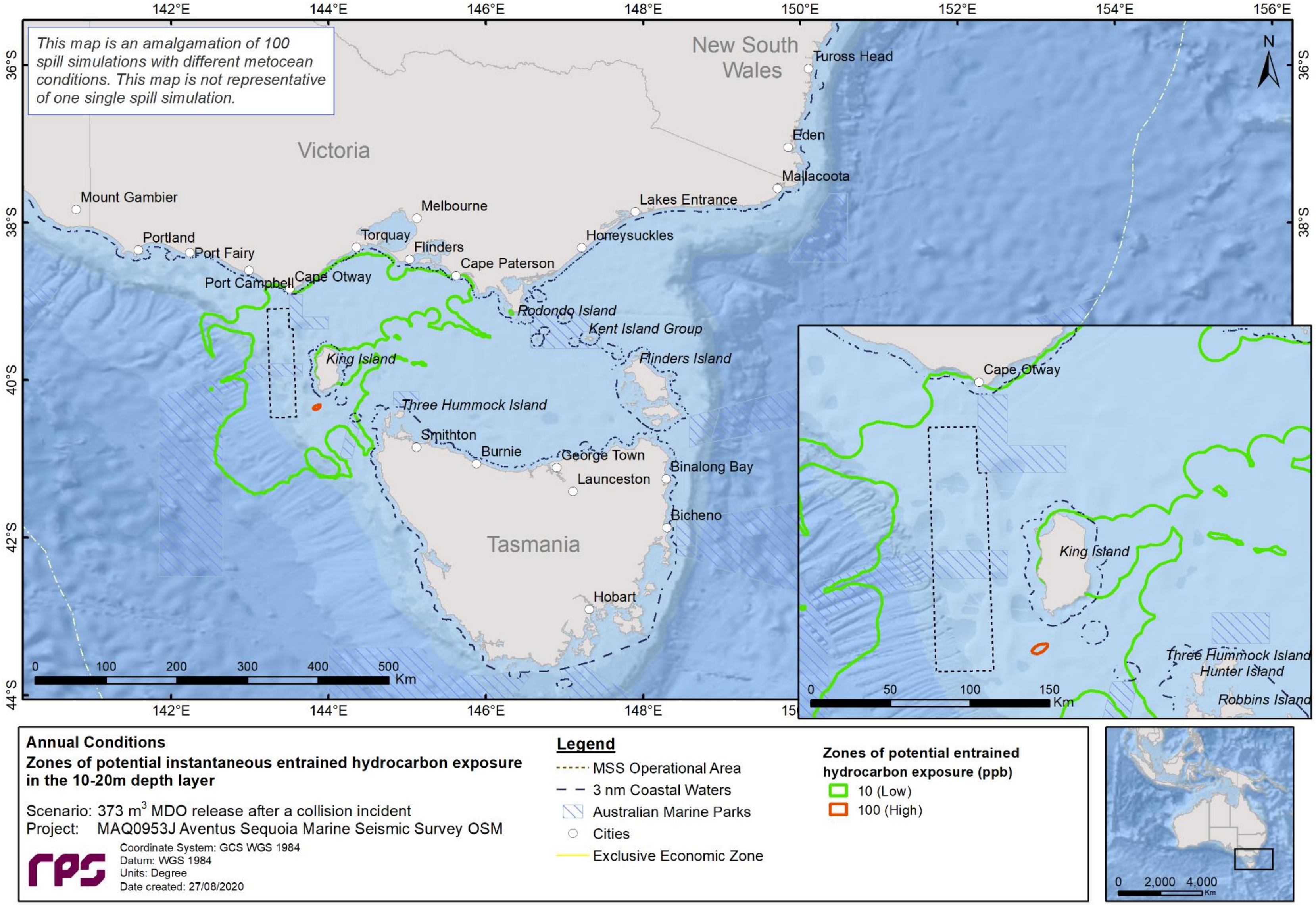


Figure 5.5 Predicted zones of potential entrained hydrocarbon exposure in the 10-20 m depth layer resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

5.1.2.4 Dissolved Hydrocarbons

The zones of potential dissolved hydrocarbon exposure in the 0-10 m, 10-20 m and 20-30 m water depth layers at the low (10-50 ppb), moderate (50-400 ppb) and high (≥ 400 ppb) thresholds are depicted in Figure 5.6 to Figure 5.8. The low exposure was predicted to extend up to a maximum distance of 251 km (east-northeast) from the centre of the Sequoia 3D MSS operational area. This distance was reduced to 211 km (east-northeast) at the moderate threshold and there was no exposure predicted at or above the high threshold.

Table 5.5 summarises the instantaneous dissolved aromatic hydrocarbon exposure to individual receptors in the 0-10 m depth layer, for each threshold.

In the surface layer (0-10m), dissolved hydrocarbon exposure at or above the low threshold was predicted for a range of receptors including three (3) AMPs and one (1) KEF. Additionally, low dissolved exposure was shown to extend to nearshore waters between Port Campbell and Cape Paterson (refer to Table 5.5).

No high exposure of dissolved hydrocarbons was predicted for this spill scenario.

Table 5.5 **Probability of exposure to individual receptors from instantaneous dissolved hydrocarbons in the 0-10 m depth layer. Results are based on a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.**

Receptors		(*) Probability (%) of dissolved aromatic concentrations at			Minimum time to receptor waters (days) at			Maximum dissolved aromatic hydrocarbon concentration (ppb)
		Low 10-50 ppb	Moderate 50-400 ppb	High ≥400 ppb	Low 10-50 ppb	Moderate 50-400 ppb	High ≥400 ppb	at any depth, for a single simulation at any depth
AMP	Apollo	5	1	-	0.13	0.46	-	84
	Franklin	1	-	-	3.38	-	-	24
	Zeehan	6	1	-	0.04	0.04	-	158
KEF	West Tasmania Canyons	4	1	-	0.04	0.13	-	120
MNP	Bunurong	1	-	-	6.42	-	-	14
	Point Addis	1	-	-	3.33	-	-	13
LGA Nearshore	Black Pyramid	1	-	-	4.21	-	-	14
	Circular Head	1	-	-	6.21	-	-	10
	Colac Otway	1	1	-	1.38	1.63	-	101
	Hunter Island	1	-	-	6.29	-	-	17
	King Island	4	1	-	1.79	4.29	-	83
	Phillip Island	1	-	-	8.08	-	-	10
	Reid Rock	1	-	-	4.13	-	-	16
Sub-LGA Nearshore	Apollo Bay	1	-	-	1.71	-	-	49
	Cape Otway West	1	1	-	1.38	1.63	-	101
State Waters	Tasmania State Waters	4	1	-	1.04	2.25	-	83
	Victoria State Waters	2	1	-	0.92	1.38	-	101

(*) Probabilities based on spills originating from any locations within the MSS operation area.

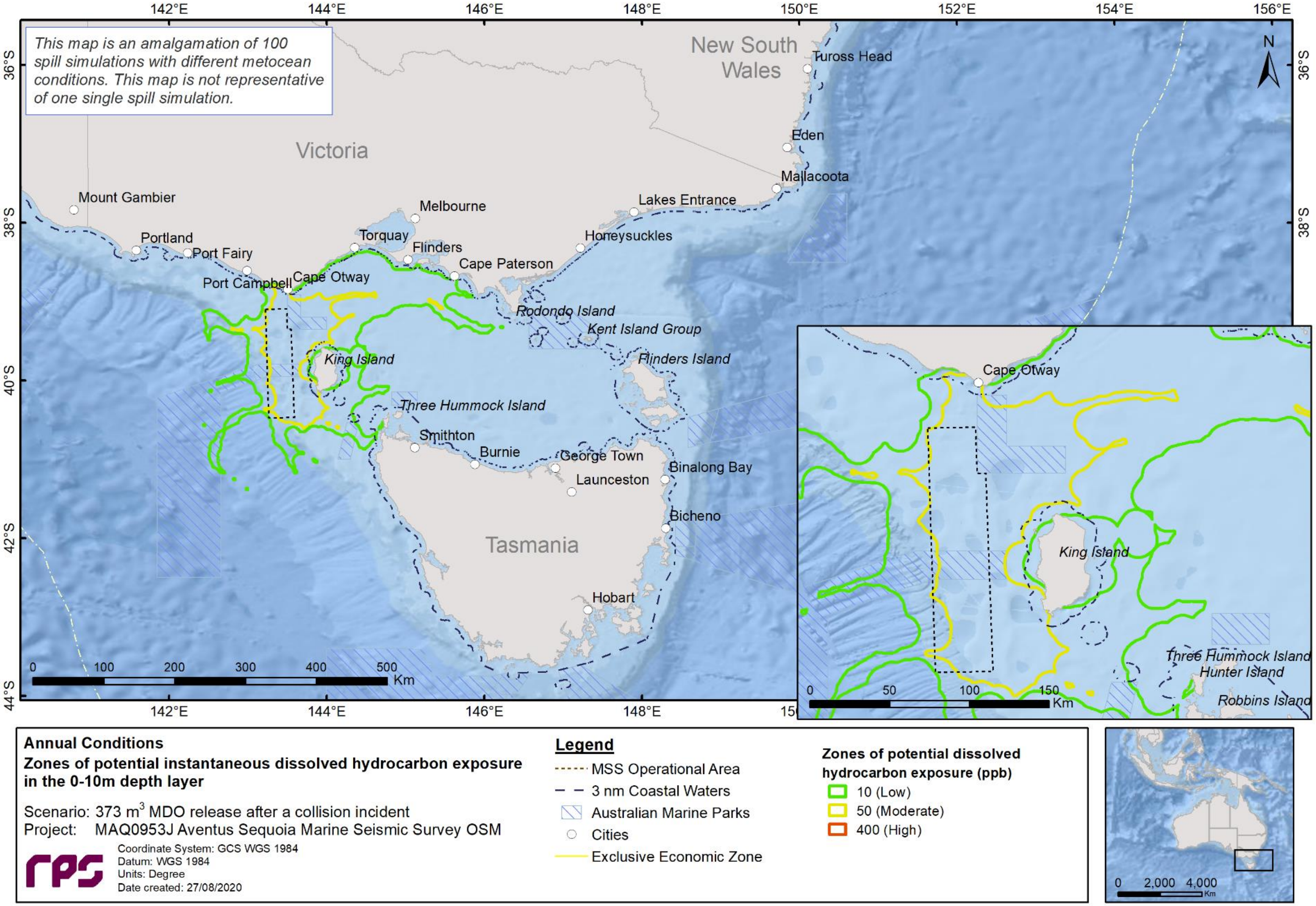


Figure 5.6 Predicted zones of potential dissolved hydrocarbon exposure in the 0-10 m depth layer resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

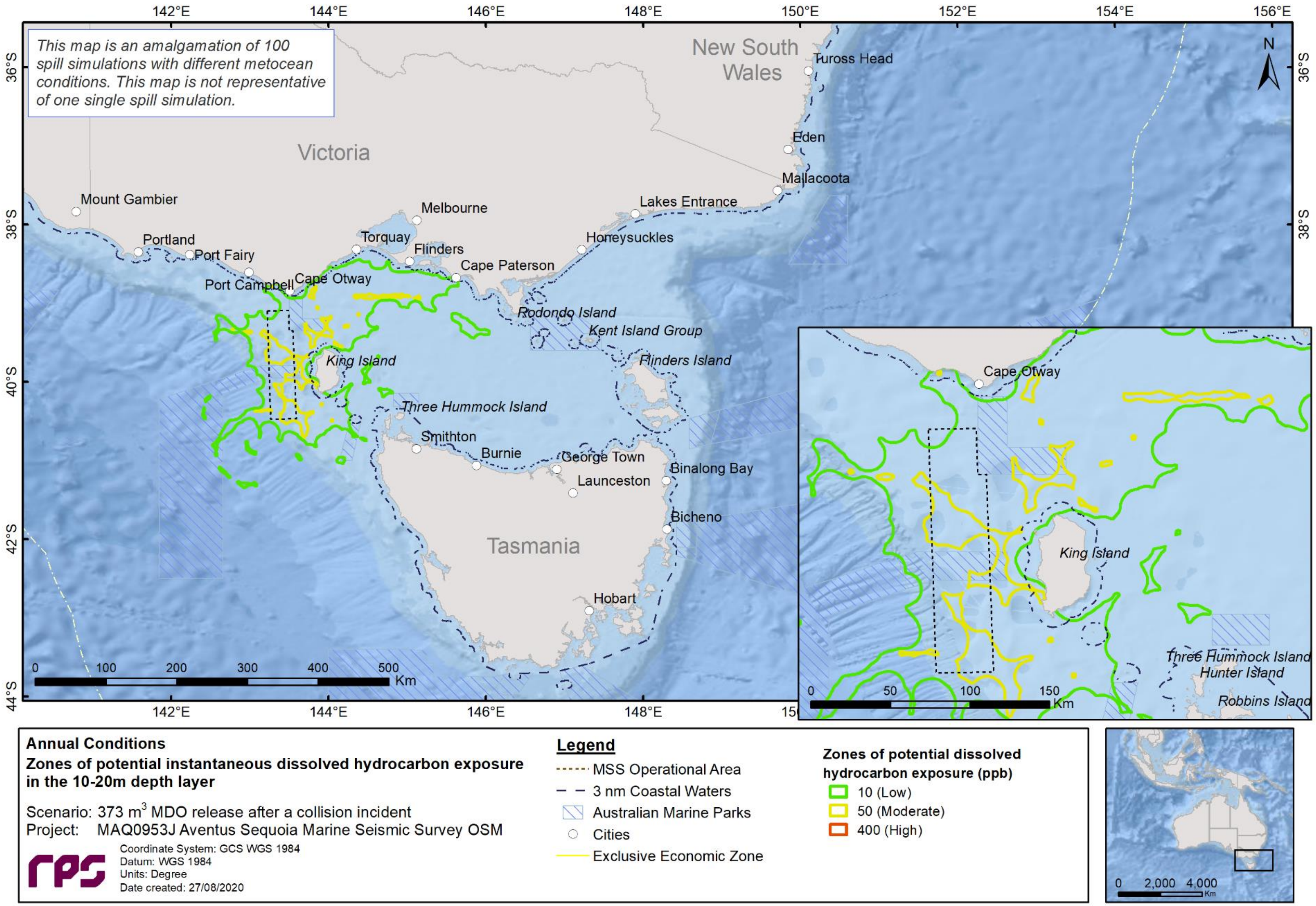


Figure 5.7 Predicted zones of potential dissolved hydrocarbon exposure in the 10-20 m depth layer resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

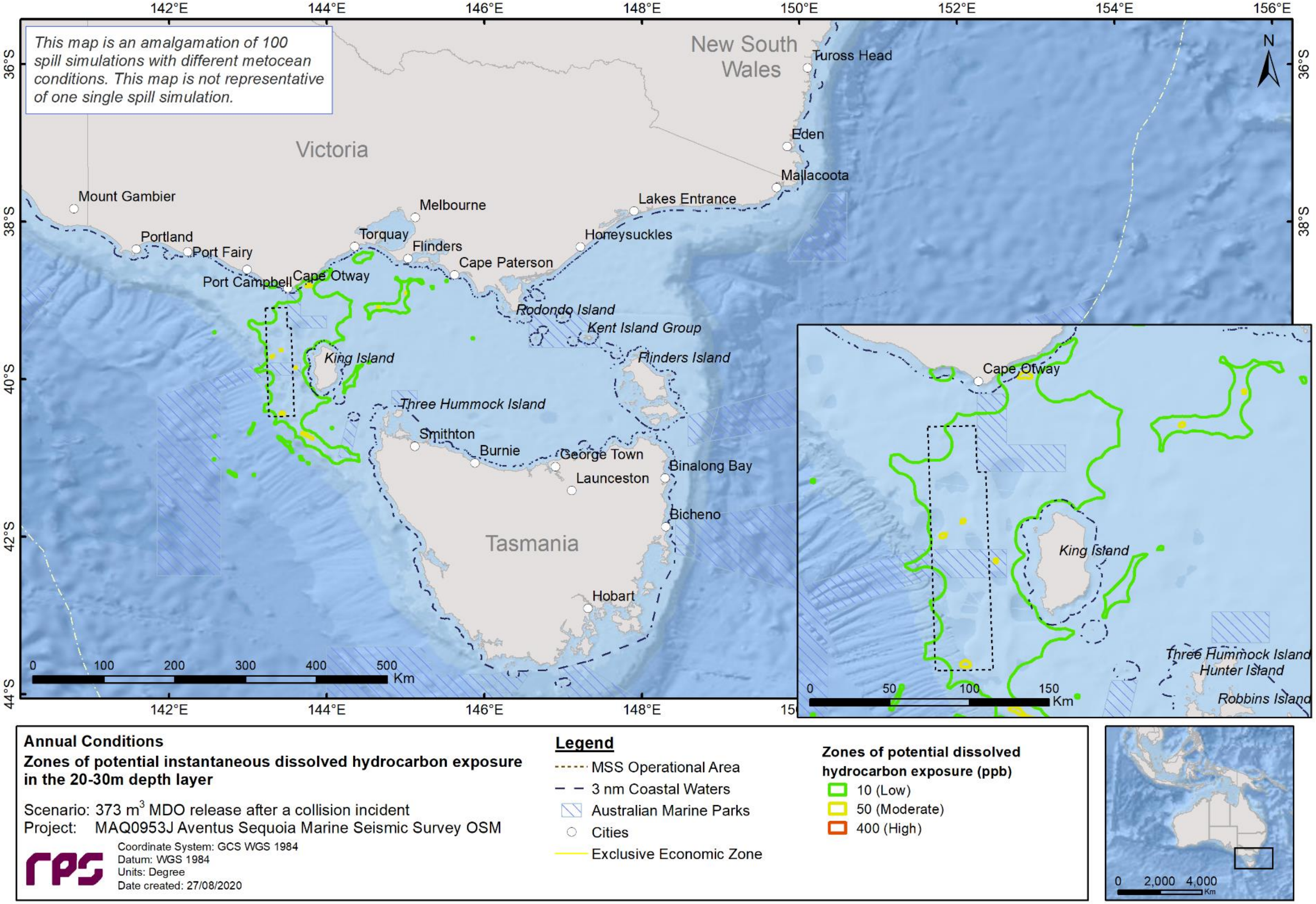


Figure 5.8 Predicted zones of potential dissolved hydrocarbon exposure in the 20-30 m depth layer resulting from a 373 m^3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area.

5.1.3 Deterministic Analysis

The following four metrics were used to identify single spill trajectories from the 100 simulations that make up the stochastic results:

i. largest volume of oil ashore;

ii. longest length of shoreline contact above 100 g/m^2;

iii. minimum time before shoreline contact above 10 g/m^2; and

iv. largest swept area of oil on the sea surface above 1 g/m^2 (visible sea surface oil).

5.1.3.1 Largest Area of Floating Oil

The deterministic spill trajectory that recorded the largest area of low (1-10 g/m^2) floating oil exposure commenced at 08:00 am 25th June 2009.

Figure 5.9 presents the potential zone of low exposure from floating oil, over the entire simulation (swept area). The low floating oil exposure was predicted to extend a maximum of ~48 km from the release site towards the northeast. Moderate (10-50 g/m^2) and high (≥50 g/m^2) floating oil exposure extended a maximum of ~26 km north and 3.3 km northeast from the release location, respectively.

Figure 5.10 displays a time series of the low (or visible) and high (or actionable) floating oil exposure over the 28-day simulation. The maximum area of coverage of visible floating oil was ~32 km^2 and 3.1 km^2 for actionable floating oil. No shoreline contact was predicted from this simulation.

Figure 5.11 presents the fates and weathering graph for the corresponding single spill trajectory. As MDO contains a high quantity of volatile hydrocarbons, a significant portion was lost to the atmosphere through evaporation. At the completion of the 28-day simulation period, 45% (or 168 m^3) was predicted to have evaporated, while 23% (or 85.0 m^3) was predicted to remain in the water column. The decayed proportion of oil at the end of the model period was 32% (or ~120 m^3). No oil was predicted to remain on the sea surface at the completion of the 28-day modelling period.

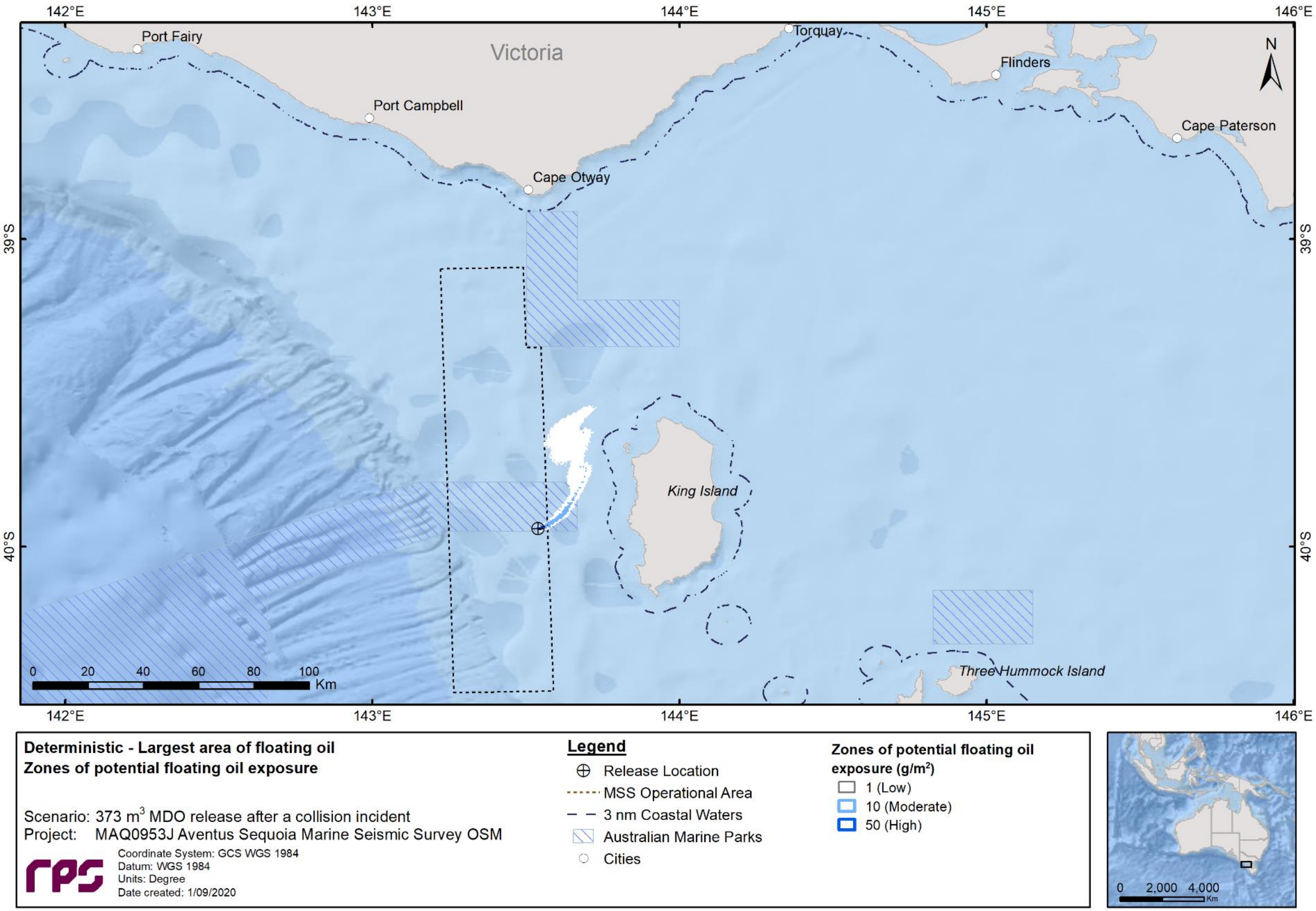


Figure 5.9 Predicted zones of potential floating oil exposure over the entire simulation for the identified deterministic trajectory. Results are based on a 373 m^3 surface release of MDO over 6 hours tracked for 28 days, starting 08:00 am 25th June 2009.

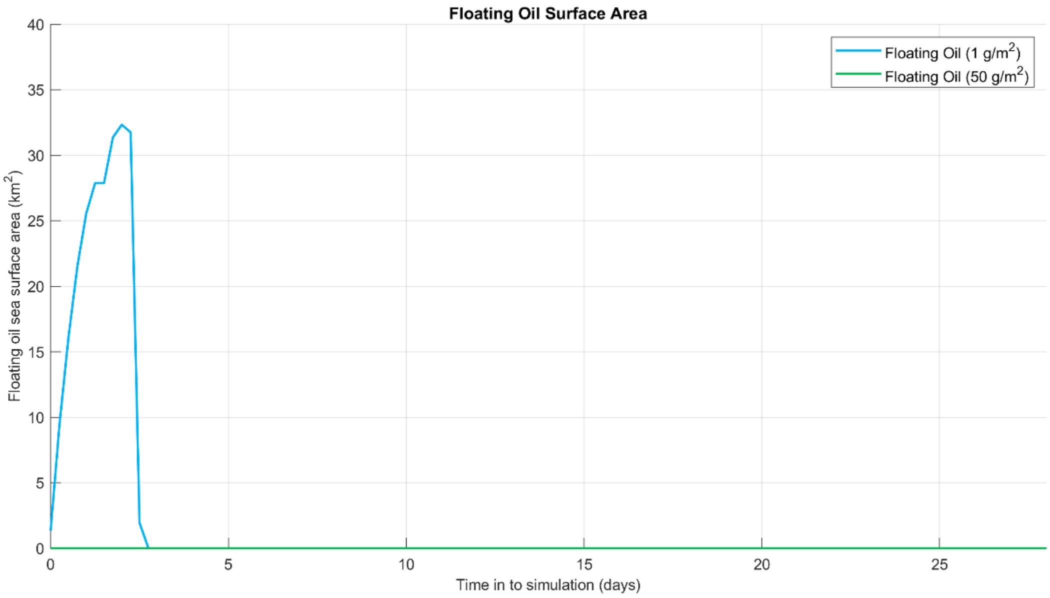


Figure 5.10 Time series of area of floating oil above the low (1 g/m^2) and high (50 g/m^2) thresholds. Results are based on a 373 m^3 surface release of MDO over 6 hours, tracked for 28 days, starting 08:00 am 25th June 2009.

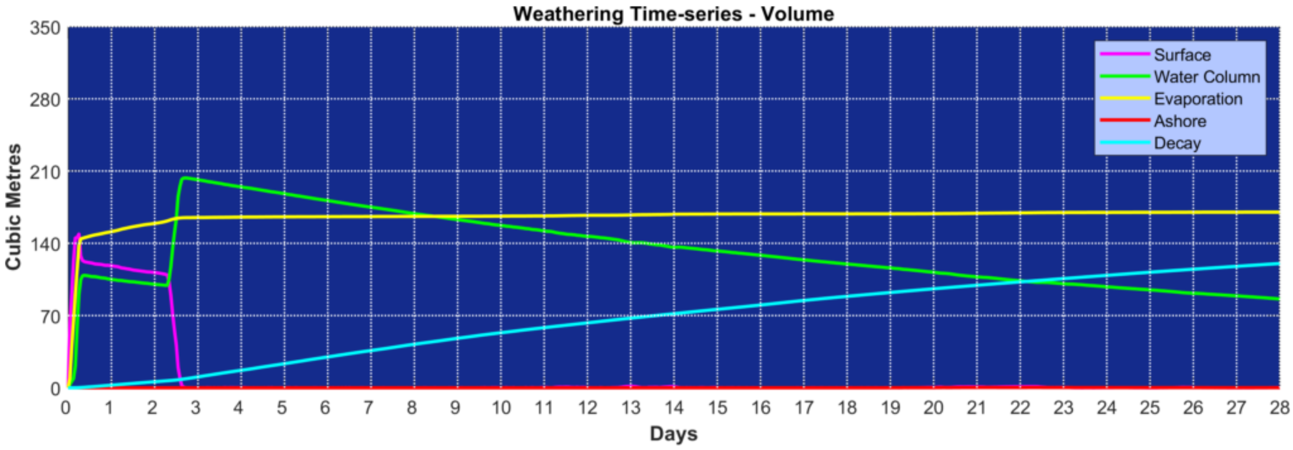


Figure 5.11 Predicted weathering and fates graph for the single spill trajectory. Results are based on a 373 m^3 surface release of MDO over 6 hours, tracked for 28 days, starting 08:00 am 25th June 2009.

5.1.3.2 Minimum time before shoreline contact above 10 g/m^2, Largest Volume of Oil Ashore and Longest Length of Shoreline Contact above 100 g/m^2

The deterministic spill trajectory commencing at 02:00 am 25th April 2015 had met all three criteria's:

- minimum time before shoreline contact above the low threshold (10 g/m^2),
- largest volume of oil ashore; and
- longest length of shoreline contacted above the moderate threshold (100 g/m^2).

The simulation had reached the shoreline near Cape Otway 40 hours (or 1.67 days) following the start of the spill. The total of 27.6 m^3 had accumulated on the nearby shorelines. The length of shoreline contacted by oil above the moderate threshold was 8.4 km.

Figure 5.12 presents the potential zones of floating oil exposure (swept area) and shoreline loading over the entire simulation. Floating oil exposure at the low threshold was predicted up to a maximum distance of 28 km (north-northeast) from the release site in nearshore waters off Cape Otway whereas the moderate floating oil exposure zone was only predicted in the immediate vicinity of the release location (up to 2 km). Note, the oil had been entrained and transported long distances in the water column prior to resurfacing as the winds eased during the simulation. Hence, the floating oil exposure zone was predicted to be discontinuous.

Figure 5.13 displays a time series of surface area of the low (or visible) and high (or actionable) floating oil exposure and moderate shoreline oil accumulation (≥100 g/m^2) over the 28-day simulation. The maximum area of coverage of visible floating oil calculated was 1.4 km^2 and 0.4 km^2 at the actionable threshold. The maximum length of actionable shoreline oil accumulation was 8.4 km, occurring approximately 5.5 days after the simulation began.

Figure 5.14 is a time series of the mass on shore at the low, moderate and high thresholds.

Figure 5.15 presents the fates and weathering graph for the corresponding single spill trajectory. At the completion of the 28-day simulation period, 42% (or 155 m^3) was predicted to have evaporated, while 19% (or 71 m^3) was predicted to remain in the water column. The decayed proportion of oil at the end of the model period was 34% (or 127 m^3) and 5% (or 20 m^3) of the oil was predicted to remain ashore.

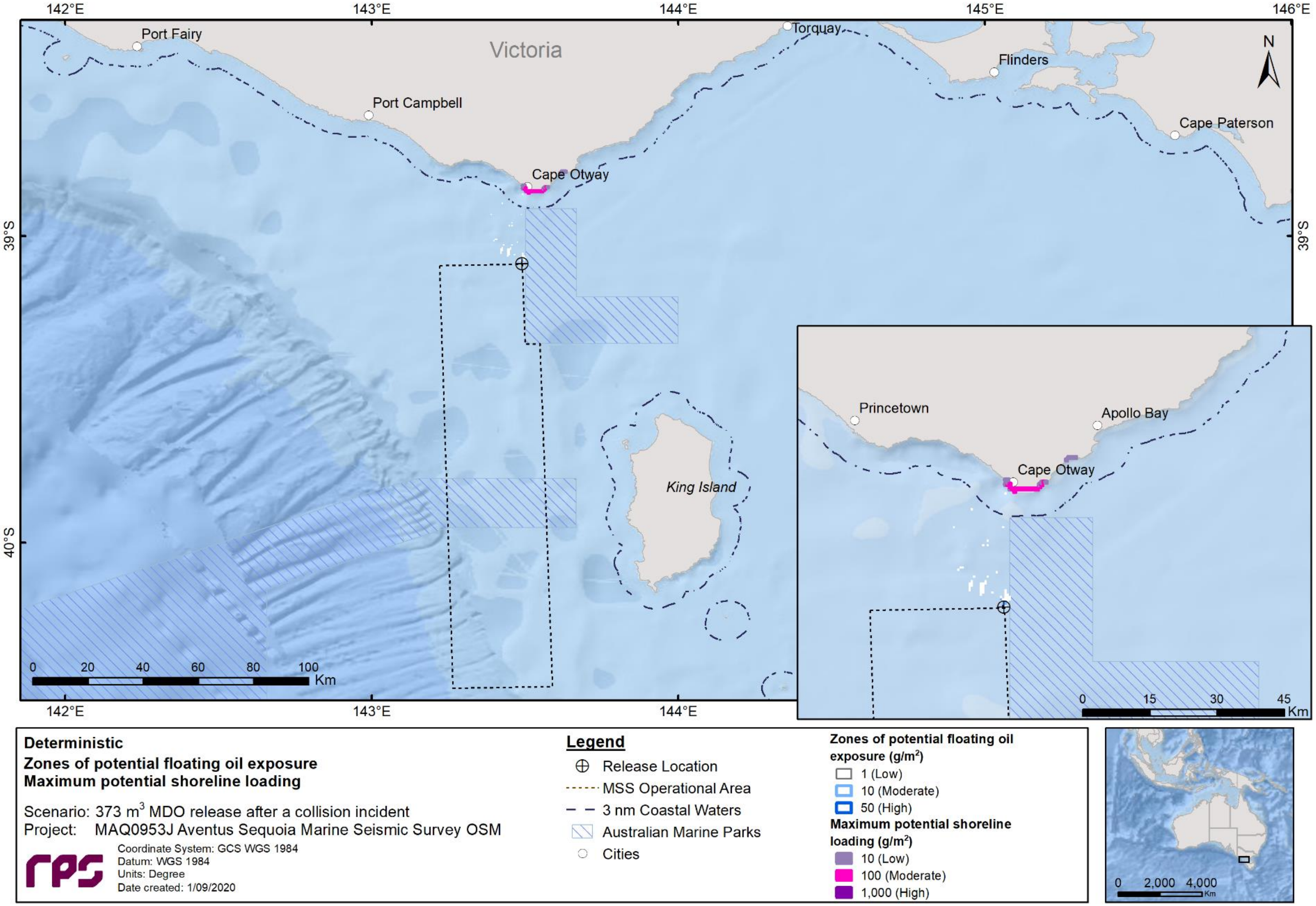


Figure 5.12 Predicted zones of potential floating oil exposure over the entire simulation for the identified deterministic trajectory. Results are based on a 373 m^3 surface release of MDO over 6 hours, tracked for 28 days, starting 02:00 am 25th April 2015.

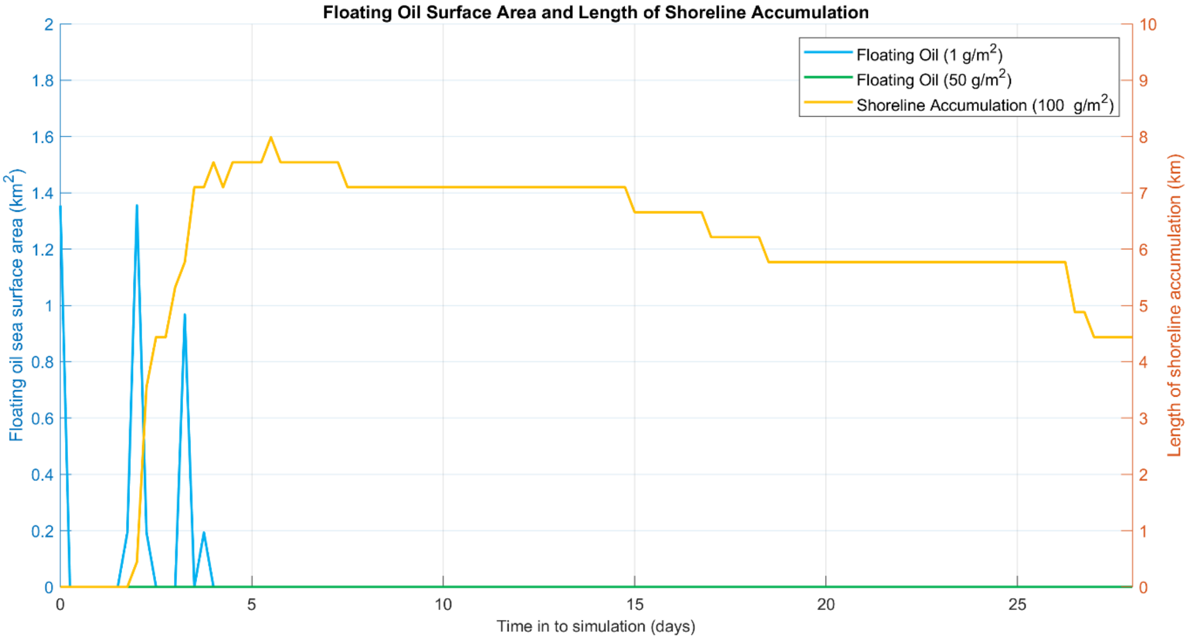


Figure 5.13 Time series of the area of visible (≥1 g/m²) and actionable floating oil (≥50 g/m²) on the sea surface and length of actionable shoreline oil (≥100 g/m²). Results are based on a 373 m³ surface release of MDO over 6 hours, tracked for 28 days, starting 02:00 am 25th April 2015.

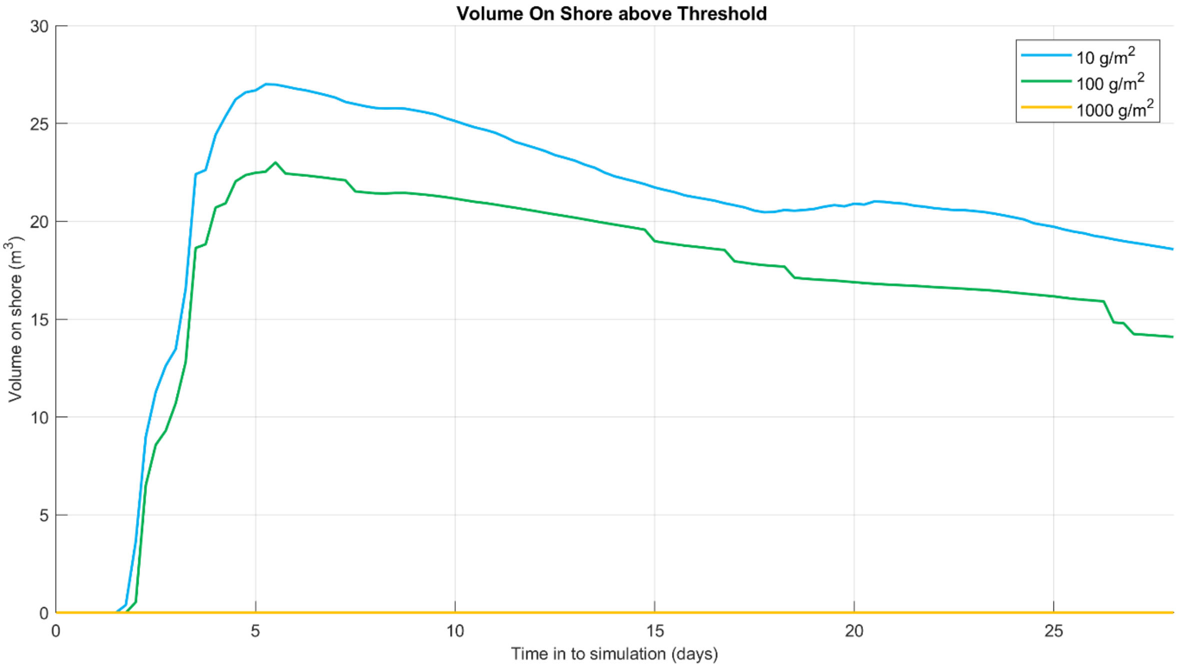


Figure 5.14 Time series of volume on shore at the low (10-100 g/m²), moderate (100-1,000 g/m²) and high (≥ 1,000 g/m²) thresholds. Results are based on a 373 m³ surface release of MDO over 6 hours, tracked for 28 days, starting 02:00 am 25th April 2015.

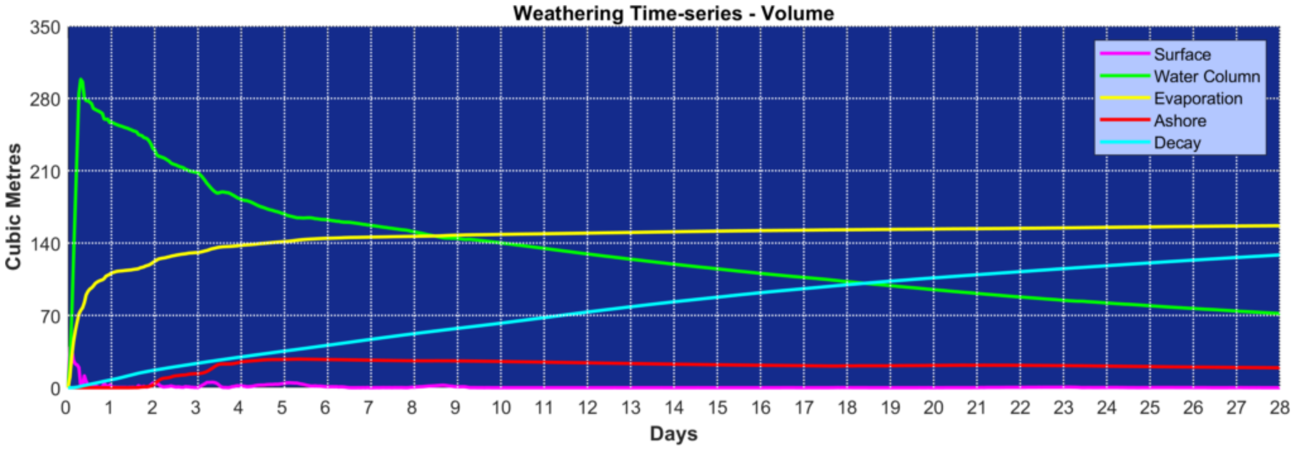


Figure 5.15 Predicted weathering and fates graph for the single spill trajectory. Results are based on a 373 m^3 surface release of MDO over 6 hours, tracked for 28 days, starting 02:00 am 25th April 2015.

6 REFERENCES

American Society for Testing and Materials (ASTM) 2013, ‘F2067-13 Standard Practice for Development and Use of Oil-Spill Trajectory Models’, ASTM International, West Conshohocken (PA).

Australian Maritime Safety Authority (AMSA) National Plan for Maritime Environmental Emergencies – 2020 edition Australian Maritime Safety Authority (AMSA) 2015, ‘Australian Maritime Safety Authority Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities Australian Maritime Safety Authority’, viewed 13 October 2020, https://www.amsa.gov.au/sites/default/files/2015-04-np-gui012-contingency-planning.pdf

Australian Maritime Safety Authority (AMSA) 2015, ‘Response, Assessment and Termination of Cleaning for Oil Contaminated Foreshores, NP-GUI-025’, viewed on 13 October 2020, https://www.amsa.gov.au/sites/default/files/2015-11-mp-gui025-response-assessment-cleaning-foreshores_0.pdf

Andersen, OB. 1995. ‘Global ocean tides from ERS 1 and TOPEX/POSEIDON altimetry’, *Journal of Geophysical Research: Oceans*, vol. 100, no. C12, pp. 25249–25259.

Anderson JW, Neff JM, Cox BA, Tatem HE & Hightower GM 1974, ‘Characteristics of dispersions and water-soluble extracts of crude and refined oils and their toxicity to estuarine crustaceans and fish’, *Marine Biology*, vol. 27, no. 1, pp. 75–88.

Anderson JW, Riley R, Kiesser S & Gurtisen J 1987, ‘Toxicity of dispersed and undispersed Prudhoe Bay crude oil fractions to shrimp and fish’, Proceedings of the 1987 International Oil Spill Conference, American Petroleum Institute, pp. 235–240.

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, ‘Australian and New Zealand Guidelines for Fresh and Marine Water, Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Baines, PG & Fandry, CB 1983, ‘Annual Cycle of the Density Field in Bass Strait’, *Australian Journal of Marine and Freshwater Research* vol. 34, no. 1, pp 143–153.

Becker, JJ, Sandwell, DT, Smith, WHF, Braud, J, Binder, B, Depner, J, Fabre, D, Factor, J, Ingalls, S, Kim, S-H, Ladner, R, Marks, K, Nelson, S, Pharaoh, A, Trimmer, R, Von Rosenberg, J, Wallace, G & Weatherall, P 2009, ‘Global bathymetry and evaluation data at 30 arc seconds resolution: SRTM30_PLUS’, *Marine Geodesy*, vol. 32, no. 4, pp. 355–371.

Blum DJ & Speece RE 1990, ’Determining chemical toxicity to aquatic species’, *Environmental Science & Technology*, vol. 24, no. 3, pp. 284–293.

Bobra, MA 1991, ‘Water-in-oil emulsification: A physicochemical study’, in Proceedings of the 1991 International Oil Spill Conference, San Diego, CA, USA, pp. 483-488.

Bonn Agreement 2009, ‘Bonn Agreement aerial operations handbook, 2009 - Publication of the Bonn Agreement’, London, viewed 15 April 2020, https://www.bonnagreement.org/site/assets/files/3947/ba-aoh_revision_2_april_2012.pdf

Carls MG, Holland L, Larsen M, Collier TK, Scholz NL & Incardona JP 2008, ‘Fish embryos are damaged by dissolved PAHs, not oil particles’, *Aquatic Toxicology*, vol. 88, no. 2, pp.121–127.

Chassignet, EP, Hurlburt, HE, Smedstad, OM, Halliwell, GR, Hogan, PJ, Wallcraft, AJ, Baraille, R & Bleck, R 2007, ‘The HYCOM (hybrid coordinate ocean model) data assimilative system’, *Journal of Marine Systems*, vol. 65, no. 1, pp. 60–83.

Chassignet, E., Hurlburt, H., Metzger, E., Smedstad, O., Cummings, J and Halliwell, G. 2009. ‘U.S. GODAE: Global Ocean Prediction with the HYbrid Coordinate Ocean Model (HYCOM)’. *Oceanography*, vol. 22, no. 2, pp. 64–75.

Daling, PS & Brandvik, PJ 1991, Characterization and prediction of the weathering properties of oils at sea – a manual for the oils investigated in the DIWO project, IKU-R--02.0786.00/16/91, SINTEF, Trondheim, Norway, 140pp.

Daling, PS, Aamo, OM, Lewis, A & Strøm-Kristiansen, T 1997, ‘SINTEF/IKU oil-weathering model: Predicting oils’ properties at sea’, in Proceedings of the 1997 International Oil Spill Conference, Fort Lauderdale, FL, USA, pp. 297-307.

Davies, AM 1977a, ‘The numerical solutions of the three-dimensional hydrodynamic equations using a B-spline representation of the vertical current profile’, in JC Nihoul (Ed), Bottom Turbulence: Proceedings of the 8th Liège Colloquium on Ocean Hydrodynamics, Elsevier Scientific, Amsterdam, pp. 1–25.

Davies, AM 1977b, ‘Three-dimensional model with depth-varying eddy viscosity’, in JC Nihoul (Ed), Bottom Turbulence: Proceedings of the 8th Liège Colloquium on Ocean Hydrodynamics, Elsevier Scientific, Amsterdam, pp. 27–48.

Delvigne, GAL & Sweeney, CE 1988, ‘Natural dispersion of oil’, *Oil and Chemical Pollution*, vol. 4, no. 4, pp. 281-310.

Delvigne, GAL 1991, ‘On scale modeling of oil droplet formation from spilled oil’, in Proceedings of the 1991 International Oil Spill Conference, San Diego, CA, USA, pp. 501-506.

Fingas, M 1995, ‘Water-in-oil emulsion formation: A review of physics and mathematical modelling’, *Spill Science & Technology Bulletin*, vol. 2, no. 1, pp. 55-59.

Fingas, M 1997, ‘The evaporation of oil spills: Prediction of equations using distillation data’, in Proceedings of the 20th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Vancouver, BC, Canada, pp. 1-20.

French, D, Reed, M, Jayko, K, Feng, S, Rines, H, Pavignano, S, Isaji, T, Puckett, S, Keller, A, French III, FW, Gifford, D, McCue, J, Brown, G, MacDonald, E, Quirk, J, Natzke, S, Bishop, R, Welsh, M, Phillips, M &Ingram, BS 1996, ‘The CERCLA Type A natural resource damage assessment model for coastal and marine environments (NRDAM/CME), Technical Documentation, Volume I - Model Description, Final

Report', Office of Environmental Policy and Compliance, U.S. Department of the Interior, Washington DC.

French, DP & Rines, HM 1997, 'Validation and use of spill impact modelling for impact assessment', in Proceedings of the 1997 International Oil Spill Conference, Fort Lauderdale, FL, USA, pp. 829-834.

French, DP 1998, 'Modelling the impacts of the North Cape oil spill', in Proceedings of the 21st Arctic and Marine Oilspill Program (AMOP) Technical Seminar, Edmonton, AB, Canada, pp. 387-430.

French, D, Schuttenberg, H & Isaji, T 1999, 'Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida Power and Light', Proceedings of the 22nd Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Alberta, pp. 243–270.

French-McCay, DP 2002, 'Development and application of an oil toxicity and exposure model, OilToxEx', *Environmental Toxicology and Chemistry*, vol. 21, no. 10, pp. 2080-2094.

French-McCay, DP 2003, 'Development and application of damage assessment modelling: example assessment for the North Cape oil spill', *Marine Pollution Bulletin*, vol. 47, no. 9, pp. 9–12.

French-McCay, DP 2004, 'Spill impact modelling: development and validation', *Environmental Toxicology and Chemistry*, vol. 23, no.10, pp. 2441–2456.

French-McCay, DP 2009, 'State-of-the-art and research needs for oil spill impact assessment modelling', Proceedings of the 32nd Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Ottawa, pp. 601–653.

French-McCay, D, Rowe, JJ, Whittier, N, Sankaranarayanan, S, & Etkin, DS 2004, 'Estimate of potential impacts and natural resource damages of oil', *Journal of Hazardous Materials*, vol. 107, no. 1, pp. 11–25.

French-McCay, D, Whittier, N, Dalton, C, Rowe, J, Sankaranarayanan, S & Aurand, D 2005a, 'Modeling the fates of hypothetical oil spills in Delaware, Florida, Texas, California, and Alaska waters, varying response options including use of dispersants', Proceedings of the International Oil Spill Conference 2005, American Petroleum Institute, Washington DC, paper 399.

French-McCay, D, Whittier, N, Rowe, J, Sankaranarayanan, S, Kim, H-S & Aurand, D 2005b, 'Use of probabilistic trajectory and impact modeling to assess consequences of oil spills with various response strategies,' Proceedings of the 28th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Ottawa, pp. 253–271.

French-McCay, D, Reich, D, Rowe, J, Schroeder, M & Graham, E 2011, 'Oil spill modeling input to the offshore environmental cost model (OECM) for US-BOEMRE's spill risk and costs evaluations', Proceedings of the 34th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Ottawa.

French-McCay, D, Reich, D, Michel, J, Etkin, DS, Symons, L, Helton, D, & Wagner J 2012, 'Oil spill consequence analysis of potentially-polluting shipwrecks', Proceedings of the 35th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar, Environment Canada, Ottawa.

Gordon, R 1982, ‘Wind driven circulation in Narragansett Bay’ PhD thesis, Department of Ocean Engineering, University of Rhode Island.

Grant, DL, Clarke, PJ & Allaway, WG 1993, ‘The response of grey mangrove (*Avicennia marina* (Forsk.) Vierh) seedlings to spills of crude oil,’ *The Journal of Experimental Marine Biological Ecology*, vol. 171, no. 2, pp. 273–295.

Gundlach, ER & Boehm, PD 1981, Determine fates of several oil spills in coastal and offshore waters and calculate a mass balance denoting major pathways for dispersion of the spilled oil, RPI/R/81/12/31-30, National Oceanic and Atmospheric Administration, Seattle, WA, USA.

Isaji, T & Spaulding, M 1984, ‘A model of the tidally induced residual circulation in the Gulf of Maine and Georges Bank’, *Journal of Physical Oceanography*, vol. 14, no. 6, pp. 1119–1126.

Isaji, T & Spaulding, ML 1986, ‘A numerical model of the M2 and K1 tide in the northwestern Gulf of Alaska’, *Journal of Physical Oceanography*, vol. 17, no. 5, pp. 698-704.

Isaji, T, Howlett, E, Dalton C, & Anderson, E 2001, ‘Stepwise-continuous-variable-rectangular grid hydrodynamics model’, Proceedings of the 24th Arctic and Marine Oil spill Program (AMOP) Technical Seminar (including 18th TSOCS and 3rd PHYTO), Environment Canada, Edmonton, pp. 597–610.

Jones, ISF 1980, ‘Tidal and wind driven currents in Bass Strait’, *Australian Journal of Marine and Freshwater Research* 31, pp 109–117.

King, B.A. and McAllister, F.A., 1998. Modelling the dispersion of produced water discharges. *The APPEA Journal*, *38*(1), pp.681-691.

Koops, W, Jak, RG & van der Veen, DPC 2004, ‘Use of dispersants in oil spill response to minimise environmental damage to birds and aquatic organisms’, Proceedings of the Interspill 2004: Conference and Exhibition on Oil Spill Technology, Trondheim, presentation 429.

Kostianoy, A.G., Ginzburg, A.I., Lebedev, S.A., Frankignoulle, M. and Delille, B. 2003. ‘Fronts and mesoscale variability in the southern Indian Ocean as inferred from the TOPEX/POSEIDON and ERS-2 Altimetry data’. *Oceanology*, vol. 43, no. 5, pp. 632–642.

Levitus, S, Antonov, JI, Baranova, OK, Boyer, TP, Coleman, CL, Garcia, HE, Grodsky, AI, Johnson, DR, Locarnini, RA, Mishonov, AV, Reagan, JR, Sazama, CL, Seidov, D, Smolyar, I, Yarosh, ES & Zweng, MM 2013, ‘The World Ocean Database’, *Data Science Journal*, vol.12, no. 0, pp. WDS229–WDS234.

Lin, Q & Mendelssohn, IA 1996, ‘A comparative investigation of the effects of south Louisiana crude oil on the vegetation of fresh, brackish and Salt Marshes’, *Marine Pollution Bulletin*, vol. 32, no. 2, pp. 202–209.

Locarnini, R.A., Mishonov A.V., Antonov, J.I., Boyer, T.P., Garcia, H.E., Baranova, O.K., Zweng, M.M., Paver, C.R., Reagan, J.R., Johnson, D.R., Hamilton, M., Seidov, D. 2013. World Ocean Atlas 2013, Volume 1: Temperature, (Eds.) Levitus, &. Mishonov, A, NOAA Atlas NESDIS 73, 40 pp

Ludicone, D., Santoleri, R., Marullo, S. and Gerosa, P. 1998. 'Sea level variability and surface eddy statistics in the Mediterranean Sea from TOPEX/POSEIDON data. *Journal of Geophysical Research*, vol. 103, no. C2, pp. 2995–3011.

Malins DC & Hodgins HO 1981, 'Petroleum and marine fishes: a review of uptake, disposition, and effects', *Environmental Science & Technology*, vol. 15, no. 11, pp.1272–1280.

Mackay, D. and Southwood, J.M., 1992. Modelling the fate of organochlorine chemicals in pulp mill effluents. *Water Quality Research Journal*, vol. 27, no. 3, pp. 509–538.

Matsumoto, K., Takanezawa, T. and Ooe, M. 2000. 'Ocean tide models developed by assimilating TOPEX/POSEIDON altimeter data into hydrodynamical model: A global model and a regional model around Japan'. *Journal of Oceanography*, vol. 56, no.5, pp. 567–581.

McAuliffe CD 1987, 'Organism exposure to volatile/soluble hydrocarbons from crude oil spills – a field and laboratory comparison', Proceedings of the 1987 International Oil Spill Conference, *American Petroleum Institute*, pp. 275–288.

McCarty LS 1986, 'The relationship between aquatic toxicity QSARs and bioconcentration for some organic chemicals', *Environmental Toxicology and Chemistry*, vol. 5, no. 12, pp. 1071–1080.

McCarty LS, Dixon DG, MacKay D, Smith AD & Ozburn GW 1992a, 'Residue-based interpretation of toxicity and bioconcentration QSARs from aquatic bioassays: Neutral narcotic organics'*, Environmental Toxicology and Chemistry: An International Journal*, vol. 11, no. 7, pp.917–930.

McCarty LP, Flannagan DC, Randall SA & Johnson KA 1992b, 'Acute toxicity in rats of chlorinated hydrocarbons given via the intratracheal route', *Human & Experimental Toxicology*, vol. 11, no. 3, pp.173–117.

McCarty LS & Mackay D 1993, 'Enhancing ecotoxicological modelling and assessment. Body residues and modes of toxic action', *Environmental Science & Technology*, vol. 27, no. 9, pp. 1718–1728.

McGrath JA, & Di Toro DM 2009, 'Validation of the target lipid model for toxicity assessment of residual petroleum constituents: monocyclic and polycyclic aromatic hydrocarbons', *Environmental Toxicology and Chemistry*, vol. 28, no. 6, pp. 1130–1148.

Middleton, JF. & Black, KP 1994. The low frequency circulation in and around Bass Strait: a numerical study. *Continental Shelf Research*, vol.14, pp. 1495–1521.

Middleton, JF & Bye AT 2007. A review of shelf-slope circulation along Australia's southern shelves: Cape Leeuwin to Portland, *Progress in Oceanography*, vol. 75, no.1, pp. 1-41.

National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) 2018, 'At a glance: Oil spill modelling', viewed 15 November 2018, https://www.nopsema.gov.au/assets/Publications/A626200.pdf

National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) 2019, 'NOPSEMA Bulletin #1: Oil spill modelling', viewed April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf

National Oceanic and Atmospheric Administration (NOAA) 2013, ‘Screening level risk assessment package Gulf state’, Office of National Marine Sanctuaries & Office of Response and Restoration, Washington DC.

National Research Council (NRC), 1985. Oil in the Sea: Inputs, Fates and Effects, National Academy Press, Washington, D.C., 601 p.

National Research Council (NRC) 1989. Review of the State-of-Knowledge Regarding Dispersant Usage in Open-Ocean Spill Responses. NRC Marine Board, Washington, DC., 306p.

National Research Council (NRC) 2003, ‘Oil in the sea III: Inputs, fates and effects’, The National Academic Press, Washington D.C.

Neff JM & Anderson JW 1981, ‘Response of marine animals to petroleum and specific petroleum hydrocarbons’ United States Department of Energy, United States.

Nirmalakhandan N & Speece RE 1988, ‘ES&T Critical Review: Structure-activity relationships. Quantitative techniques for predicting the behaviour of chemicals in the ecosystem’, *Environmental Science & Technology*, vol. 22, no. 6, pp. 606–615.

Nordtug T, Olsen AJ, Altin D, Overrein I, Storøy W, Hansen BH & De Laender F 2011, ‘Oil droplets do not affect assimilation and survival probability of first feeding larvae of North-East Arctic cod’, *Science of the Total Environment*, vol. 412, pp.148–153.

Okubo, A., 1971. *Application of the telegraph equation to oceanic diffusion: Another mathematic model*.

Owen, A 1980, ‘A three-dimensional model of the Bristol Channel’, *Journal of Physical Oceanography*, vol. 10, no. 8, pp. 1290–1302.

Qiu, B & Chen, S 2010, ‘Eddy-mean flow interaction in the decadally modulating Kuroshio Extension system’, *Deep-Sea Research II*, vol. 57, no. 13, pp. 1098–1110.

Redman AD 2015, ‘Role of entrained droplet oil on the bioavailability of petroleum substances in aqueous exposures’, *Marine Pollution Bulletin*, vol. 97, no. (1-2), pp. 342–348.

Saha, S., Moorthi, S., Pan, H-L., Wu, X., Wang, J. and Nadiga, S. 2010. ‘The NCEP Climate Forecast System Reanalysis’, *Bulletin of the American Meteorological Society*, vol. 91, no. 8, pp. 1015–1057.

Scholten, MCTh, Kaag, NHBM, Dokkum, HP van, Jak, R.G., Schobben, HPM & Slob, W 1996, Toxische effecten van olie in het aquatische milieu, TNO report TNO-MEP – R96/230, Den Helder.

Suprayogi, B & Murray, F 1999, ‘A field experiment of the physical and chemical effects of two oils on mangroves’, *Environmental and Experimental Botany*, vol. 42, no. 3, pp. 221–229.

Swartz RC, Schults DW, Ozretich RJ, Lamberson JO, Cole FA, Ferraro SP, Dewitt TH & Redmond MS 1995, ‘ΣPAH: A Model to predict the toxicity of polynuclear aromatic hydrocarbon mixtures in field-collected sediments’, *Environmental Toxicology and Chemistry*, vol. 14, no. 11, pp. 1977–1187.

Verhaar, HJ, Van Leeuwen, CJ & Hermens, JL 1992, ‘Classifying environmental pollutants’, *Chemosphere*, vol. 25, no. 4, pp. 471-491.

Verhaar, HJ, de Wolf, W, Dyer, S, Legierse, KC, Seinen, W & Hermens, JL 1999, ‘An LC_{50} vs time model for the aquatic toxicity of reactive and receptor-mediated compounds. Consequences for bioconcentration kinetics and risk assessment’, *Environmental science & technology*, vol. 33, no. 5, pp.758-763.

Willmott, CJ 1981, ‘On the validation of models’, *Physical Geography*, vol. 2, no. 2, pp. 184-194.

Willmott, CJ 1982, ‘Some comments on the evaluation of model performance’, *Bulletin of the American Meteorological Society*, vol. 63, no. 11, pp. 1309-1313.

Willmott, CJ, Ackleson, SG, Davis, RE, Feddema, JJ, Klink, KM, Legates, DR, O’Donnell, J & Rowe, CM 1985, ‘Statistics for the evaluation and comparison of models’, *Journal of Geophysical Research: Oceans*, vol. 90, no. C5, pp. 8995-9005.

Willmott, CJ & Matsuura, K 2005, ‘Advantages of the mean absolute error (MAE) over the root mean square error (RMSE) in assessing average model performance’, *Journal of Climate Research*, vol. 30, no. 1, pp. 79-82.

Yaremchuk, M & Tangdong, Q 2004, ‘Seasonal variability of the large-scale currents near the coast of the Philippines’. *Journal of Physical Oceanography*, vol. 34, no., 4, pp. 844–855.

Zigic, S, Zapata, M, Isaji, T, King, B, & Lemckert, C 2003, ‘Modelling of Moreton Bay using an ocean/coastal circulation model’, Proceedings of the 16th Australasian Coastal and Ocean Engineering Conference, the 9th Australasian Port and Harbour Conference and the Annual New Zealand Coastal Society Conference, Institution of Engineers Australia, Auckland, paper 170.

Zweng, MM, Reagan, JR, Antonov, JI, Locarnini, RA, Mishonov, AV, Boyer, TP, Garcia, HE, Baranova, OK, Johnson, DR, Seidov, D & Biddle, MM 2013, ‘World Ocean Atlas 2013, Volume 2:Salinity’, (Eds.) Levitus, S & Mishonov, A, NOAA Atlas NESDIS 74, 39 pp.

1. Existing Environment (Spill EMBA)

In accordance with OPGGS(E) Regulation 13(2), the 'Environment that may be affected' (Spill EMBA) by the activity is described in this section, together with its values and sensitivities. This does not include receptors within the Spill EMBAs identified for planned aspects detailed in Sections 4.1 to 4.8. The Spill EMBA is the term used consistently to describe the environmental that may be affected by an MDO release from the vessel. This uses the entrained hydrocarbon contour from the oil Spill model runs to identify the largest predicted spatial extent that hydrocarbon could extend.

This section has been separated to avoid repetition and provide a description of the environment specific to the Spill EMBA.

1.1. Regional Context

The Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0) is a spatial framework for classifying Australia's marine environment into bioregions that make sense ecologically and are at a scale useful for regional planning (CoA, 2006). Under this framework, the Sequoia MSS occurs in Commonwealth waters within the Otway meso-scale region, which extends from Apollo Bay (Vic) to Cape Jaffa (South Australia) and includes the western islands of Bass Strait such as King Island (an area of 37,331 km^2).

The characteristics of the Otway marine bioregion environment include very steep-moderate offshore gradients, high wave energy and cold temperate waters subject to upwelling events (i.e. the Bonney Upwelling) (IMCRA, 1998). Currents are generally slow, but moderately strong through the entrance to Bass Strait. Upwelling water is nutrient rich and corresponds with increases in the abundance of zooplankton which attracts baleen whales and other species (including EPBC-listed species) which feed on the plankton swarms (krill). Shoreline habitats of the Otway coastline include penguin colonies, fur seal colonies and bird nesting sites.

The Operational Area and Spill EMBA are within the area covered by the Commonwealth of Australia's South-East Marine Bioregional Plan, which was developed to improve the way decisions are made under the EPBC Act in relation to the protection of marine biodiversity and the sustainable use of oceans and their resources by marine-based industries. The South-east Marine Region, an area of 1,632,402 km^2, contains 11 bioregions under IMCRA and includes a broad range of temperate and subantarctic environments. The South-East Marine Bioregion extends from near the far south coast of New South Wales, around Tasmania and as far west as Kangaroo Island in South Australia. It includes the Commonwealth waters of Bass Strait and those surrounding Macquarie Island in the Southern Ocean. Significant variation in sea-floor features and water depth found throughout the South-east Marine Region contribute to the high level of species diversity. The shelf break (which includes the edges of the continental shelf and the upper slope) serves to intensify currents, eddies and upwellings, creating a rich and productive area for biodiversity (DoE, 2015b).

The Spill EMBA overlaps seven IMCRA bioregions (Figure 1-1) including:

- Southeast Shelf Transition
- Southeast Transition
- Western Bass Strait Shelf Transition
- West Tasmania Transition

- Bass Strait Shelf Province
- Tasmanian Shelf Province
- Tasmania Province.

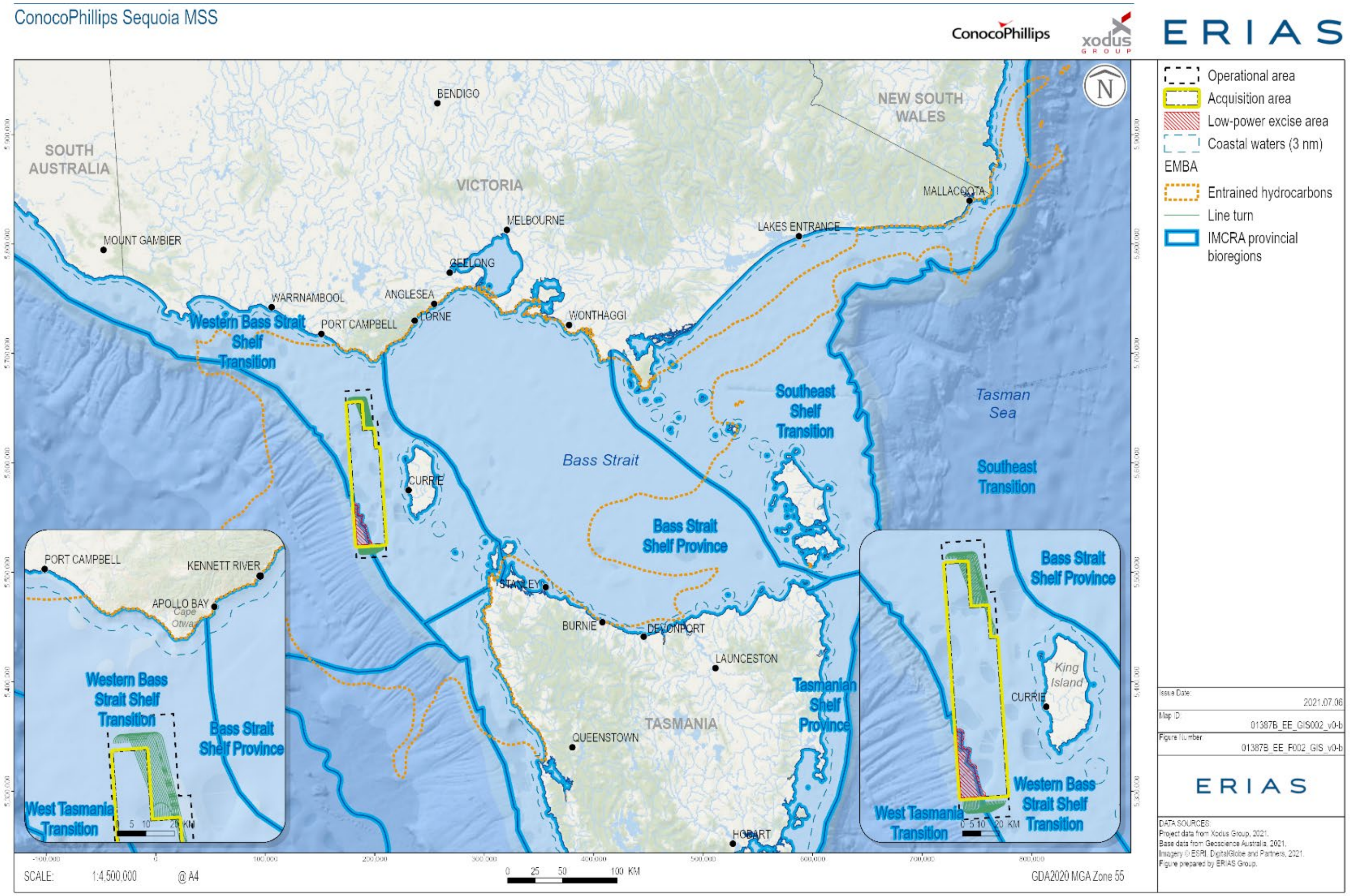


Figure 1-1: Sequoia Spill EMBA and IMCRA bioregions

1.1.1. Climate

Bass Strait is located on the northern edge of the westerly wind belt known as the 'Roaring Forties'. In winter, when the subtropical ridge moves northwards over the Australian continent, cold fronts generally create sustained west to south-westerly winds and frequent rainfall in the region (McInnes and Hubbert, 2003). In summer, frontal systems are often shallower and occur between two ridges of high pressure, bringing more variable winds and rainfall.

Occasionally, intense mesoscale low-pressure systems occur in the region, bringing very strong winds, heavy rain, and high seas. These events are unpredictable in occurrence, intensity, and behaviour, but are most common between September and February (McInnes and Hubbert, 2003).

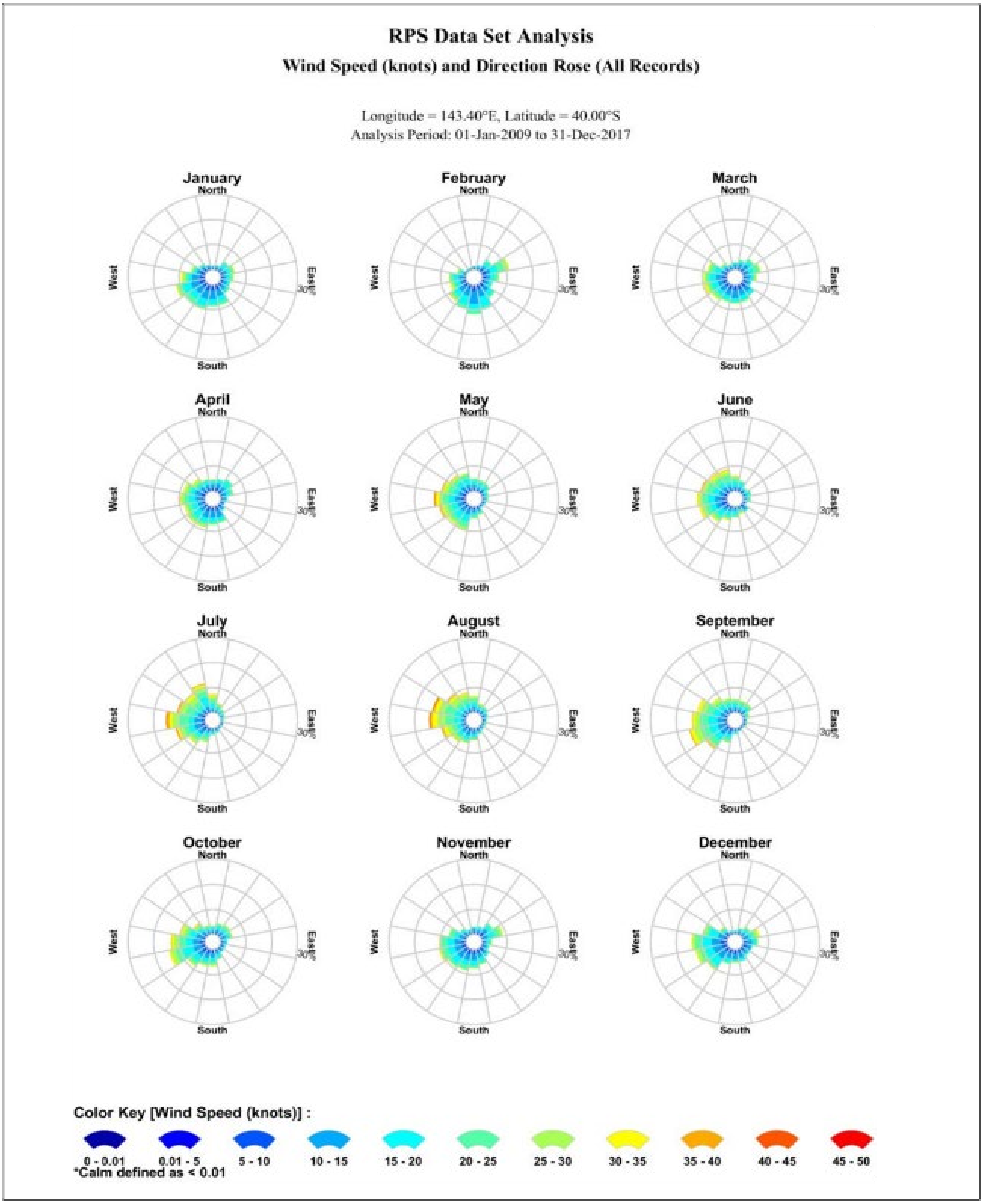
RPS (2020) acquired high-resolution wind data from 2009 to 2017 (inclusive) across their modelling domain from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR). Table 1-1 lists the monthly average and maximum winds derived from the CFSR station in the region.

Monthly wind rose distributions from 2009 to 2017 (inclusive) are shown in Figure 1-2,which clearly indicates the dominance of western winds for most of the year with the windiest months from June to September (RPS, 2020).

Table 1-1 Predicted average and maximum wind speeds for the representative wind station in the Bass Strait

Month	Average wind speed (knots)	Maximum wind speed (knots)	General direction (from)
January	15	43	Southwest
February	15	46	South-southwest and East-northeast
March	15	41	West-southwest and northeast
April	15	49	West (variable)
May	17	50	West (variable)
June	18	46	West (variable)
July	19	45	West-northwest
August	20	47	West-northwest
September	18	50	West
October	17	45	West
November	15	39	West
December	15	41	West
Minimum	15	39	
Maximum	20	50	

Source: RPS (2020)



Source: RPS (2020)

The convention for defining wind direction is the direction the wind blows from.

Figure 1-2 Monthly wind rose distributions from 2009-2017 (inclusive) for the representative wind station closest to the centre in Bass Strait.

The climate of the region is temperate with cool, wet winters and warm dry summers (IMCRA, 1998). The area has a mean maximum temperature of 21.3°C (February) and a mean minimum temperature of 7.6°C (July) (BOM, 2018). Historical (1995 – 2020) average air temperatures recorded at King Island airport range from 14.6°C. to 15.4°C (BoM, 2020).

The annual average rainfall is 859 mm with the predominant rainfall falling between May and October (BOM, 2018). Lower mean monthly rainfall totals of are expected during September and October.

1.1.2. Metocean Characteristics

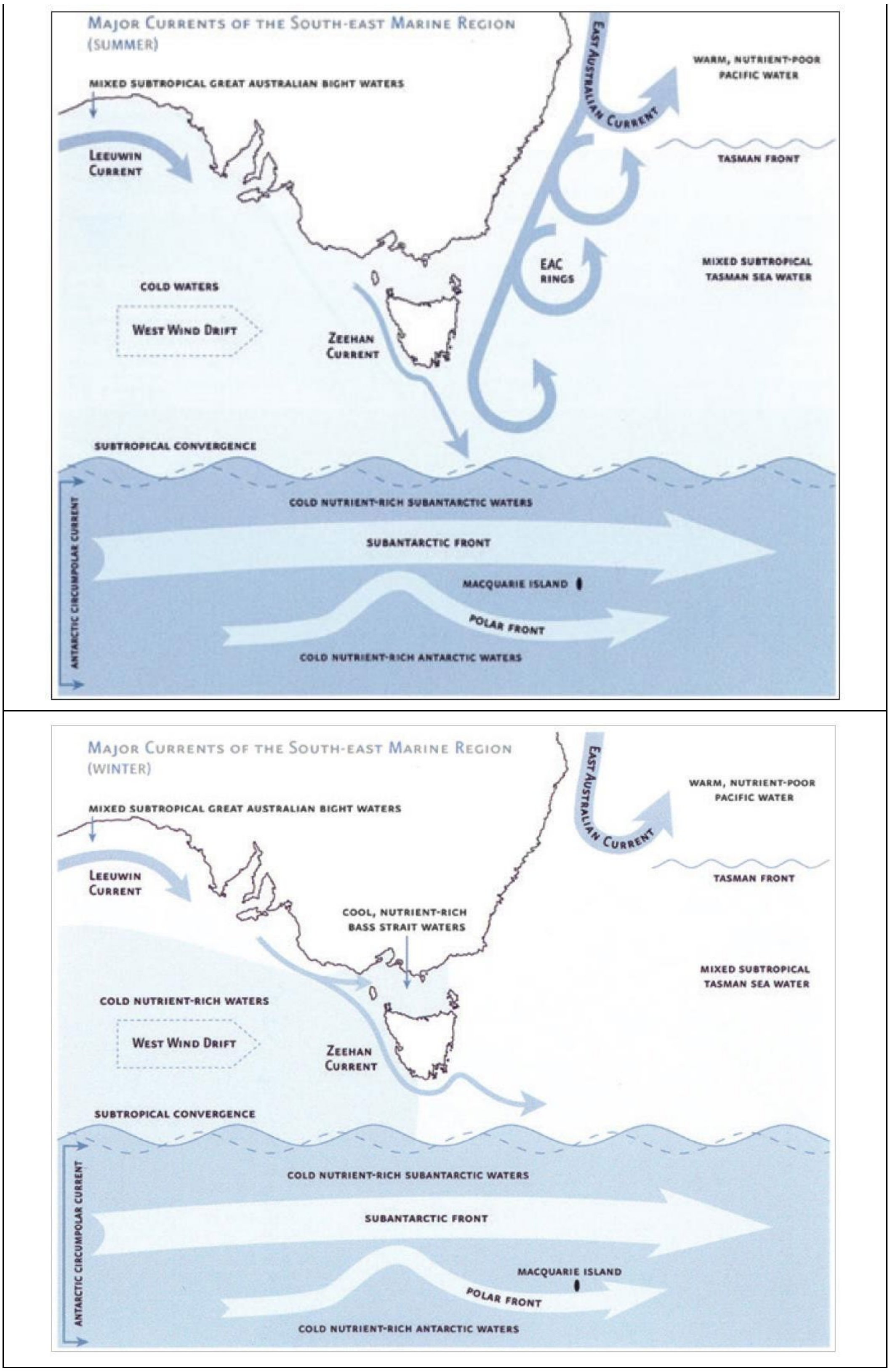
1.1.2.1. Currents and Tides

There is a slow easterly flow of waters in Bass Strait and a large anti-clockwise circulation (DoE, 2015b). The Leeuwin Current transports warm, sub-tropical water southward along the Western Australian (WA) coast and then eastward into the Great Australian Bight (GAB), where it mixes with the cool waters from the Zeehan Current running along Tasmania's west coast (DoE, 2015b). The Leeuwin and Zeehan currents are stronger in winter than in summer, with the latter flowing into Bass Strait during winter (Figure 1-3).

Bass Strait experiences strong tidal currents primarily driven by tides, winds and density-driven flows over the relatively shallow continental shelf. Tidal waves enter Bass Strait from the east and west almost simultaneously and as a result in the centre of the strait there is an area with small tidal currents where the two waves meet. The magnitude of the tidal currents increases as the distance from the central strait increases with relatively strong tidal currents at either end. The times and magnitudes of tides within Bass Strait are relatively uniform and predictable. However, the effects of meteorological phenomena may be significant, causing variations in level and also changing the phasing or timing of the tide (Sandery and Kampf, 2005).

Tides are semi-diurnal with some diurnal inequalities (Jones and Padman, 2006; Easton, 1970), generating tidal currents along a north-east/south-west axis, with speeds generally ranging from 0.1 to 2.5 m/s (Baines and Fandry, 1983). The maximum range of spring tides in western Bass Strait is approximately 0.8 to 1.2 m, however the tidal ranges and velocities vary rapidly in the western entrance to Bass Strait (IMCRA, 1998).

Near the seabed, currents run parallel with the coast and can exceed 0.5 m/s when generated by a storm (Woodside, 2003). Close to the shore where water depths are less than 10 m, the currents are of variable speed and are often strong. Current speeds are estimated to range from 0.31 m/s for a mean spring tide to 0.5-1 m/s at the adjacent Thylacine Field (Woodside, 2003). Average and maximum surface current speeds from combined HYCOM and tidal currents are detailed in RPS (2020).



Source: DoE (2015).

Figure 1-3 Major ocean currents in south-eastern Australian waters during summer (top) and winter (bottom)

1.1.2.2. Waves

In the Bass Strait, the interaction between sea and swell and the resultant wave motion is complicated by the islands and Australian mainland coastline, embayments, peninsulas and headlands. This restricts the access of swell from the Southern Ocean into Bass Strait. Some swell is blocked completely and some refracted by the seabed and modified as it passes into shallower waters of Bass Strait. There are also waves generated by wind within Bass Strait and the conditions at any location will be the result of these two wave-energy bands (Falconer and Lindforth, 1972).

The local wave climate is derived principally from locally generated wind waves mostly from the west and southwest. Wave heights range from 1.5 m to 2 m with periods of 8 s to 13 s, although heights of 5 m to 7 m can occur during storm events.

1.1.2.3. Water Temperature

The shallowness of Bass Strait means that its waters more rapidly warm in summer and cool in winter than waters of nearby regions (DoE, 2015b). Waters are cold temperate with the mean sea surface temperatures varying from 13°C in winter to 18°C in summer (RPS, 2020). The far eastern region of Bass Strait (i.e., Flinders Island area) is influenced during winter months by warm waters, making this region warmer than other Tasmanian waters at that time (IMCRA, 1998).

During winter, the South Australian current moves dense, salty warmer water eastward from the Great Australian Bight into the western margin of Bass Strait. In winter and spring, waters within the strait are well mixed with no obvious stratification, while during summer the central regions of the straight become stratified (RPS, 2020).

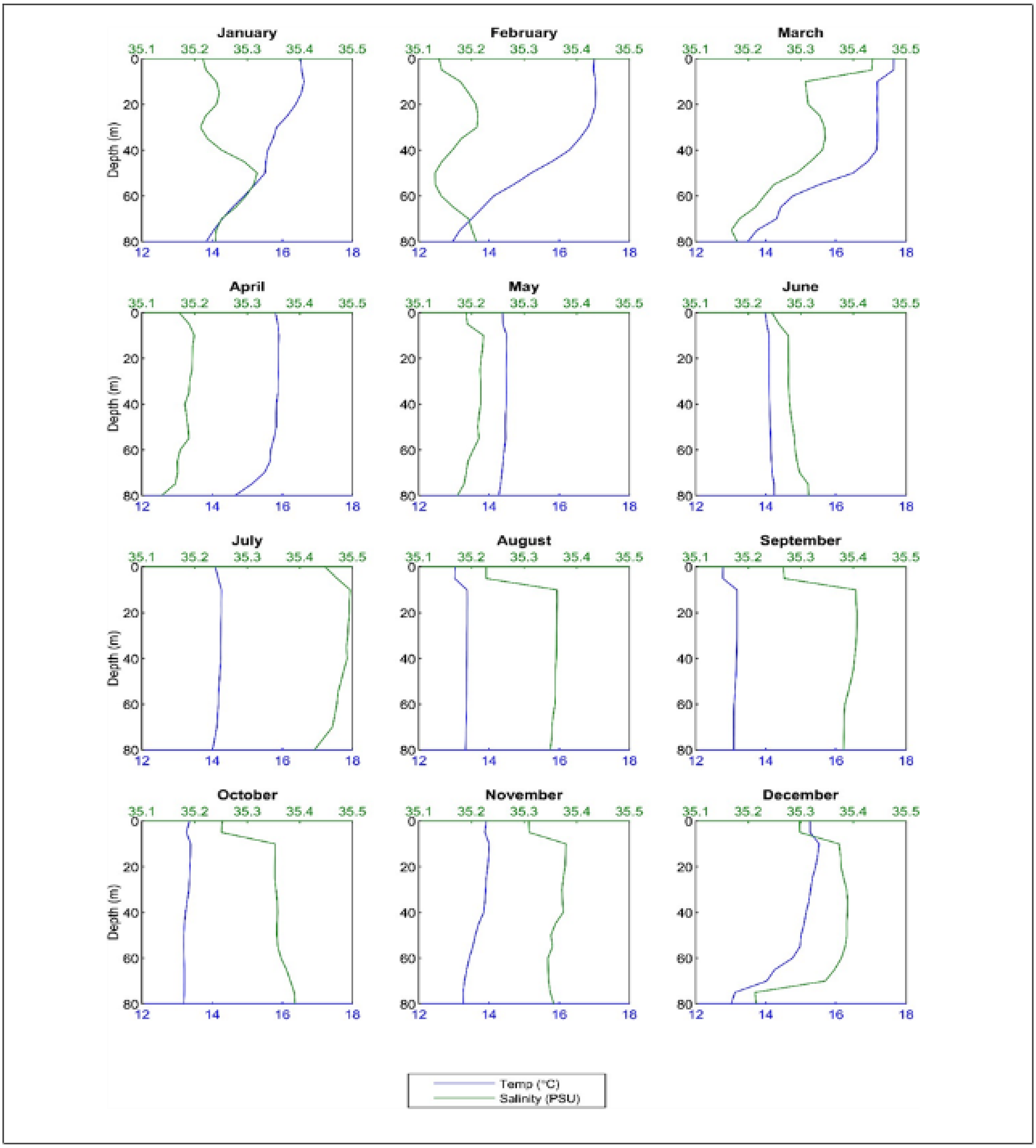
RPS (2020) reports that the temperature in the top 30 m of the water column in the region (based on the World Ocean Atlas) varies from 13 to 17°C across the year. In the shallower waters of the Spill EMBA such as the Bunurong Marine National Park (MNP) and Bunurong Marine Park, Parks Victoria (2006) notes that surface water temperatures range from 13°C in the cooler months to 17.5°C in the warmer months.

Figure 1-4 shows the variation in water temperature seasonally and over depth in Bass Strait.

1.1.2.4. Salinity

RPS (2020) reports that the average monthly salinity (based on the World Ocean Atlas database) over the water depth range of 30 m is approximately 35.0 practical salinity units (PSU) year-round.

Figure 1-4 shows the slight variation in salinity both seasonally and over depth in the region.



Source: RPS (2020). Depth of 0 m is the water surface

Figure 1-4 Temperature (blue line) and salinity (green line) profiles for the region

1.2. Physical Environment

1.2.1. Water Quality

The nutrient concentrations in Central Bass Strait are low compared to that of what is seen at its extremities (Gibbs et al.,1986; Gibbs, 1992). It is hypothesised that this could be due to the biological demands of the Bass Strait waters consuming much of the nutrients before moving into Central Bass Strait (Gibbs, 1992).

In nearshore areas, water quality may be negatively affected through the discharge of polluted waters from rivers, which drain catchments dominated by stock grazing and small coastal settlements (PV, 2006).

1.2.2. Air Quality

Air quality in the Spill EMBA is expected to be high given that air flow originates in the Southern Ocean, and there are no intervening land masses that could influence the quality of air from any anthropogenic or natural terrestrial sources.

1.2.3. Bathymetry

The bathymetry of Bass Strait is gently sloping with water depths increasing gradually from the shore to a maximum of about 1,000 m as shown in Figure 1-5. The region’s seabed is characterised by a mixture of basins, terraces, plateaus, banks, deep escarpments, canyons and areas of continental rise (Harris et al 2005).

Mainland Tasmania and the Bass Strait islands belong to the same continental landmass as mainland Australia. The continental shelf is narrow along the east coast of Tasmania but broadens in the northwest and northeast, underlying Bass Strait and the Otway and Gippsland basins. The central part of Bass Strait contains a depression that exchanges water with the ocean to the north of King Island. The main seafloor feature of western Bass Strait is a ridge that extends from King Island to northwest Tasmania.

The southern shelf or coastal boundary of the Australian mainland is a maximum width of 200 km in the central Great Australian Bight (GAB) which narrows to 20 km on the Bonney coast of South Australia/Victoria (Butler et al., 2002). Bass Strait, to the east of the Bonney coast, consists of a broad shallow region, bordered on the eastern and western sides by very deep waters of the continental slope. The depth of the shelf at the Bonney coast increases gradually to 100 m where a distinct increase in steepness is observed (Butler et al., 2002). The continental slope and abyssal plain are connected by several very large and steep canyons along the Bonney coast, which are thought to contribute to upwelling events and local biodiversity (Butler et al., 2002).

To the west of Tasmania there are also numerous canyons cut from the continental shelf at about 300 m depth to the abyssal plain (~3,500 m depth) with the shallower continental margin characterised by gentle to moderate sloping ground (NOO, 2002). On the continental shelf, the seabed slopes gradually upwards in a northerly and easterly direction across the shelf to a depth of about 30 m within 1 km of the coastline.

1.2.4. Seabed

The seabed in the nearshore parts of the Spill EMBA is mapped at a coarse scale using LiDAR data for the Oil Spill Response Atlas (OSRA). This section describes the seabed in the areas intersected by the Spill EMBA, broken down into OSRA mapping sections (moving from the west of the Spill EMBA to the east).

Table 1-2: Seabed areas intersected by the Spill EMBA

Seabed Area	Description
Apollo Bay	The nearshore seabed west of Cape Otway is characterised by gently sloping sandy sediments. South of Cape Otway is an extensive area of subtidal reefs that extent east around the Cape.
Lorne	The nearshore seabed at Apollo Bay is characterised by gently sloping sandy sediments and an absence of reef habitat. To the east, nearshore reef habitat is common with sandy sediments dominant further away from the coast. Cape Patton, Point Hawdon and Point Grey are the exception to this general pattern, whereby reef habitat is dominant throughout the mapped nearshore area.
Anglesea	From Fairhaven to Jan Juc, the nearshore environment is primarily sandy with subtidal rocky reef habitat present further away from the coast. Adjacent Torquay, subtidal rocky reef is dominant within the Point Danger Marine Sanctuary.
Bellarine Peninsula South	East of Torquay to Point Lonsdale, the nearshore sediments are mainly sandy with subtidal rocky reef habitat dominant further away from the shoreline. Within Port Phillip Bay, the northern Mornington Peninsula coast is dominated by an uninterrupted extent of nearshore sandy sediments from Point Nepean to Sorrento.
Mornington Peninsula South	The nearshore seabed of the southern Mornington Peninsula coast from Point Nepean to Flinders is predominantly subtidal rocky reef and rocky substrate with intermittent patchy areas of sandy sediments. East of Flinders, aquatic vegetation is present in the nearshore environment among sandy sediments and an absence of hard substrate.
Phillip Island	The nearshore seabed of the northern and western coast of Phillip Island is dominated by subtidal rocky reef and hard substrates with sandy sediments present further away from the coast. The southern nearshore seabed of Phillip Island is dominated by subtidal rocky reef with intermittent and sparse areas of sandy sediments from Summerland to Surf Beach. East of Surf Beach until Cape Woolamai, sandy seabed is common with only some interspersed areas of rocky substrate.
Kilcunda	The seabed intersected by the Spill EMBA adjacent Kilcunda comprises distinct patches of subtidal rocky reef and sandy sediments. Around Cape Paterson and the Bunurong MNP, extensive areas of subtidal rocky reef are dominant (up to 1 km wide in some areas) with sandy sediments present further offshore. The seabed of Venus Bay is exclusively sandy sediments with no areas of subtidal rocky reef mapped. Anderson Inlet is not intersected by the Spill EMBA.
Cape Liptrap	There are extensive areas of subtidal rocky reef mapped off the coast of Cape Liptrap. East of the cape adjacent Walkerville is an area of mixed sandy sediment with offshore reef before transitioning to continuous sandy sediments and an absence of hard substrate in Waratah Bay.
Wilsons Promontory West	The western parts of Wilsons Promontory intersected by the Spill EMBA are dominated by sandy sediments, with small and isolated areas of rocky reef located around the offshore islands.
Wilsons Promontory East	The eastern parts of Wilsons Promontory intersected by the Spill EMBA are dominated by sandy sediments, with small and isolated patches of reef.
Marlo	The nearshore seabed adjacent the township of Marlo is dominated by sandy sediments with two small sections of subtidal rocky reef east of Ricardo Beach.
Bemm River	The seabed adjacent Cape Conran features nearshore subtidal rocky reef before transitioning to predominantly sandy seabed to the east. Subtidal rocky reef is present south of Pearl Point before becoming mostly sandy sediments again further to the east.
Point Hicks	The nearshore seabed intersected by the Spill EMBA is dominated by sandy sediments, with patches of subtidal reef.
Mallacoota	The areas of nearshore seabed intersected by the Spill EMBA south of Mallacoota are dominated by subtidal rocky reef with intermittent areas of sandy sediments. East of Mallacoota is dominated by sandy sediments with areas of reef concentrated around the offshore islands of Gabo Island and Tullaberga Island. Mallacoota inlet and its seagrass communities are not intersected by the Spill EMBA.

The following information provides a description of the key seabed features listed above:

1.2.4.1. Subtidal rocky reef

Rocky reefs provide a stable seabed for a wide range of plants and animals including kelps and other seaweeds and encrusting invertebrates such as sea squirts, sponges and bryozoans. In turn fixed biota provide habitat and food for mobile animals including molluscs, octopus, crustaceans, and a wide range of fish species. There have been a wide range of studies of nearshore reef biota in Victoria including work for the Environment Conservation Council's marine coastal and estuarine investigation (Ferns and Hough, 2000). The nearshore reefs along Victoria's open coastline are characterised by an abundance of brown kelps, with a diverse understorey of red, green and brown seaweeds, sea squirts, sponges, bryozoans, crustaceans and molluscs. There is a degree of variation in the composition of biota on the reefs along the coast but in general most species are represented widely along the Victorian coast. Parks Victoria (2006) notes that the Bunurong MNP and Bunurong Marine Park (both sites with significant areas of subtidal rocky reef and rock platforms) have the highest diversity of intertidal and shallow subtidal invertebrate fauna recorded in Victoria on sandstone.

1.2.4.2. Sandy substrate

The shifting sands of unsheltered nearshore seabed are often too mobile for the development of marine floral communities and lack the necessary hard substrate required for anchoring. As such, these environments can appear barren and featureless on the surface. Nevertheless, a rich abundance of faunal communities may be present among the sands including species of molluscs, bivalves, annelids, crustaceans, and echinoderms.

1.2.4.3. Seagrass Communities

Seagrasses are often called nursery habitats because the leafy underwater canopy they create provides shelter for small invertebrates (such as crabs, shrimp and other types of crustaceans), small fish and juveniles of larger fish species. Seagrass leaves absorb nutrients and slow the flow of water, capturing sand, dirt and silt particles, which, along with their roots trap and stabilise the sediment, which helps improve water clarity and quality and reduces erosion of coastlines, as well as providing suitable habitat for benthic infauna. Seagrass beds are an important component of unique food webs whereby the seagrass may be consumed directly by grazers, provide substrate for epiphytic organisms to colonise and eventually nutrients for detritivores (Parks Victoria, 2006).

1.2.4.4. Tasmania

Seamap Australia (2017) presents benthic spatial data and has been used in place of OSRA mapping to describe in part the seabed within the Tasmanian section of the Spill EMBA. The nearshore seabed of the northwest coast of Tasmania from Stanley to Hunter Island is mapped as predominantly sand, with seagrass present in the strait between Robins Island and Tasmania. The seabed around the Kent Group is mapped as predominantly sand with areas of hard consolidated substrate present close to the shoreline. Nearshore seabed mapping of King Island and the west coast of Tasmania is not included in the Seamap database.

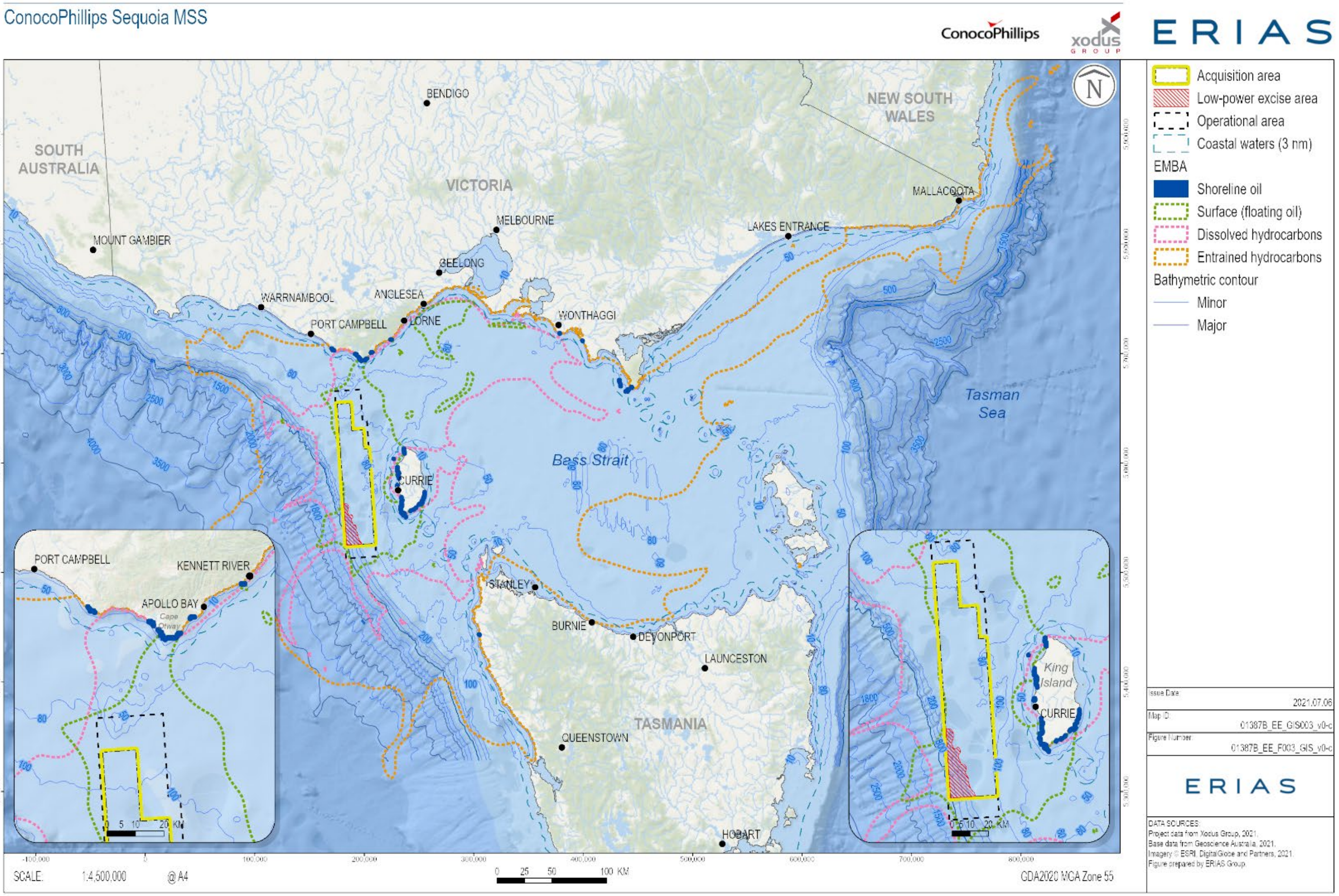
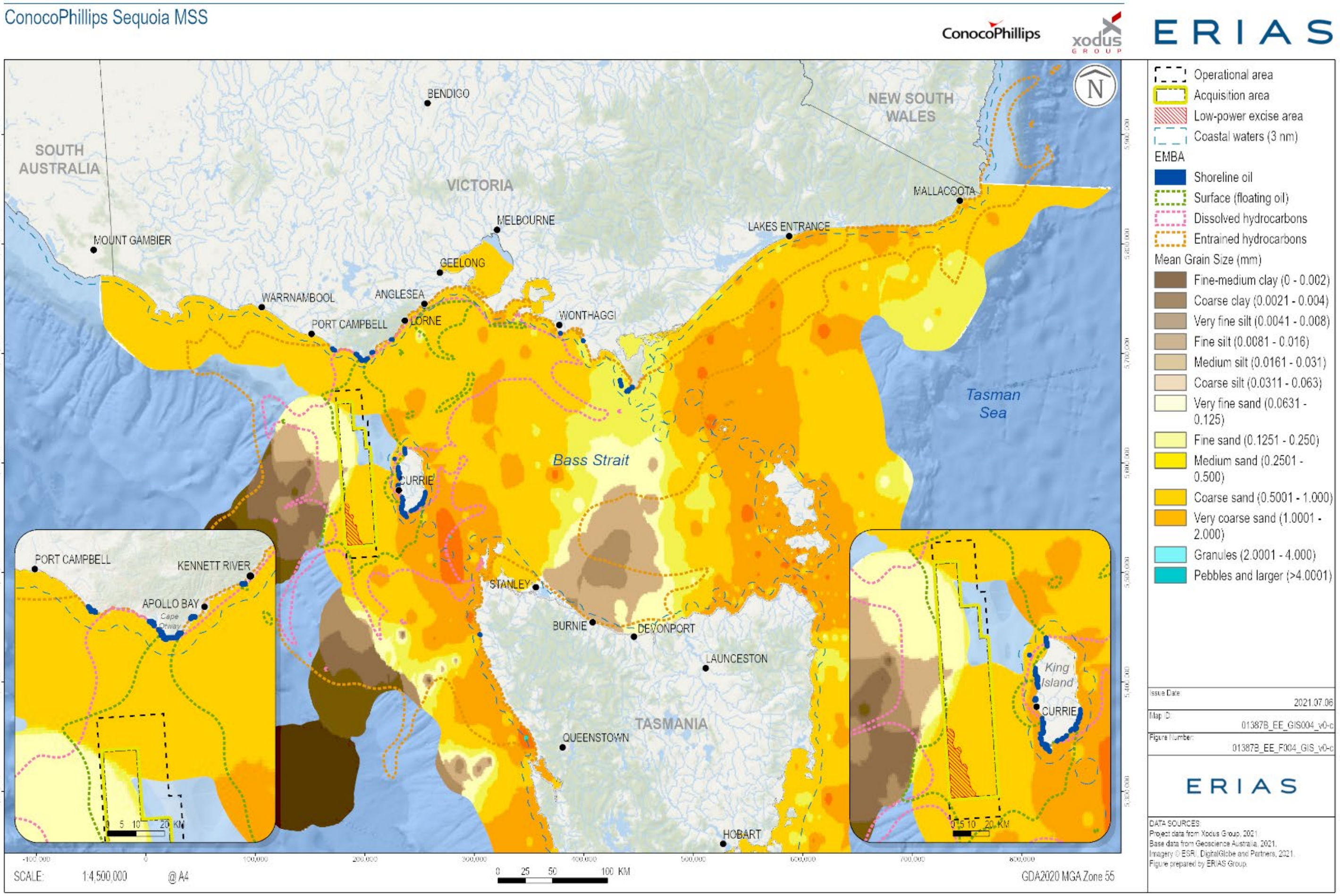


Figure 1-5 Bathymetry of Bass Strait



DATA SOURCES:
Project data from Xodus Group, 2021.
Base data from Geoscience Australia, 2021.
Imagery © ESRI, DigitalGlobe and Partners, 2021.
Figure prepared by ERIAS Group.

Figure 1-6 Average seabed sediment grain size across Bass Strait

1.2.5. Shorelines

The coastal environment throughout southern and eastern Australia is varied, and includes areas of rocky cliffs, sandy beaches, and tidal flats. Each of these shoreline types has the potential to support different flora and fauna assemblage due to the different physical factors (e.g. waves, tides, light etc.) influencing the habitat.

The following description of shorelines (Table 1-3) intersected by the Spill EMBA is based on, Google Earth satellite imagery and OSRA mapping (OSRA, 2021).

Table 1-3 Shoreline areas intersected by the Spill EMBA

Shoreline Area	Description
King Island (north, west, southeast coasts)	the western and south-eastern coastline is predicted to be exposed to shoreline loading of hydrocarbons. The west coast of the Island is predominantly rocky shoreline with some areas of sandy beaches. The longest stretch of beach is located on the northwest coast of the island.
Port Campbell	the shoreline is predominantly sand beach, intertidal shore platform and mixed sand beach and shore platform. South of Princetown is the Glenelg River Estuary and identified shorebird habitat on the adjacent sandy beach
Cape Otway West	the Spill EMBA intersects the west, south and east coasts of Cape Otway. This coastline is dominated by intertidal shore platforms and rocky substrate in general with the near absence of sand beach.
Apollo Bay	the section of coastline that may be exposed to shoreline loading is dominated by intertidal shore platforms, rock platforms and some areas of sandy beach.
Kilcunda	the coastline of Cape Paterson is dominated by intertidal shore platform and rock platform with the complete absence of sand beach in the section potentially exposed to shoreline loading
Wilson Promontory West	the offshore islands in this sector potentially intersected by shoreline loading are all dominated by intertidal shore platforms and provide important breeding habitat for Little Penguins, Australian fur-seals and New Zealand fur-seals. All the islands are protected within the Wilsons Promontory Marine National Park (MNP) and Wilsons Promontory Marine Park.
Cape Otway West	the shoreline south of Wattle Hill is dominated by rock platform with a short stretch of sandy beach located at Milanesia Beach. From Johana Beach until Point Flinders, sand beach is dominant with interspersed areas of rock platform as well the Johanna and Aire River Estuaries. At Cape Otway, there is extensive rock platform with interspersed areas of mixed sand beach and intertidal shore platform.
Apollo Bay	East of Cape Otway, the shoreline is a mixture of sand beach and intertidal shore platform. Hooded plover habitat is identified from the Park River Estuary to Shelly Beach. From Marengo to Skenes Creek, sand beaches are dominant in the sheltered area of Apollo Bay. From Skenes Creek until Wye River, the shoreline is a mixture of sand beach and rock platforms, interspersed with the Smythes Creek, Carrisbrook Creek, Grey River and Kennet River Estuaries.
Lorne	From Wye River to Lorne, the shoreline is characterised by a mixture of sand beach and intertidal shore platform with shorebird habitat identified throughout. At Lorne and Fairhaven, uninterrupted stretches of sand beach at present. Shorebird roosting and feeding is identified at the Painkalac Creek Estuary.
Anglesea	From Anglesea to Barwon Heads, sand beach is the dominant shoreline type with intermittent stretches of rock platform and intertidal shore platform present. At the Anglesea River Estuary, shorebird feeding habitat has been identified as well as at Addiscot Beach, Thompson Creek Estuary and Thirteenth Beach
Bellarine Peninsula South	The Barwon River Estuary and shorebird roosting sites are present in this section and sand beach is dominant from Barwon Heads to St Leonards. The northern shoreline of the Mornington Peninsula is primarily sandy beach from Point Nepean to Sorrento with sparse areas of intertidal shore platform.
Mornington Peninsula South	The southern Mornington Peninsula coastline from Point Nepean to Flinders is a mixture of sand beach and intertidal shore platform, with an uninterrupted stretch of sand beach present at Gunnamatta Beach. Shorebird habitat and feeding sites are identified in the Point Nepean National Park, Pelly Point, Cape Schanck, and West Head. North of Flinders towards Balnarring, a mixture of sand beach and intertidal shore platform is present along with numerous identified shorebirds roosting sites, particularly around Shoreham.
Phillip Island	Sand beaches and intertidal shore platform are dominant on the north shoreline of Phillip Island with shorebird habitat identified from Cowes to Summerland. Off the coast of Summerland is Seal Rocks, which is a known breeding and haul-out site for Australian fur-seals. On the southern coast of Phillip Island, sand beach and rock platforms are common. From Surf Beach to Cape Woolamai, sand beach is

	dominant. The Cape Woolamai coast on the eastern edge of the island is dominated by sandy beach and sand dunes with some isolated areas of cobble/shingle beach. The sandy beach is identified habitat for coastal bird species.
Kilcunda	starting near Venus Bay, the west-facing beaches continue to be dominated by sandy beaches. West of Anderson Inlet, the shoreline is dominated by mixed sand beach/shore platform and intertidal shore platform. North of Harmers Haven, the shoreline is again dominated by sandy beaches, interspersed by mixed sand beach/shore platform through to San Remo.
Cape Liptrap	the Spill EMBA intersects Waratah Bay, which comprises mostly sandy beaches and intertidal shore platforms. The shoreline around Cape Liptrap is dominated by mixed sand beach/shore platform in the southern area, shifting to mixed cobble/shingle beach/shore platform on the western side of the cape. North of this point, the shoreline is dominated by sandy beaches with small sections of mixed sand beach/shore platform in the more southerly reaches. These sandy beaches are noted to have large numbers of hooded plovers and are backed by the Cape Liptrap Coastal Park.
Wilsons Promontory West	the western parts of Wilsons Promontory intersected by the Spill EMBA are dominated by intertidal shore platforms and interspersed by sandy beaches, particularly in the bays (e.g., Oberon Bay, Norman Beach (Tidal River) and Darby Beach. The offshore islands in this sector (Kanowna, Cleft, Anser Group, Wattle, McHugh, Glennie Group and Norman islands) are all dominated by intertidal shore platforms and provide important breeding habitat for Little Penguins, Australian fur-seals and New Zealand fur-seals. All the islands are protected within the Wilsons Promontory Marine National Park (MNP) and Wilsons Promontory Marine Park.
Wilsons Promontory East	the shoreline of Wilsons Promontory East is dominated by intertidal shore platform in areas exposed directly to the sea. Sheltered bays, such as Waterloo Bay and Sealers Cove, are dominated by sandy beach and mixed sand beach/shore platform. At these locations, Freshwater Creek estuary and Sealers Creek estuary meet Bass Strait.
Marlo	the shoreline adjacent the township of Marlo is predominantly sandy beach until the Snowy River estuary, which is continuously open. East of Marlo is continuous sandy beach until Cape Conran where there are areas of intertidal shore platform. Areas of the sandy beach are noted as shorebird roosting sites and Hooded plover habitat.
Bemm River	The Bemm River section is predominantly sandy beach east of Cape Conran until Pearl Point, which is noted as mixed sand beach/shore platform. The shoreline east of Pearl Point is sandy beach other than the Tamboon and Sydenham Inlet estuaries, which are both noted as intermittently open. Coastal bird habitat and tern nesting sites are noted as both of the estuary sites.
Point Hicks	the shoreline intersected by the Spill EMBA is primarily sandy beach with isolated areas of intertidal shore platform and mixed sand beach/shore platform. The Thurra River estuary and Mueller River estuary (both intermittently open) are present east of Point Hicks. The Wingman Inlet estuary (continuously open) is located adjacent the Skerries and is identified as hooded plover habitat.
Mallacoota	the shoreline intersected by the Spill EMBA is dominated by mixed sand beach/shore platform with some continuous areas of sand beach present at Secret Beach and Quarry Beach. Four intermittently open estuaries are located along this stretch of coast. The shoreline east of Mallacoota is dominated by sand beach with mixed sand beach/shore platform present at Cape Howe on the Victoria/NSW border.
Whistler Point to Cataraqui (King Island)	From Point in the south of the island, the dominant coastal feature is rocky shoreline with small cliffs 5 m above the high-water mark (ListMap, 2020). There are small stretches of coarse grain sand beach or shoreline located in sheltered bays and coves, most notably at Fitzmaurice Bay and Porky Beach (ListMap, 2020). The capital of King Island (Currie) is also located along this stretch.
South of Cataraqui Point	very steep or vertical cliffs are present until Surprise Point, which features a pebble, cobble or boulder beach (ListMap, 2020). Extended stretches of coarse sand beach are located at Surprise Bay and Colliers Beach.
North of Whistler Point	there is a long stretch of coarse sand beach located at Cooper Bluff and Yellow Rock Beach (ListMap, 2020). At Cape Wickham on the northern cape of King Island, rocky shorelines are dominant until Disappointment Bay where a long stretch of sandy beach extends from Rocky Point down the east coast of the island until Naracoopa (ListMap, 2020).

1.3. Ecological Environment

The key sources of information for the species that may be present in the relevant Spill EMBAs are presented in this section from data obtained via the EPBC Act PMST and SPRAT databases, as well as the South-East Commonwealth Marine Reserves Network Management Plan 2013-23. A copy of the PMST is provided in Appendix J.

1.3.1. Plankton

Plankton is a key component in oceanic food chains and support nearly all marine life. Plankton is divided into two groups, namely phytoplankton (microscopic plants) and zooplankton (microscopic animals). Plankton is the dominant biomass of marine ecosystems (CSIRO, 2015). The Lifecyle and biological characteristics of Plankton is described in Section 4.1.

1.3.1.1. Bonney Upwelling

The primary ecological importance of the Bonney Upwelling is as a feeding area for the Pygmy Blue Whale (PBW) (*Balaenoptera musculus brevicauda*). The upwelled nutrient-rich water promotes blooms of coastal krill (*Nyctiphanes australis*), which in turn attracts PBW to the region to feed. The upwelling is one of only three identified feeding areas consistently used by PBW in Australian coastal waters (Butler et al., 2002). The upwelling occurs when strong south-easterly surface winds induce warm, nutrient-deficient surface waters away from the coastline. This leads to surface upwellings bringing cool, nutrient-rich deep waters closer to the surface where there is enough sunlight for primary production among planktonic organisms to take place (Hosack and Dambacher, 2012).

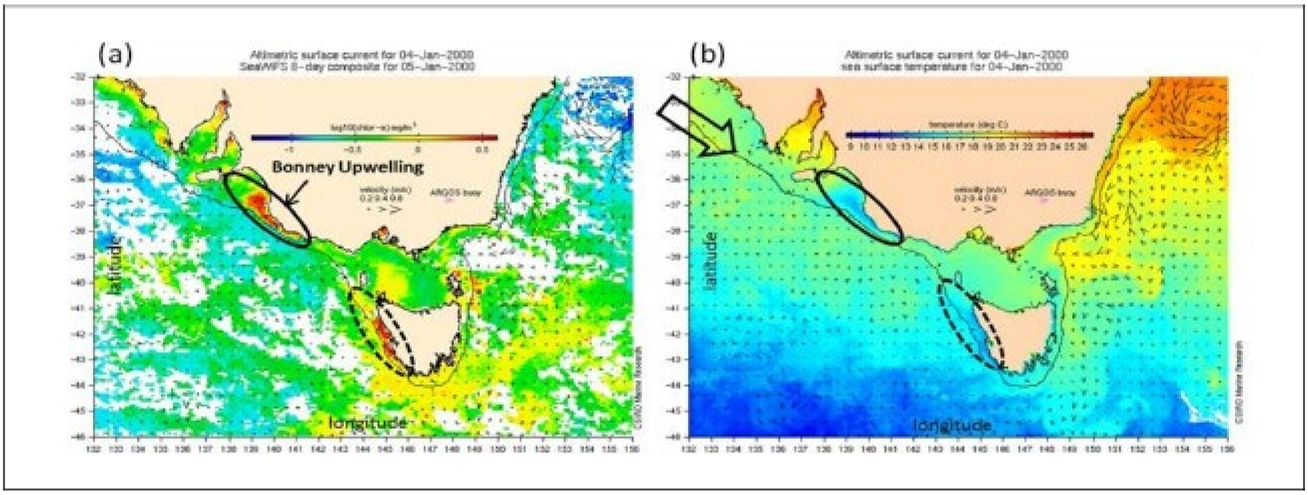
Plankton distribution from the upwelling area is dependent upon prevailing ocean currents including the Leeuwin Current, East Australia Current, flows into and from Bass Strait and Southern Ocean water masses. Populations are thought to be highly variable both spatially and temporally and are likely to comprise characteristics of tropical, southern Australian, central Bass Strait and Tasman Sea populations.

1.3.1.2. West Tasmanian Upwelling

A detailed analysis of satellite-derived ocean data (chlorophyll a levels) for the periods 1998-2000 and 2005- 2014 suggests that the western Tasmanian shelf also accommodates a productive ecosystem (Figure 1-7). Based upon the Kampf (2015) study, this region forms part of the Great South Australian Coastal Upwelling System and experiences two phytoplankton blooms per annum:

1. The first and larger bloom – occurs in the late austral summer months (typically February-April) resulting from favourable winds that occur between December-April. Stronger upwelling winds do not always create phytoplankton blooms.
2. The second smaller bloom – occurs in spring (October) coincident with the onset of spring bloom in the western Tasman Sea. The mechanism for this smaller bloom remains unclear.

Kampf (2015) identifies that the accuracy of satellite data cannot be used to identify upwelling jets however would suggest the existence of upwelling jets on the western Tasmanian shelf. The significance of these jets is that they operate to disperse nutrient-rich water northwards along the shelf and possibly into western Bass Strait. This advective process would explain elevated chlorophyll a level in western Bass Strait – a typical feature of the region during austral summer months. The western Tasmanian upwelling system lies to the west of the Tasmanian mainland and at least 130 km southeast of the acquisition area.



Source: Kmapf (2015)

Figure 1-7 Coastal Upwelling Event in early January 2000 evident in satellite derived distributions of (a) MODIS-OC3 chlorophyll a and (b) sea surface temperature. The large arrow in (b) indicates the pathway of the South Australian Current

1.3.2. Benthic Assemblages

Marine Flora

The subtidal and intertidal rocky reefs of Bass Strait, located closer to the shoreline of Victoria and Tasmania, are understood to have a high diversity of plant species including seagrasses and macroalgae. In sheltered parts of shallow bays, inlets and estuaries, seagrasses establish extensive underwater meadows that are critical in the early life stages of many fish species (refer to Section 4.3 for Fish).

Victorian Biodiversity Atlas (VBA) (DELWP, 2020) records for the Spill EMBA include 139 species of marine flora including red, green and brown algae species. The most commonly recorded genera in the Spill EMBA are detailed in Table 1-4.

Table 1-4: Commonly recorded marine flora species within the Spill EMBA

Species	Description
Crayweed (*Phyllospora comosa*)	Type of temperate 'forest-forming' seaweed, important as habitat for many marine species and also for producing oxygen and capturing atmospheric carbon. It is found in the oceans around Australia and New Zealand.
Red algae (*Jania rosea*)	Seaweed with hard, calcareous, branching skeleton and found in sheltered reef habitats, often in crevices or other shaded areas.
Brown algae (*Acrocarpia paniculata*)	This dark brown seaweed is distributed from the GAB, around Tasmania, through to Port Stephens, NSW. Typically grows to 1 m long.
Red algae (*Cheilosporum sagittatum*)	This species is a seaweed of temperate waters of Australia from Perth, WA, to Coffs Harbour, NSW, and around Tasmania.
Brown algae (*Ecklonia radiata*)	Kelp species that is found around the world. The species grows in kelp beds on reefs and where sheltered it can form dense forests. It can be found in the low intertidal zone to depths of approximately 25m.

Red algae (*Amphiroa anceps*)	Species is distributed all around Australia except for Tasmania.
Brown algae (*Cystophora retorta*)	Species is from Nickol Bay, WA, to Wilsons Promontory, VIC, and around Tasmania.

Benthic Assemblages

Williams et al. (2009) notes that in surveys conducted along the shelf edge (150-400 m water depths, where the continental shelf drops away sharply to form the continental slope), the following key habitats occur:

- Bryozoan thickets (dominated by emergent bryozoans and small erect sponges and ascidians), where giant crabs are caught;
- Low and/or encrusting bryozoans and sponges;
- Low microfauna in association with detritus; and
- Absence of epifauna (often with bioturbation).

A conceptual model was developed that divided the Otway bioregion continental margin into four depth related zones consisting of the shallow shelf, middle shelf, deep-shelf, shelf edge/upper slope (Figure 1-8). The Spill EMBA is across all five zones. A description of the benthic environment and species supported in each shelf is provided below:

- Shallow shelf (0 to 70 m) – contains exhumed limestone substrates that host dense encrusting mollusc, sponge, bryozoan and red algae assemblages with epifauna such as bivalves. This is observed in the Apollo Marine Reserve where the seafloor has many rocky reef patches inter-dispersed with areas of sediment and in places has rich benthic fauna dominated by sponges (DoE, 2015b). South-east Australia is also recognised as having one of the richest macrophyte floras in the world (409 genera with 1124 species) and the benthic algal communities include more than 200 species of which 165 species are rare (Butler et al., 2002).
- Middle shelf (70 to 130 m) - a zone of swell-wave shoaling and production of mega-rippled bryozoan and sponge sands;
- Deep shelf (130 to 180 m) - described as having accumulations of intensely bioturbated, fine, bioclastic sands supporting bryozoans, benthic forms and in-faunal echinoids; and
- At the shelf edge/upper slope (greater than 180 m) – supports aphotic bryozoan/sponge/coral communities.

Boreen *et al.* (1993) examined 259 sediment samples collected over the Otway Basin and the Sorell Basin of the west Tasmanian margin. Samples were taken during two research cruises (January/February 1987 and March/April 1988) on the RV Rig Seismic using dredges, corers, grabs and a heat-flow probe. Based on assessment of the sampled sediments the authors concluded the Otway continental margin is a swell-dominated, open, cool water, carbonate platform.

Invertebrate of Benthic Assemblages species within the Spill EMBA are summarised within section 1.3.2

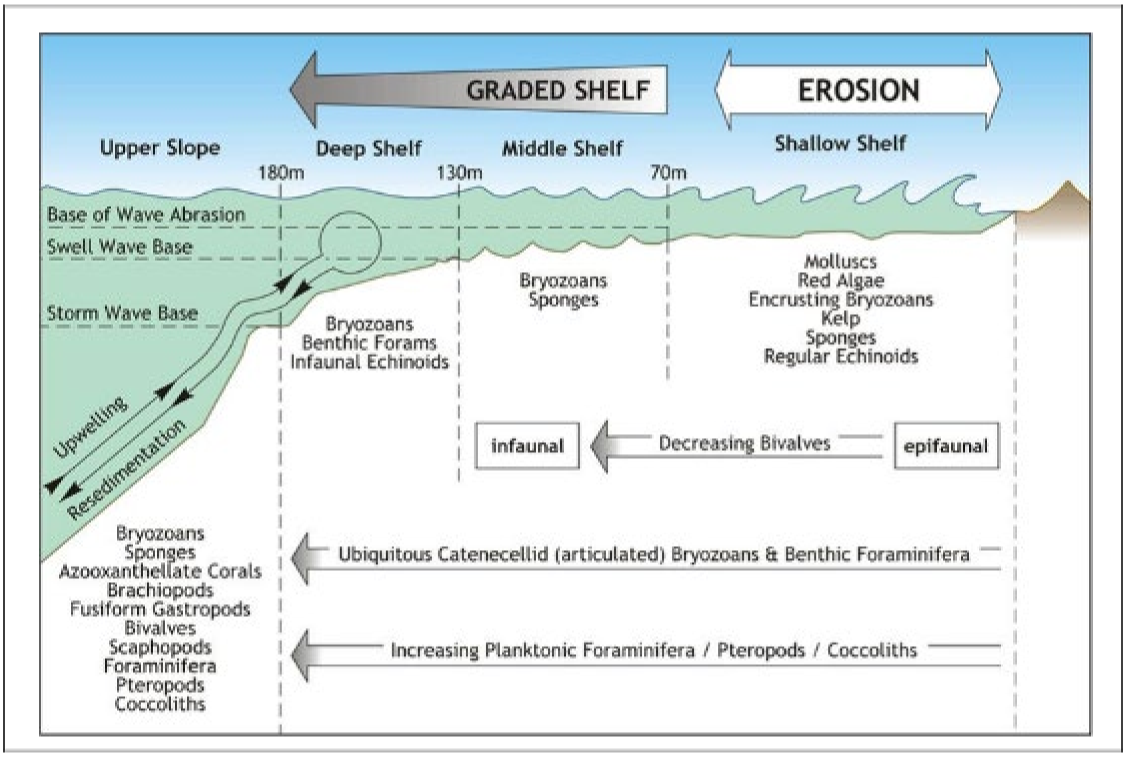


Figure 1-8 Model of the geomorphology of the Otway Continental Margin (Boreen et al., 1993)

Marine Canyons

Canyons are topographically complex seascapes, contain diverse bottom types, act as conduits for the passage of material down the continental slope and profoundly modify the hydrodynamic regime of the continental margin (Schlacher et al., 2007). As such, canyons are sites of both upwelling (Kämpf 2005), and downwelling (Wåhlin 2002).

Sponges (*Porifera*) play a key structural and functional role in the marine benthos. Sponges can profoundly modify the physical properties of the seafloor and influence the composition, abundance, and distribution of the fauna (Bett and Rice 1992).

In 2004, seafloor mapping and collection of sponges was undertaken at five prominent marine canyons in southeast Australia. Four of these canyons are located within the Spill EMBA including King Island Canyons, Hole, Pieman Canyon and Big Horseshoe Canyon (Figure 1-9) (Schlacher et al., 2007). The survey identified a rich sponge fauna array in the canyons with a relatively small collecting effort. A total of 14 sled samples yielded 165 species, 65 genera, 41 families and 10 orders (Schlacher et al., 2007). Broad comparison with seamounts in the Tasman and Coral Seas indicate that the canyon megabenthos may rival or exceed that of seamounts in terms of sponge richness. Seamounts are conventionally regarded as benthic hotspots in the deep sea, characterised by high levels of benthic biomass, diversity and endemism (Richer de Forges et al., 2000).

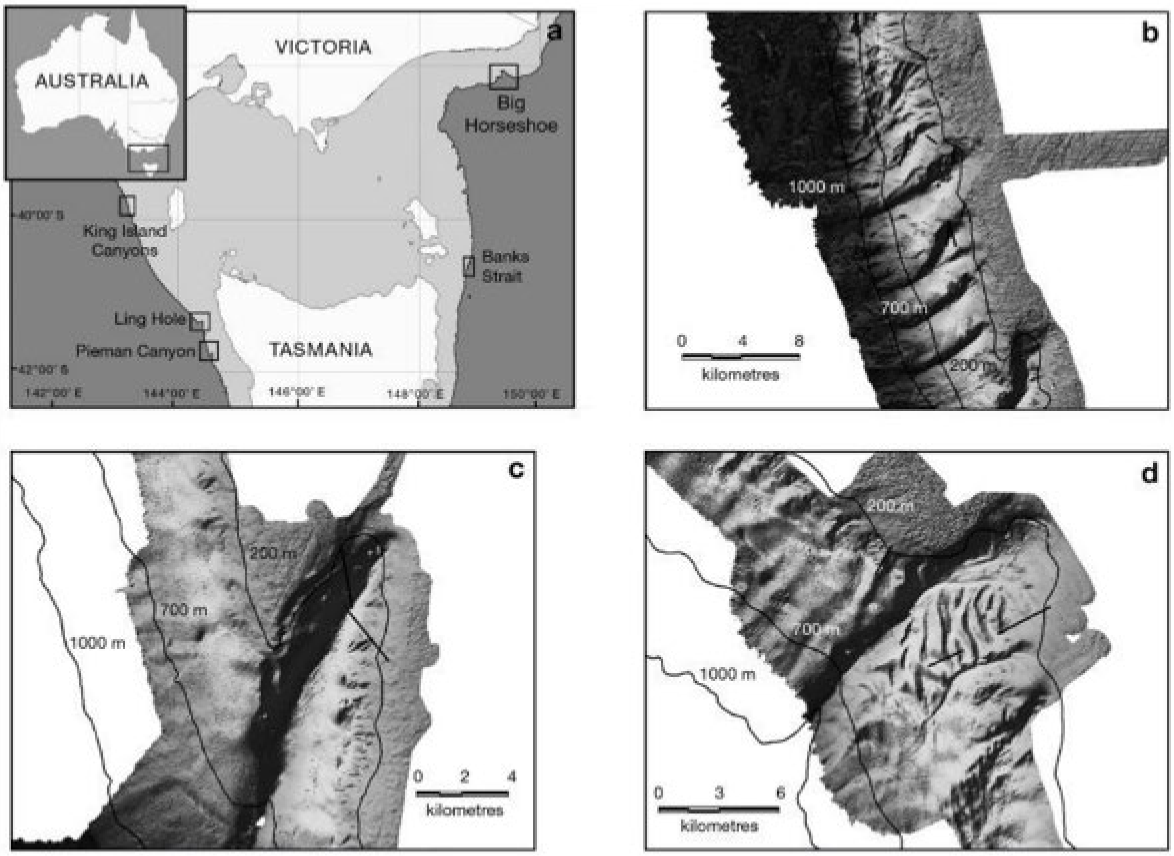


Fig. 1. (a) Locations of canyon sampling sites off southeastern Australia; (b) King Island canyons; (c) Pieman canyon; (d) Ling Hole canyon. Depth contours are 200, 700 and 1000 m as labelled; locations of sled transects are shown as straight lines

Source: Schlacher et al (2007).

Figure 1-9 Marine canyons sampled in southeast Australia

1.3.3. Marine Invertebrates

The Bass Strait region is known to consist of marine invertebrates such as porifera (sponges); cnidarians (e.g., jellyfish, corals, anemones, sea-pens); bryozoans (filter feeders); arthropods (e.g., sea spiders); crustaceans (e.g., rock lobster, giant crab, krill); molluscs (e.g., bivalves, sea slugs, gastropods); echinoderms (e.g., urchins, sea cucumbers); and annelids (e.g., polychaete worms).

There is little targeted information available on the nature or distribution of epibiota for central Bass Strait, but data is available for the wider Bass Strait from the Museum of Victoria biological sampling programs conducted from 1979 to 1983 (Wilson and Poore, 1987).

Studies by the Museum of Victoria (Wilson and Poore, 1987; Poore et al., 1985) found that invertebrate diversity was high in southern Australian waters although the distribution of species was patchy, with little evidence of any distinct biogeographic regions. The results of invertebrate sampling undertaken in shallower inshore sediments indicate a high diversity and patchy distribution. In these areas, crustaceans, polychaetes, and molluscs were dominant (Parry et al., 1990). This information can be used to extrapolate existing conditions for central Bass Strait.

Generally, the epibiota of the region is sparse and characterised by scallops and other large bivalve molluscs, crabs, seasquirts, seapens, urchins, lampshells, polychaete worms, sponges and bryozoans. A variety of mobile crabs, prawns and brittle stars are also relatively common. Many of the mobile epibiota appear to occur in aggregations from time to time (scallops, prawns and crabs) while some of the fixed epibiota occur in patches (sponges and bryozoans). For example, trawling conducted for the Museum of Victoria biological sampling programs recorded large hauls of sponges along some trawl transects. The main hauls of sponges were located in an arc around southern Bass Strait (Passlow, et al., 2006). These sessile invertebrates, including sponges, bryozoans, hydroids and ascidians, form single species or mixed aggregations on the seabed that increase the vertical structure of benthic habitat and provide shelter from predators on the seafloor (Maldonado et al., 2017). Due to the increased habitat complexity that sponge assemblages provide, these areas are associated with localised increases in biodiversity (Maldonado et al., 2017). It is likely that the sponges referred to in Butler et al (2002) and Maldonado et al. (2017) provide a similar ecosystem function when aggregations form in Bass Strait.

These sediments generally have a lower productivity than seagrass and macroalgal beds due to the absence of large photosynthesising plants, however they are often rich in small invertebrates that live on microscopic algae, bacteria and food particles in the passing water. These in turn provide food for larger surface dwelling and burrowing invertebrates, which in Tasmanian waters are dominated by crustaceans, polychaete worms, gastropods and bivalve molluscs (Parsons, 2011).

More detailed information about Southern Rock Lobster, Giant Crab, and Molluscs within the Operational Area can be found in Section 4.2 – Invertebrates.

1.3.4. Fish

It is estimated that there are over 500 species of fish found in the waters of Bass Strait, including a number of species of importance to commercial and recreational fisheries (LCC, 1993). Fish species commercially fished in and the Spill EMBA are listed in Section 4.3.

There are 45 fish species listed under the EPBC Act with potential to occur in the Spill EMBA (Full PMST results are listed in Appendix K). This includes 15 species listed as threatened, four species listed as migratory and a further 30 listed marine species all of which are Sygnathiformes (seahorses, pipefishes and their relatives). Of the 15 species listed as Threatened within the Spill EMBA seven are described in Section 4.3 with a summary of the remainder detailed in Table 1-5.

A total of two Biological Important Areas (BIA) for fish species occur within the Spill EMBA. These include the Breeding and Foraging BIAs for the White Shark (*Carcharodon Carcharias*) and the Foraging and Migration BIA for the Grey Nurse Shark (east coast population) (*Carcharias Taurus*) (Section 5.4 MDO release).

The EPBC fish species in the Spill EMBA are described in this Section.

Table 1-5 Fish species within the Spill EMBA not previously described within Section 4.3

	Likely Habitat
Dwarf Galaxias (EPBC Act: Vulnerable)	Habitat suitable to the Dwarf Galaxias is slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks, often (but not always) containing dense aquatic macrophytes and emergent plants (Saddlier et al., 2010; DELWP, 2015). There are 46 rivers and wetlands that are listed in the Dwarf Galaxias Action Statement (DELWP, 2015) as being important to the species, none of which are intersected by the Spill EMBA.
Grey Nurse Shark (east coast population) (EPBC Act: Critically Endangered)	The species currently has a broad inshore distribution throughout sub-tropical to cool temperate waters on the continental shelf, with separate east coast and west coast populations (DoE, 2014b). The east coast population extends from central Queensland to southern NSW, occasionally as far south as the NSW/Victoria border (DoE, 2014b), which coincides with the BIA for their migration and breeding (October to November). The southern extent of this BIA is intersected by the Spill EMBA. Preferred habitat for Grey Nurse Sharks is inshore rocky reefs or islands, generally aggregating near the seabed in water depths of 10 – 40 m in deep sandy or gravel filled gutters, or in rocky caves (DoE, 2014b). There are no known aggregation sites located off the Victorian coast (DoE, 2014b). Given the current distribution of the Grey Nurse Shark, it is unlikely to occur within the Spill EMBA in significant numbers.
Black Rockcod (EPBC Act: Vulnerable)	The Black Rockcod (*Epinephelus daemelii*) is a large cod species distributed in warm temperate to temperate marine waters of south-eastern Australia, from southern Queensland to Mallacoota in Victoria, and rarely south of this point (DSEWPC, 2012a). The species inhabits caves, gutters and crevices generally to depths of 50 m, with juveniles found inshore. Individuals are highly territorial and have small home ranges (DSEWPC, 2012a). The Black Rockcod is a protogynous hermaphrodite, meaning it changes sex from female to male during its life cycle. Overfishing by commercial and recreational line fishers caused the first localised declines of the black cod in the early 1900s (DSEWPC, 2012c). Given their known distribution, the Black Rockcod may occur in suitable habitat within the far-eastern extent of the Spill EMBA north of Mallacoota.
Whale Shark (EPBC Act: Vulnerable, listed migratory)	The Whale Shark (*Rhincodon typus*) is the world's largest fish and one of only three filter feeding shark species (TSSC, 2015a). They have a broad distribution in warm and tropical waters of the world, and in Australia are known only to occur on the west coast of Western Australia, with a feeding aggregation occurring off the Ningaloo Reef between March and July each year (TSSC, 2015a). The most significant threat to whale sharks is intentional and unintentional mortality from fishing outside of Australian waters. In Australian waters, threats to the recovery of the species include boat strike from large vessels and habitat disruption from mineral exploration, production and transportation. Other less important threats include disturbance from domestic tourism operations, marine debris and climate change (TSSC, 2015a). The species is not known to migrate through Bass Strait, and it is highly unlikely to occur within the Spill EMBA.
Bullneck Sea Horse (Listed marine species)	The Bullneck Seahorse (*Hippocampus minotaur*) is a pygmy seahorse in the genus Hippocampus. This seahorse has never been found in the wild, and little is known about its natural habitat. The only known specimens were collected on the coast of Eden, Australia. Scientists believe it lives in sand beds at the bottom of the ocean (more than 100 meters underwater) and may inhabit gorgonian corals.
Trawl and Mollinson's pipefish (Listed marine species)	Trawl Pipefish are endemic to temperate waters of Southern Australia, from off Nowra, NSW and eastern Tasmania to Port Lincoln, South Australia. It inhabits rubble and shelly substrates on the continental shelf at 10 – 204 m. Mollinson Pipefish are Endemic to temperate waters of Victoria and Tasmania. Known in Victorian waters from Western Port and Port Phillip Bay, and from south-eastern Tasmania. Mollison's Pipefish live amongst brown macroalgae on rocky reef at 7 – 45 m.
Southern Bluefin Tuna (EPBC Act: Conservation Dependent)	Southern Bluefin Tuna (*Thunnus maccoyii*) are recorded from every Australian state but absent from the coasts of the Northern Territory and northern Queensland, and very rare in central and western Bass Strait (DAWE, 2020b). Elsewhere the species is circum-global in temperate and cold temperate waters of the southern hemisphere. Southern Bluefin Tuna breed between October and March in an area off Java, Indonesia and migrate down the Western Australian coast during their first year (DAWE, 2020b). Some fish then head west into the Indian Ocean, while others head eastwards into the Great Australian Bight. It is unlikely that Southern Bluefin Tuna occur in in the Spill EMBA.

	Likely Habitat
Spotted handfish (EPBC Act: Critically Endangered)	The Spotted Handfish (*Brachionichthys hirsutus*) is endemic to the Derwent Estuary (northern Tasmania) and adjacent areas in south-eastern Tasmania. It inhabits shallow protected coastal bays with sandy and shelly substrates at depths to 60 m (DSEWPC, 2012b).
Ziebell's Handfish (EPBC Act: Vulnerable)	Ziebell's Handfish *(Brachiopsilus ziebelli*) is known only from eastern and southern Tasmania - in the southern parts of the D'Entrecasteaux Channel, Cox Bight in south-west Tasmania, and the Forestier and Tasman Peninsulas, and off Bicheno, eastern Tasmania (DAWE, 2020b). The species inhabits rocky areas and soft bottoms, often near rocky patches with sponge and macroalgal communities. Females lay their egg masses around sponges in depths of about 20 m (DAWE, 2020b). Ziebell's handfish is unlikely to occur in the Spill EMBA.
Harrisson's Dogfish (EPBC Act: Conservation Dependent)	In Australian waters, Harrisson's Dogfish (*Centrophorus harrissoni*) is distributed off the Clarence River, New South Wales, to off South East Cape, Tasmania, and from Fraser Seamount, Queensland, to Taupo Seamount, NSW (DAWE, 2020b). The main threat to Harrisson's Dogfish in Australian waters was population reduction caused by past fishing pressure in both state and Commonwealth-managed commercial fisheries operating on the upper-slope (Wilson et al., 2009). Harrisson's Dogfish populations are estimated to have declined by more than 90% in parts of their range off southern NSW and eastern Victoria. As a result, the species was listed as Conservation Dependent under the EPBC Act in June 2013. It may be present in the Spill EMBA.
Southern dogfish (EPBC Act: Conservation Dependent)	The Southern Dogfish (*Centrophorus zeehaani*) is distributed along the continental slope of southern Australia from off Forster (NSW) to Bunbury (WA), including Tasmania, in depths of 200 – 700 m, but usually in depths below 400 m (DAWE, 2020b). Southern dogfish undertake day-night migrations across their depth range from relatively deep daytime residence depths (1,000 m) to shallower night-time feeding depths (to 200 m). This species habitat preferences indicates that it is likely to occur in the Spill EMBA.
Scalloped Hammerhead (Sphyrna lewini) EPB Act: Conservation dependent	The Scalloped Hammerhead (*Sphyrna lewini*) are found globally in tropical and sub-tropical waters. In Australia they extend across northern Australia and throughout the Torres Strait, the Great Barrier Reef, the Coral Sea and south through Sandy Strait into NSW. Globally, Scalloped Hammerheads are listed as Endangered by the IUCN Red List of Threatened Species. They are born in shallow coastal habitats and embayment's throughout the year although more common late spring and summer. They are known to be highly migratory and form aggregations, but their aggregation is unknown in Australian waters (Harry and Tobin, 2014). It is possible that they may be present in the Spill EMBA, but distribution is not clear.

1.3.5. Cetaceans

Cetaceans are a group of marine mammals that include whales, dolphins and porpoises. The PMST for the Spill EMBA (Appendix K) identified 32 cetacean species, 5 listed as threatened and 11 as migratory. The five species listed as threatened (Blue Whale (*Balaenoptera musculus*), Humpback Whale (*Megaptera novaeangliae*), Southern Right Whale (SRW) (*Eubalaena australis*), Fin Whale (*Balaenoptera physalus*) and Sei Whale (*Balaenoptera borealis*)) are described in Section 4.5.2 to 4.5.4. Biological Import Areas occur for three species within the Spill EMBA (Section 5.4). These are for the Humpback Whale (foraging), the Pygmy Blue Whale (foraging, known foraging, foraging (annual high use area)) and the Southern Right Whale (connecting habitat, aggregation, breeding, migration and resting on migration).

1.3.6. Pinnipeds

The PMST for the Spill EMBA (Appendix K) shows five EPBC listed pinniped species within the Spill EMBA. The Australia Fur-seal and the New Zealand Fur-seal have been previously described in Section 4.5.6. The three remaining EPBC listed pinnipeds listed within the Spill EMBA are detailed in Table 1-6. There are no BIA for pinnipeds within the Spill EMBA.

Table 1-6 Pinniped species within the Spill EMBA not previously described

Species	Likely Habitat
Southern Elephant Seal (EPBC Act: Vulnerable, listed marine)	Elephant seals (*Mirounga leonine*) have a nearly circumpolar Southern Hemisphere distribution with most breeding colonies and haul-out areas occurring on subantarctic islands north of the seasonal pack ice zone (TSSC, 2016a). Within Australian jurisdiction, Southern Elephant Seals breeds and hauls-out on Macquarie Island (1,900 km southeast) and Heard Island (5,500 km southwest). Historically, Southern Elephant Seal populations occurred on islands of western Bass Strait before these were extirpated by European sealers (TSSC, 2016a). In 2005, the world population was estimated at between 664,000 and 740,000 animals occurring in the South Atlantic, South Indian and Pacific Oceans. Tracking studies have indicated the routes travelled by elephant seals, demonstrating their main feeding area is at the edge of the Antarctic continent. Currently, occasional pupping is seen on Maatsuyker Island (426 km south) in southern Tasmania where 12 individuals were recorded in 2015. The species is threatened by climate and oceanographic variability and change, fisheries catch and entanglement, prey depletion due to fisheries and pollution including marine debris (TSSC, 2016a). Given the known distribution of southern elephant seals it is unlikely to occur in significant numbers in the Spill EMBA.
Subantarctic Fur-seal (EPBC Act: Endangered, listed marine)	The species has a wide southern hemisphere distribution and a dispersed breeding distribution on isolated subantarctic and subtemperate islands north of the Antarctic polar front. In the Australian region, the only established breeding colony occurs on Macquarie Island, located. (TSSC, 2016b). Juvenile vagrants have been recorded to reach the southern shores of Tasmania and the mainland with 50 individuals recorded from NSW to WA since the 1970s. The species is threatened but climate and oceanographic variability and change, predation of pup cohort at Macquarie Island, fisheries entanglement and bycatch and pollution (TSSC, 2016b). Given the locations of recordings of subantarctic fur-seals in the Spill EMBA, it is highly unlikely that the species is present in the Spill EMBA.
Australian Sea-lion (EPBC Act: Vulnerable, listed marine)	The Australian Sea-lion is endemic to southern Australia and its core range is located from Kangaroo Island (SA) (609 km northwest) to the Houtman Abrolhos Islands (WA) (2,900 km northwest) (TSSC, 2010). Australian Sea-lions regularly visit haul-out sites and breeding colonies on remote sections of coastline and have been sighted at over 200 locations. Historically, the main threat to the species was over-harvest due to commercial hunting. Although this threat does not still occur, populations have not yet recovered to pre-exploitation levels. Interactions with the commercial gillnet fishery, Southern Rock Lobster fishery and death caused by fishery-related equipment are current threats to the species. The species may be present in the Spill EMBA, though in low numbers as vagrant individuals given the low number of sightings. Breeding colonies in Bass Strait recorded by Shaughnessy (1999) for both the Australian and New Zealand Sea-lion (Section 4.5.6.1) and OSRA mapping within the region of the Sequoia MSS are listed below and detailed in **Error! Not a valid result for table.**: • Reid Rocks, which is located 50 km east of the Operational Area and is intersected by the EMBA • Lady Julia Percy Island (130 km northwest of the Operational Area) • Seal Rocks (intersected by the EMBA) (25% of the breeding population and 154 km northeast of the Operational Area) • Cape Bridgewater (145 km northwest of the Operational Area) • Kanowna Island (10,700 adults and 2,700 pups, 238 km east of the Operational Area) • Anser Group of Islands (all more than 240 km east of the Operational Area) • Rag Island (1,000 fur seal and 235 pups in 2006, 275 km east of the Operational Area). Haul-out sites in Bass Strait for both the Australian and New Zealand Sea-lion (Section 5.4), as reported by Barton et al (2012), Carlyon et al (2011) and OSRA (2017), are listed below **Error! Not a valid result for table.**:

Species	Likely Habitat
	• West Moncoeur Island (south of Wilson's Promontory, 255 km east of the Operational Area) • The Hogan Islands Group (297 km east of the Operational Area) • Kanowna Island (238 km east of the Operational Area) - ~300 individuals • Beware Reef (483 km northeast of the Operational Area, seals present most of the year) • Gabo Island (589 km northeast of the Operational Area) – 30-50 individuals.

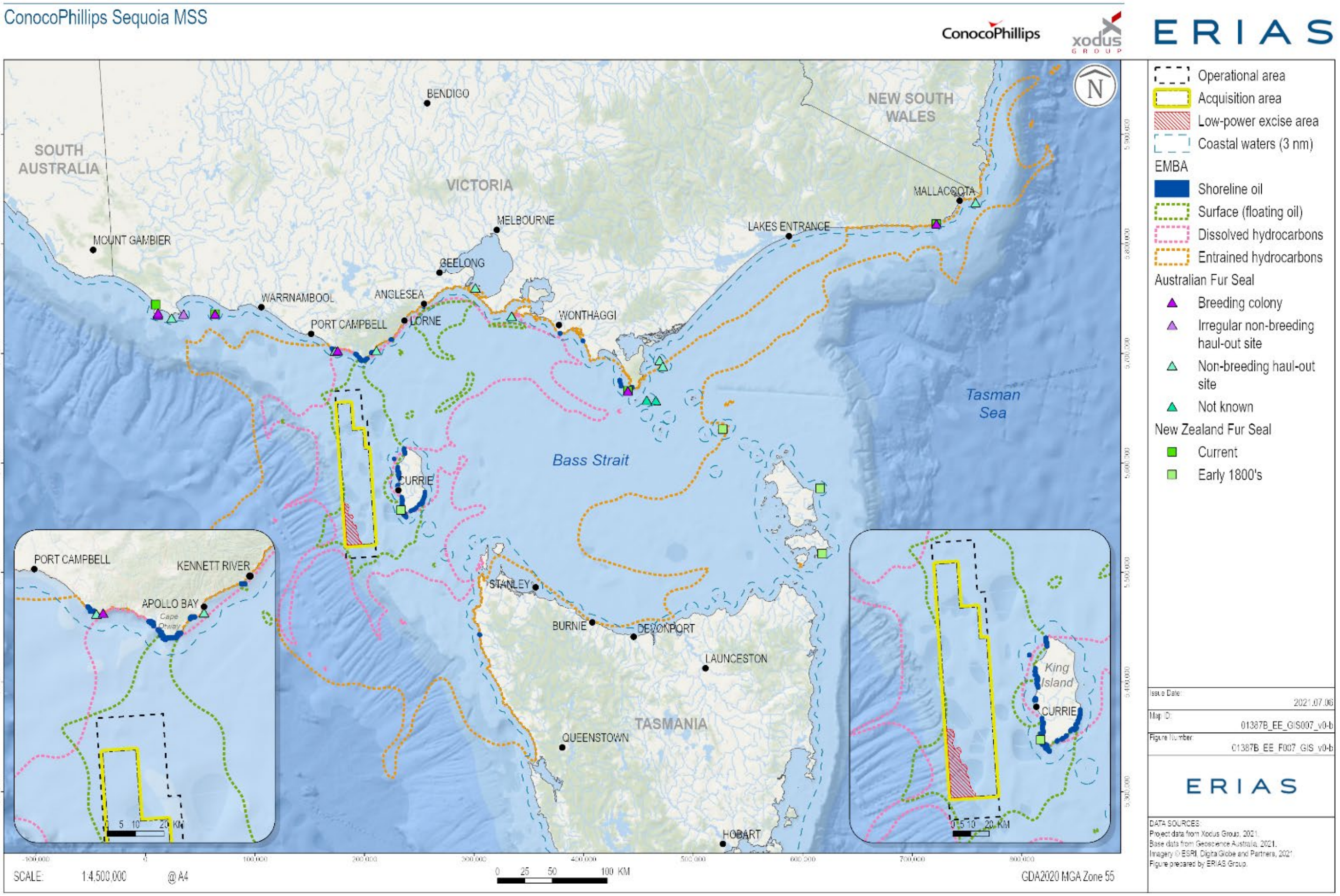


Figure 1-10 Australian and New Zealand Fur-seal Breeding colonies and haul-out sites intersected by the Operational Area and Spill EMBA

1.3.7. Marine Reptiles

Five species of reptiles in total were indented in the PMST search for the Spill EMBA (Appendix K) with all five listed as threatened. The Loggerhead Turtle (*Caretta caretta*), Green Turtle (*Chelonia mydas*) and Leatherback Turtle (*Dermochelys coriacea*) are described in Section 4.6. The Hawksbill Turtle (Eretmochelys imbricate) and the Flatback Turtle (Natator depressus) are described in Table 1-7. There are no BIAs for turtles in the Otway.

Wilson and Swan (2005) report that 31 species of sea snake and two species of sea kraits occur in Australian waters, though none of these occurs in waters of the southern coast of Australia, with the exception of the yellow-bellied sea snake (*Pelamis platurus*) that extends into waters off the Victorian coast. This species is the world’s most widespread sea snake and feeds on fish at the sea surface (Wilson and Swan, 2005).

Table 1-7 Turtle species within the Spill EMBA not previously described

Receptor	Likely Habitat
Hawksbill turtle (EPBC Act: Vulnerable, listed migratory)	The Hawksbill Turtle (*Eretmochelys imbricate*) is widely distributed in the tropical and subtropical waters of Australia. Their eggs are laid on warm beaches with the most important nesting sites for the species located in northern Queensland, northeast Arnhem Land and Western Australia (DoEE, 2017a). Adult Hawksbill Turtles are primarily found in tropical reefs where they are usually seen resting in caves and ledges or otherwise feeding on sea sponges. No major nesting sites have been recorded in Victoria or Tasmania, however the DoEE (2017a) maps the Hawksbill Turtle as having a known or likely range in eastern Bass Strait. There has been one sighting of the species recorded in the Spill EMBA (CIE, 2020). The Spill EMBA does not intersect any nesting beaches of the Hawksbill Turtle; it possibly occurs in the Spill EMBA as a vagrant.
Flatback turtle (EPBC Act: Vulnerable, listed migratory)	In Australia, the Flatback Turtle (*Natador depressus*) is found only in the tropical waters of northern Australia, where it feeds on soft-bodied prey. Nesting occurs only in these tropical waters. The DAWE (2020d) maps the flatback turtle as having a known or likely range north of the Victorian/NSW border. The CIE database (2020) does not contain any records of this species on the southern coast of Australia. This species could be encountered in the far eastern extent of the Spill EMBA.

1.3.8. Seabirds and Shorebirds

The focus of this section is true seabirds (i.e., birds of the order *Procellariiformes*) and true shorebirds (i.e., birds of the order *Charadriiformes*). Seabirds are those whose normal habitat and food source is derived from the sea, whether that be coastal or offshore, while shorebirds spend more of their time (nesting, feeding and breeding) on the shoreline and do not swim. The species descriptions provided in this chapter are focused on species that are listed as threatened under the EPBC Act.

The PMST for the Spill EMBA (Appendix K) identified 101 EPBC listed seabirds and shore birds. Of these 47 are listed as threatened respectively. In addition, 29 species have Biological Important Areas within the Spill EMBA. Figures for these are presented in Section 5.4.

Several seabirds and shorebirds have previously been described in Section 4.4. Other seabird and shorebird species that occur within the Spill EMBA are described within Table 1-8.

Table 1-8 Seabird and shorebird species within the Spill EMBA not previously described

Receptor	Likely Habitat
Albatrosses and Petrels (EPBC Act Endangered and Vulnerable, migratory, listed marine)	Albatrosses and Giant-Petrels are among the most oceanic of all seabirds, and seldom come to land unless breeding (DSEWPC, 2011b). Many species, such as Antipodean Albatross, are extremely dispersive, spending most of their time over the pelagic waters of the oceans while others like adult shy albatrosses, tend to remain sedentary, regularly foraging over coastal waters throughout their adult lives (DSEWPC, 2011b). Albatross and Giant Petrel species exhibit a broad range of diets and foraging behaviours, and hence at-sea distributions are diverse. Combined with their ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat, however the most critical foraging habitat is southern waters where many species spend the majority of their foraging time (DSEWPC, 2011b). They have a widespread distribution throughout the southern hemisphere. They feed mainly on cephalopods, fish and crustaceans, using surface feeding or plunge diving to seize their prey (ACAP, 2011). Albatrosses are colonial, usually nesting on isolated islands and foraging across oceans in the winter months with most observations along the edge of the continental shelf (DSEWOC, 2011b). Of the species listed, the Wandering Albatross, Black-browed Albatross, Grey-headed Albatross and Shy albatross breed in Australian jurisdictions (DSEWPC, 2011b). The remaining species forage in Australian waters. The closest breeding island is Albatross Island (TAS) (intersected by the Spill EMBA); and Macquarie Island which has Black-browed Albatross, Grey-headed Albatross and Wandering Albatross (outside the Spill EMBA) (ACAP, 2011; DSEWPC, 2011b). Many of the albatross and giant petrel species listed are formally managed under the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPC, 201ba) and contain BIAs within the Spill EMBA. There are numerous threats to albatrosses both on terrestrial breeding sites and at-sea in their foraging habitat (DSEWPC, 2011b). The most pervasive threat to albatross and giant petrel survival is the accidental mortality and injury arising from interactions with human fishing activities (DSEWPC, 2011b). Albatross are likely to overfly and forage in the Spill EMBA.
	The petrel species listed are oceanic and have a widespread distribution throughout the southern hemisphere. They are colonial and breed on sub-Antarctic and Antarctic islands in a circumpolar band generally between 40°S and 60°S. Petrel species feed on small fish, cephalopods (octopus, squid and cuttlefish) and crustaceans along the edge of the continental shelf and open waters (DSEWPC, 2011b). The closest breeding islands to the, but outside the Spill EMBA, are Maatsukyer Island (TAS) (Soft Plumaged Petrel, ~185 km south of the Spill EMBA) and Macquarie Island (Blue Petrel, Northern and Southern Giant petrels, ~1,700 km southeast of Spill EMBA) (ACAP, 2011; DSEWPC, 2011b). Petrels are likely to overfly and forage in the Spill EMBA.
Fairy prion (southern) (EPBC Act: Vulnerable, listed marine)	The Southern Fairy Prion (*Pachyptila turtur subantarctica*) is mainly found offshore. The species diet is comprised mostly of crustaceans (especially krill), but occasionally includes some fish and squid. It feeds mainly by surface-seizing and dipping but can also catch prey by surface-plunging or pattering (Birdlife Australia, 2020). In Australia, it is known to breed only on Macquarie Island (~1,700 km southeast of the Spill EMBA) (Birdlife Australia, 2020). No BIA for this species lies within the Operational Area or Spill EMBA (DAWE, 2020c). The approved conservation advice for the species notes that key threats include predation, soil erosion and flooding on Macquarie Island (TSSC, 2015e). The Southern Fairy Prion is likely to be present in the Spill EMBA or Operational Area but not in large numbers.
Shorebirds and coastal species plovers	There are six EPBC Act-listed plovers (Double-banded, Greater Sand, Lesser Sand, Pacific Golden, Grey and Hooded) that may occur within the Spill EMBA. Plovers are medium sized wading birds that have wide-ranging coastal habitats comprising estuaries, bays, mangroves, damp grasslands, sandy beaches, sand dunes, mudflats and lagoons (Flegg, 2002), with roosting also taking place on sand bars and spits. Plovers feed on a range of molluscs, worms, crustaceans and insects. Plovers (with the exception of the Hooded and Red-capped Lovers) breed in Asia and the Artic region and are more likely to be present in Australia during summer, depending on the species.

Terns	There are four EPBC Act-listed tern species (Caspian, Little, Fairy and Crested) that may occur within the Spill EMBA. Terns are slender, lightly built birds with long, forked tails, narrow wings, long bills, and relatively short legs. Many of the tern species present along the southern Australian coastline are widespread and occupy beach, wetland and grassland habitats. Terns rarely swim; they hunt for prey in flight, dipping to the water surface or plunge-diving for prey (Flegg, 2002) usually within sight of land for fish, squid, jellyfish and sometimes crustaceans (DEHWA, 2007). The main identified potential threat to the species in Victoria is an oil Spill where the proximity of oil facilities poses a risk to breeding habitat. Given the location of its foraging BIA in South Australia, the tern is likely to be an uncommon visitor to the Spill EMBA.
Sandpipers	There are seven EPBC Act-listed sandpiper species (Common, Sharp-tailed, Pectoral, Broad-billed, Marsh and Terek) that may occur within the Operational Area and Spill EMBA. Sandpipers are small wader species found in coastal and inland wetlands, particularly in muddy estuaries, feeding on small marine invertebrates (Birdlife Australia, 2020). Sandpipers breed in Europe and Asia and migrate to Australia during the southern summer (Birdlife Australia, 2020). The Curlew Sandpiper (EPBC Act: Critically endangered) is a common visitor during the Australian summer, congregating in large flocks, sometimes comprising thousands of birds, at sheltered intertidal mudflats and also at the muddy margins of terrestrial wetlands (Birdlife Australia, 2020). They often mix with other species of shorebirds, pecking at invertebrates on the surface of the mud or making shallow probes below its surface, sometimes wading in belly-deep water while probing. Feeding becomes more intense as migration time approaches, with birds fuelling up for their long flight back to their breeding grounds in Siberia. Up to 1,800 Curlew Sandpipers are known to congregate to feed at the Gippsland Lakes (outside the Spill EMBA). The Wildlife Conservation Plan for Migratory Shorebirds (DoE, 2015d) notes that threats to species such as sandpipers include habitat loss, habitat modification, anthropogenic disturbance, climate change, harvesting of prey species, fisheries by-catch and hunting. Sandpipers may be present along shorelines of the Spill EMBA during spring and summer.
Snipes	There are four EPBC-Act listed snipe species (Latham's, Swinhoe's, Pin-tailed and Australian Painted) that may occur within the Spill EMBA. These snipe species (other than the Australian Painted Snipe, which is endemic to Australia) are present during the southern hemisphere summer (breeding in Asia and Russia in the northern hemisphere summer). The Australian Painted Snipe (*Rostratula australis*) (EPBC Act: Endangered) is a medium-sized wader that roosts among dense vegetation around the edge of wetlands, especially temporary ones which have muddy margins and small, low-lying islands where it feeds on seeds and invertebrates (Birdlife Australia, 2020). The species is known to occur at Mallacoota Inlet. The nest of the species is usually a scrape in the ground lined with twigs and stalks of grass. It is threatened by the loss and degradation of wetlands, through drainage and diversion of water for agriculture and reservoirs (Birdlife Australia, 2020). The approved conservation advice for the Australian painted snipe lists loss and degradation of wetlands through drainage and diversion to be the primary threat to the species (DSEWPC, 2013a).
Godwits	There are three EPBC Act-listed godwit species (Bar-tailed, Northern Siberian and Black-Tailed) that may occur within the Operational Area and Spill EMBA. Godwits are large waders that are found around all coastal regions of Australia during the southern hemisphere summer (breeding in Europe during the northern hemisphere summer), though the largest numbers remain in northern Australia. The Bar-tailed Godwit (EPBC Act: Vulnerable) and the Northern Siberian Bar-tailed Godwit (EPBC Act: Critically endangered) arrive in Australia each year in August from breeding grounds in the northern hemisphere. They are commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit where they forage on intertidal mudflats or sandflats, in soft mud or shallow water and occasionally in shallow estuaries where they feed on annelids, crustaceans, arachnids, fish eggs and spawn and tadpoles of frogs, and occasionally seeds. (Birdlife Australia, 2020). The Wildlife Conservation Plan for Migratory Shorebirds (DoE, 2015g) notes that threats to migratory species such as godwits include habitat loss, habitat modification, anthropogenic disturbance, climate change, harvesting of prey species, fisheries by-catch and hunting.

Knots	The Red Knot (EPBC Act: Endangered) and Great Knot (EPBC Act: Critically endangered) are EPBC Act-listed species that may occur within the Spill EMBA during summer. Both the Red Knot and Great Knot have a coastal distribution around the entire Australian coastline when it is present during the southern hemisphere summer (breeding in eastern Siberia in the northern hemisphere summer). The Red Knot is a medium-sized wader that prefers sandy beach, tidal mudflats and estuary habitats, where they feed on bivalve molluscs, snails, worms and crustaceans (Birdlife Australia, 2020). The Great Knot inhabits intertidal mudflats and sandflats in sheltered coasts, including bays harbours and estuaries. They forage on the moist mud, and they often roost on beaches or in nearby low vegetation, such as mangroves or dune vegetation. Lake Reeve (outside the Spill EMBA) has supported the largest concentration (5,000) of Red Knot recorded in Victoria. Migratory shorebirds, such as knots are sensitive to certain development activities due to their high site fidelity, tendency to aggregate, very high energy demands, and need for habitat networks containing both roosting and foraging sites. Habitat loss and degradation through land reclamation, urban expansion, hydrological changes, pollution and exploitation of shellfish are all threats to knots.
Eastern Curlew (EPBC Act: Critically endangered	The Eastern Curlew (*Numenius madagascariensis*) is the largest wader that visits Australia, with a very long down-curved bill. The species is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons (Birdlife Australia, 2020). The Eastern Curlew is widespread in coastal regions in the northeast and south of Australia, including Tasmania, and scattered in other coastal areas and is rarely seen inland. It breeds in Russia and north- eastern China. The eastern curlew eats mainly small crabs and molluscs. The species is threatened by human disturbance, habitat loss and degradation from pollution, changes to hydrological regimes and invasive plants (DoE, 2015). Given their coastal presence they may be in the Spill EMBA.
Orange-bellied Parrot (EPBC Act: Critically Endangered)	The Orange-bellied Parrot (*Neophema chrysogaster*) breeds in Tasmania during summer, migrates north across Bass Strait in autumn and over-winters on the mainland. The species is listed as critically endangered with only around 50 individuals left in the wild (Birdlife Australia, 2020). Birds depart the mainland for Tasmania from September to November (Green, 1969). The southward migration is rapid (Stephenson, 1991), so there are few migration records. The northward migration across western Bass Strait is more prolonged (Higgins, 1999). The species is likely to fly over the Spill EMBA during migration.
Swift Parrot (EPBC Act: Critically Endangered)	The Swift Parrot (*Lathamus discolour*) is a small parrot that has rapid, agile flight. During summer, it breeds in colonies in blue gum forest of south-east Tasmania. Infrequent breeding also occurs in northwest Tasmania. The entire population migrates to the mainland for winter. On the mainland it disperses widely and forages on flowers and psyllid lerps in eucalypts. The birds mostly occur on inland slopes, but occasionally occur on the coast (TSSC, 2016c). Until recently the main threat to swift parrots was thought to be habitat loss and alteration within breeding and drought refuge habitats (TSSC, 2016b). However, predation on the nests in Tasmania by Sugar Gliders (*Petaurus breviceps*) is now considered to pose a significant threat to the species, as sugar gliders take not only the young and eggs in the nest but also the sitting female (TSSC, 2016b). Given its habitat preferences, this species is unlikely to occur within the Spill EMBA other than overflying it during migration.
Little Penguin (EPBC Act: listed marine)	A Little Penguin BIA (breeding and foraging) is intersected by the Spill EMBA. Little Penguins are known to breed throughout southern Australia from Western Australia to New South Wales, including Bass Strait and Tasmania. Most Little Penguins stay at sea throughout autumn and winter, although some will return frequently to their burrows all year round. Little Penguins breed from August to October, nesting from late September to about late October with incubation through to mid-November while chick raising occurs over the subsequent summer months (Arnould and Berlincourt, 2013; Gormley and Dann, 2009). Little Penguins have an annual breeding cycle that results in their behaviour and activity changing considerably throughout the year. Little Penguins are known to travel considerable distance during the non- breeding season and display much shorter foraging behaviour during the chick raising phase of their cycle. During the breeding period, the penguins forage close to the colonies to attend to their chicks daily. By winter the chicks have fledged and the adults have moulted and can undertake foraging trips of extended duration in order to regain the weight lost during the autumn moulting period (Gormley and

	Dann, 2009). For the duration of the survey period (September to October), Little Penguins are likely to conduct shorter foraging trips and stay closer to their nests in comparison to the winter period. Little Penguins tracked from Phillip Island during the winter were shown to travel hundreds of kilometres and stay away from the colony for periods lasting a couple of weeks. Port Phillip Bay (intersected by the Spill EMBA) was heavily utilised, suggesting that this area is an important feeding ground (Arnould and Berlincourt, 2013). There are many Little Penguin colonies along the Victorian coast and their size varies considerably from six to 35,000 birds at Pyramid Rock and Gabo Island respectively (both intersected by the Spill EMBA). One of Australia's largest Little Penguin colonies of ~26,000 breeding individuals exist on the Summerland Peninsula, Phillip Island (intersected by the Spill EMBA). There are also smaller colonies on rocky islands off Wilsons Promontory and King Island (both intersected by the Spill EMBA) (Arnould and Berlincourt, 2013). Little Penguins are threatened by introduced predators including dogs and cats that prey on the nesting birds when they occupy breeding colonies on land (DAWE, 2020b). Little Penguins are likely to forage in the waters of the Spill EMBA.

1.4. Social, Economic and Cultural Heritage Environment

1.4.1. Commonwealth Marine Area

The Commonwealth marine environment is a matter of national environment significance (MNES) under the EPBC Act. The Spill EMBA for the Sequoia MSS Spill EMBA occurs within the Bass strait that is part of the South-East Marine Region bioregions. Provincial bioregions are large areas of the ocean where the fish species and ocean conditions are broadly similar. The South-east Marine Region, which comprises the Commonwealth waters and seabed from waters extending from the far south coast of New South Wales, around Tasmania and as far west as Kangaroo Island in South Australia. It includes the Commonwealth waters of Bass Strait and those surrounding Macquarie Island in the Southern Ocean.

1.4.1.1. Australian Marine Parks

Australian Marine Parks (AMPs) occur within Commonwealth waters and were proclaimed as Commonwealth reserves under the EPBC Act in 2007 and 2013. The South-east Commonwealth Marine Reserves Network was designed to include examples of each of the provincial bioregions and the different seafloor features in the region (DNP, 2013). There are five Australian Marine Parks (AMPs) relevant to this activity in the South-east Commonwealth Marine Reserves Network. The Spill EMBA intersects with five AMPs (Figure 1-11), which are described in the subsections below.

Following proclamation of the South-east Commonwealth Marine Reserve Network, approval was given under Section 359B of the EPBC Act for the carrying on of oil and gas seismic surveys in Special Purpose zones (IUCN VI) and Multiple Use zones (IUCN VI), and the transit of vessels in connection with these (DNP, 2013).

Section 2.5 of the South-east Commonwealth Marine Reserves Network Management Plan 2013-23 identifies pressures relevant to the marine network. Pressures are defined as human-driven processes, events and activities that may detrimentally affect the values of the reserves network (DNP, 2013). Pressures and sources of pressure on the conservation values of the of the South-east Marine Region Reserves Network according to the Management Plan may include:

- Extraction of living resources and by-catch associated with commercial fishing, recreational fishing, and illegal, unregulated and unreported fishing
- Noise pollution associated with shipping, other vessels, seismic survey, offshore mining operations and offshore construction

- Oil pollution associated with shipping, other vessels and offshore mining operations
- Invasive species and diseases translocated by shipping, fishing vessels, other vessels and tourism
- Light pollution associated with offshore mining operations and other offshore activities.

Pressures related to the effects of climate change and associated large-scale effects on the marine environment are unpredictable and may include shifts in major currents, rising sea levels, ocean acidification, and changes in the variability and extremes of climatic features (e.g., sea temperature, winds, and storm frequency and intensity). There remains a high level of uncertainty about the effects that climate change related pressures will have on the conservation values protected by the South-east Commonwealth marine reserves (DNP, 2013).

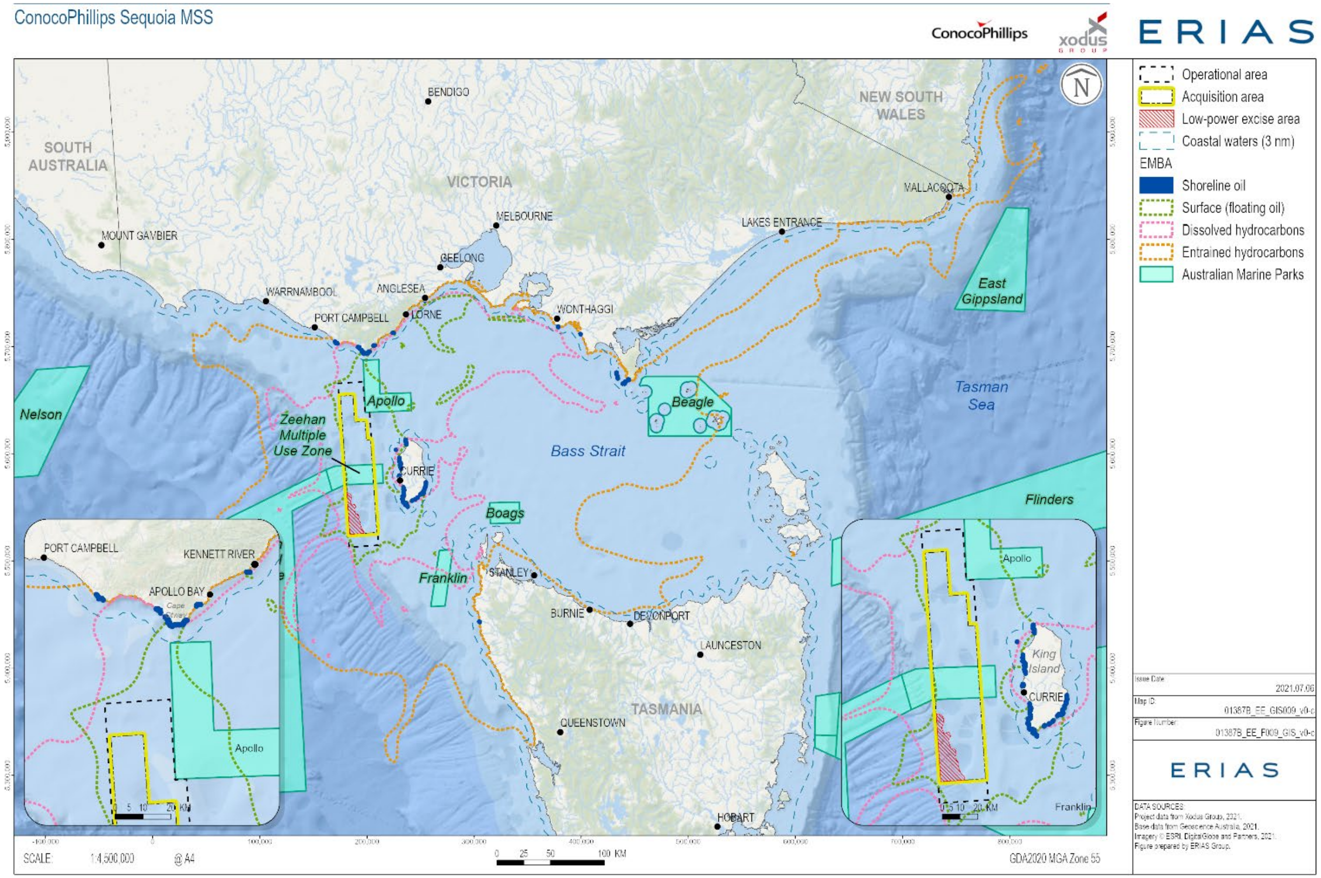


Figure 1-11: Protected areas intersected by the Spill EMBA

Apollo AMP

The survey acquisition area lies approximately 8 km south of the Apollo AMP at its closest point while the Operational Area skirts approximately 200 m west of Apollo AMP at its closest point. This AMP has a water depth of less than 50 m near Cape Otway and extends to 100 m along the Otway Depression - a deep undersea valley joining the Bass Basin to the open ocean. The waters of the reserve are exposed to large swell waves generated from the southwest and strong tidal flows. The sea floor has many rocky reef patches interspersed with areas of sediment and, in places, has rich, benthic fauna dominated by sponges. Seabirds, dolphins, seals and white shark forage in the reserve, and Pygmy Blue Whale (*Balaenoptera musculus brevicauda*) (PBW) migrate through Bass Strait (DNP, 2013). The major conservation values for the AMP are (DNP, 2013):

- Ecosystems, habitats and communities associated with the Western Bass Strait Shelf Transition and the Bass Strait Shelf Province and associated with the sea-floor features: deep/hole/valley and shelf;
- An important migration area for Blue, Fin, Sei and Humpback Whales;
- An important foraging area for Black-browed and Shy Albatross, Australasian Gannet, Short-tailed Shearwater and Crested Tern;
- A cultural and heritage site wreck of the *MV City of Rayville*.

Beagle AMP

The Beagle AMP is located 261 km east of the acquisition area in shallow water (50–70 m deep) and covers an area of 2,928 km^2 that surrounds the Hogan and Kent Group of islands. The deep rocky reefs support a rich array of sea life, including sponge gardens and Port Jackson sharks. The area provides homes and feeding grounds for seabirds, Little Penguins and Australian fur seals (DNP, 2013). The reserve is located near the Furneaux group of islands which contains island important to breeding seabirds and shorebirds such as the Fairy Prion, Shy Albatross, Silver Gull, Short tailed Shearwater, Black-faced Cormorant, Australasian Gannet, Common Diving Petrel and Little Penguins.

Boags AMP

The Boags AMP is located 106 km east of the acquisition area of the northwest coast of Tasmania and covers 537 km^2. The AMP represents an area of shallow ecosystems that has a depth range of mostly between 40 m and 80 m. It encompasses the fauna of Bass Strait, which is expected to be especially rich based on studies of several seafloor-dwelling animal groups (DNP, 2013).

The Boags AMP contains a rich array of life, particularly benthic animals and animals living in the seafloor sediments and muds including crustaceans, polychaete worms and molluscs, as is common for the Bass Strait seabed. The sandy seabed of the AMP is also likely to host benthic fish such as flathead, skates, rays and latchets but not extensive sponge gardens. The reserve is adjacent to the important seabird colonies of Tasmania’s northwest, particularly the Hunter Island Group including three Hummock Island, Hunter Island, Steep Island, Bird Island, Stack Island and Penguin Islet). Bird species present in the Hunter group include Shy Albatross, Fairy Prions, Black-faced Cormorants, Common Diving Petrels, Little Penguins and Cape Barren Geese. It is likely that the rich abundance of benthic fauna facilitates the presence of pelagic fish species within the AMP. The proximity of these two features means that the AMP is an important foraging area for the variety of seabirds that inhabit the Hunter group (DNP, 2013). The AMP overlaps the identified BIAs of several seabird species including the Black-browed Albatross, Buller's Albatross, Campbell Albatross, Indian Yellow-nosed Albatross, Shy Albatross, Wandering Albatross, White-faced Storm Petrel, Common Diving Petrel and Short-tailed Shearwater as well as the Southern Right and PBW BIAs. The marine park is also on the migration route for the critically endangered orange-bellied parrots as they across Bass Strait each spring and autumn on their migration to and from Tasmania to the Australian mainland (Parks Australia, 2020).

Franklin AMP

The Franklin AMP is located 61 km southeast of the survey area and 25 km off the northwest coast of Tasmania in waters ranging from 40 m to 150 m deep over a total area of 671 km^2. The reserve represents an area of shallow continental shelf ecosystems and incorporates the major bioregions of western Bass Strait and the Tasmanian shelf (DNP, 2013). The ocean reserve provides feeding grounds for seabirds including species of albatross, petrel, shearwater and cormorant that have breeding colonies on the nearby Hunter Island Group. Great White Sharks are also known to forage in the park (DNP, 2013).

Zeehan AMP

The Operational Area spatially overlaps the Multiple Use Zone (IUCN VI) of the Zeehan AMP. The management approach for IUCN VI areas provides for general sustainable use by allowing activities that do not significantly impact on benthic habitats. Activities are allowed or may be authorised provided they are consistent with the IUCN management principles and will not have an unacceptable impact on the values of the area (DNP, 2013).

The Zeehan AMP covers a depth range from 50 m (coastal shelf) to 3,000 m (abyssal plain). A significant feature of this reserve is a series of four submarine canyons that incise the continental slope, extending from the shelf edge to the abyssal plain. When the Zeehan Current (extending from the west) meets these canyons, water swirls upwards, taking nutrients towards the surface and contributing to diverse marine life. The AMP includes a variety of seabed habitats, including exposed limestone, that support animal communities of large sponges and other, permanently fixed, invertebrates on the continental shelf. There are also extensive 'thickets' of invertebrate animals, such as lace corals and sponges, on the continental slope. The rocky limestone provides important habitats for a variety of commercial fish species, including the Giant Crab and SRL. The major conservation values for the Zeehan AMP are (DNP, 2013):

- Examples of ecosystems, habitats and communities associated with the Tasmania Province, the West Tasmania Transition and the Western Bass Strait Shelf Transition and associated with the sea-floor features: abyssal plain/deep ocean floor, canyon, deep/hole/valley, knoll/abyssal hill, shelf and slope;
- An important migration area for Blue and Humpback Whales; and
- An important foraging area for Black-browed, Wandering and Shy Albatrosses, and Great-winged and Cape Petrels.

1.4.1.2. Threatened Ecological Communities

Threatened Ecological Communities (TECs) are protected as MNES under Part 13, Section 181 of the EPBC Act and provide wildlife corridors and/or habitat refuges for many plant and animal species. Listing a TEC provides a form of landscape or systems-level conservation (including threatened species). Three TECs that occur within the Spill EMBA are detailed in Table 1-9 and Section 5.4.

Table 1-9 Threatened Ecological Communities

Receptor	Sensitivity description
Giant kelp Forrest of SE Australia (Threatened)	Giant Kelp (*Macrocystis pyrifera*) is large brown algae that grows on rocky reefs from the sea floor 8 m below sea level and deeper. Its fronds grow vertically toward the water surface, in cold temperate waters off southeast Australia. It is the foundation species of this TEC in shallow coastal marine ecological communities. The kelp species itself is not protected, rather, it is communities of closed or semi-closed giant kelp canopy at or below the sea surface that are protected (DSEWPC, 2012c). Giant Kelp is the largest and fastest growing marine plant. Its presence on a rocky reef adds vertical structure to the marine environment that creates significant habitat for marine fauna, increasing local marine biodiversity. Species known to shelter within the kelp forests include Weedy sea Dragons (*Phyllopteryx taeniolatus*), Six-spined Leather Jacket (*Mesuchenia freycineti*), Brittle Star (*Ophiuroid spp*), urchins, sponges, Blacklip Abalone (*Tosia spp*) and Southern Rock Lobster (*Jasus edwardsii*). The large biomass and productivity of the Giant Kelp plants also provide a range of ecosystem services to the coastal environment. Giant Kelp is a cold-water species and as sea surface temperatures have risen on the east coast of Australia over the last 40 years, it has been progressively lost from its historical range (DSEWPC, 2012c). Giant Kelp requires clear, shallow water no deeper than approximately 35 metres (DSEWPC, 2012b). They are photo-autotrophic organisms that depend on photosynthetic capacity to supply the necessary organic materials and energy for growth. O'Hara (in Andrew, 1999) reported that giant kelp communities in Tasmanian coastal waters occur at depths of 5 to 25 m. The largest extent of the ecological community is in Tasmanian coastal waters from Eddystone Point in the north-east of Tasmania along the eastern coastline to Port Davey. It is also known to develop intermittently on the northern and western coasts of Tasmania (DSEWPC, 2012c). The listing advice for the TEC identifies that in Tasmania, patches of the TEC are predominantly found in sheltered embayments associated with rocky reefs on the south and east coasts. Patches are rare on the west and northern coasts but do occur in sheltered areas where substrata and water conditions are favourable for growth (DSEWPC, 2012c) (refer Figure 5.5). Ocean warming, pollution and overgrazing are key threats to the community and have contributed to its significant decline in Australia (DSEWPC, 2012c).
Subtropical and Temperate Coastal Salt Marsh	According to the Conservation Advice for Subtropical and Temperate Coastal Saltmarsh, this TEC occurs in a relatively narrow strip along the Australian coast, within the boundary along 23°37' latitude along the east coast and south from Shark Bay on the west coast of WA (TSSC, 2013). The community is found in coastal areas which have an intermittent or regular tidal influence. The coastal saltmarsh community consists mainly of salt-tolerant vegetation including grasses, herbs, sedges, rushes and shrubs. Succulent herbs, shrubs and grasses generally dominate, and vegetation is generally less than 0.5 m in height (Adam, 1990). In Australia, the vascular saltmarsh flora may include many species, but is dominated by relatively few families, with a high level of endism at the species level. The saltmarsh community is inhabited by a wide range of infaunal and epifaunal invertebrates and low and high tide visitors such as fish, birds and prawns (Adam, 1990). It is often important nursery habitat for fish and prawn species. Insects are also abundance and an important food source for other fauna. The dominant marine residents are benthic invertebrates, including molluscs and crabs (Ross et al., 2009). Saltmarsh communities are threatened by clearing and fragmentation, land reclamation, altered hydrology and tidal restriction, invasive species, climate change, mangrove encroachment, recreation, eutrophication, grazing, insect control and inappropriate fire regimes (TSSC, 2013). The coastal saltmarsh community provides extensive ecosystem services such as the filtering of surface water, coastal productivity and the provision of food and nutrients for a wide range of adjacent marine and estuarine communities and stabilising the coastline and providing a buffer from waves and storms. Most importantly, the saltmarshes are one of the most efficient ecosystems globally in sequestering carbon, due to the biogeochemical conditions in the tidal wetlands being conducive to long-term carbon retention. A concern with the loss of saltmarsh habitat is that it could release the huge pool of stored carbon to the atmosphere.
Assemblages of species associated with open-coast salt-wedge estuaries	This ecological community is the assemblage of native plants, animals and micro-organisms associated with the dynamic salt-wedge estuary systems that occur within the temperate climate, microtidal regime (< 2 m), high wave energy coastline of western and central Victoria. The ecological community currently encompasses 25 estuaries in the region defined by the border between South Australia and Victoria and the most southerly point of Wilsons Promontory (DAWE, 2013).

of western and central Victoria ecological community	Geomorphically, the estuaries of the ecological community are drowned river-valley and barrier-built systems. They are generally narrow and shallow, although some may have wider lagoons or deeper pools along their length. The mouths of the estuaries are west- and east-facing and typically form a sandbar (or berm) which may overlay a sill. These estuaries are influenced by seasonal longshore sand drift and characterised by intermittent mouths (sometimes open and sometimes closed) (DAWE, 2013). Salt-wedge estuaries are usually highly stratified, with saline bottom waters forming a 'saltwedge' below the inflowing freshwater layer of riverine waters. The wedge of heavier marine waters is introduced into the estuary by wave energy and tides. There is typically a well-formed halocline boundary between the two water-column layers, which may vary in size from a few centimetres to 1–1.5 m (Sherwood, 1983; Newton 1994; Mondon et al. 2003). Mixing at this boundary causes the surface layer to entrain saltwater and become more saline as it moves seawards. To compensate for the entrained saltwater, there is a slow movement of the deeper saltwater layer upstream. Over a standard annual hydrological cycle, the salt-wedge may be in one of three main phases: emplacement (i.e. formation); presence, or; reduction (i.e. retreat) which may extend to complete flushing (Newton 1994, 1996).

1.4.1.3. Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity. KEFs have no legal status in decision-making under the EPBC Act but may be considered as part of the Commonwealth marine area.

The Spill EMBA intersects five KEFs (**Error! Reference source not found.** described in the subsections below.

Table 1-10 Key Ecological Features

Receptor	Sensitivity description
Bonney Coast Upwelling KEF	The Bonney Coast Upwelling KEF is a predictable, seasonal upwelling bringing cold nutrient rich water to the sea surface and supporting regionally high productivity and high species diversity in an area where such sites are relatively rare and mostly of smaller scale (DAWE 2015). The Bonney Coast upwelling is defined as a key ecological feature as it is an area of enhanced pelagic productivity and has high aggregations of marine life (DAWE 2015). In addition to whales, many endangered and listed species frequent the area, possibly also relying on the abundance of krill that provide a food source to many seabirds and fish. The high productivity of the Bonney Coast Upwelling KEF is also capitalised on by other higher predator species such as Little Penguins and Australian fur seals feeding on baitfish (CoA 2015c). The Bonney Coast Upwelling KEF lies on the continental shelf situated ~120 northwest of Cape Jaffa, South Australia to Portland, Victoria (Figure 4 9). The location of the Bonney Coast Upwelling KEF was originally derived through a review of enhanced chlorophyll occurrence for summer seasonal data between the years of 1998 and 2010 (Research Data Australia, 2013). The Bonney Coast Upwelling is a phenomenon that generally starts in the eastern part of the Great Australian Bight in November/December and spreads eastwards to the Otway Basin around February (Gill et al., 2011) as the latitudinal high-pressure belt migrates southward. The upwelling occurs via Ekman dynamics, where the ocean surface experiences a steady wind stress which results in a net transport of water at right angles to the left of the wind direction. The primary ecological importance of the Bonney Coast Upwelling is as a feeding area for the PBW. The upwelled nutrient-rich re-heated Antarctic intermediate water promotes blooms of coastal krill (*Nyctiphanes australis*) which in turn attracts PBW to the region to feed. The Bonney Upwelling is one of only two identified seasonal feeding areas for PBW in Australian coastal waters and is one of 12 known blue whale feeding aggregation areas globally. Sightings of other species – namely the Sei Whale (Gill et al., 2015), and the Fin Whale (Morrice et al., 2004), indicate this is potentially an important feeding ground for other species. The Bonney Coast Upwelling promotes planktonic diversity, which increases productivity of the area as a fishery and foraging ground for many higher predator species including Little Penguins and fur-seals feeding on baitfish.

West Tasmania Canyons KEF	The West Tasmania Canyons are intersected by the Operational Area and Spill EMBA. This KEF is located on the relatively narrow and steep continental slope west of Tasmania. This location has the greatest density of canyons within Australian waters where 72 submarine canyons have incised a 500 km-long section of slope (Heap and Harris, 2009). The canyons in the Zeehan AMP are relatively small on a regional basis, each less than 2.5 km wide and with an average area of 34 km2 shallower than 1,500 m. The Zeehan canyons are typically gently sloping and mud-filled with less exposed rocky bottoms compared with other canyons in the south-east marine region (e.g., Big Horseshoe Canyon). Submarine canyons modify local circulation patterns by interrupting, accelerating, or redirecting current flows that are generally parallel with depth contours. Their size, complexity and configuration of features determine the degree to which the currents are modified and therefore their influences on local nutrients, prey, dispersal of eggs, larvae and juveniles and benthic diversity with subsequent effects which extend up the food chain (DAWE, 2020b). Eight submarine canyons surveyed in Tasmania displayed depth-related patterns with regard to benthic fauna, in which the percentage occurrence of faunal coverage visible in underwater video peaked at 200- 300 m water depth, with averages of over 40% faunal coverage. Coverage was reduced to less than 10% below 400 m depth. Species present consisted of low-relief bryozoan thicket and diverse sponge communities containing rare but small species in water depths of 150 m to 300 m. Sponges are concentrated near the canyon heads, with the greatest diversity between 200 m and 350 m water depths. Sponges are associated with abundance of fishes and the canyons support a diversity of sponges comparable to that of seamounts (DAWE, 2020b). Based upon this enhanced productivity, the West Tasmanian canyon system includes fish nurseries (Blue Warehou (*Seriolella brama*) and Ocean Perch), foraging seabirds (albatross and petrels), White Shark and foraging Blue and Humpback Whales.
Big Horseshoe Canyon KEF	The Big Horseshoe Canyon lies south of the coast of eastern Victoria and is the easternmost arm of the Bass Canyon system. The steep, rocky slopes provide hard substrate habitat for attached large megafauna. Canyons have a marked influence on diversity and abundance of species through their combined effects of topography, geology and localised currents, all of which act to funnel nutrients and sediments into the canyon. Sponges and other habitat forming species provide structural refuges for benthic fish, including the commercially important Pink Ling (*Genypterus blacodes*) It is the only known temperate location of the Stalked Crinoid (*Metacrinus cyaneu*), which occurs in water depths between 200 m and 300 m (DoE, 2015b).
Upwelling East of Eden KEF	Dynamic eddies of the East Australian Current cause episodic productivity events when they interact with the continental shelf and headlands. The episodic mixing and nutrient enrichment events drive phytoplankton blooms that are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish (DoE, 2015b). The key value of the KEF is its high productivity and aggregations of marine life. The upwelling of this region on the eastern Victorian coast and southern NSW coast occurs more or less continuously from austral spring to autumn (Huang and Wang, 2019). However, there is strong temporal (i.e., month to month, seasonal and inter-annual) variability of the upwelling characteristics and area of influence (Huang and Wang, 2019). The upwelling supports regionally high primary productivity that supports fisheries and biodiversity, including top order predators, marine mammals and seabirds. This area is one of two feeding areas for blue whales and humpback whales, known to arrive when significant krill aggregations form. The area is also important for other cetaceans, seals, sharks and seabirds (DoE, 2015b).
Canyons of the Eastern Continental Slope	The canyons of the eastern continental slope are defined as a KEF as they provide a unique seafloor feature with enhanced ecological functioning, integrity and biodiversity, which apply to both its benthic and pelagic habitats. These canyons affect the water column by interrupting the flow of water across the seafloor and creating turbulent conditions in the water column. This turbulence transports bottom waters to the surface, creating localised upwellings of cold, nutrient-rich waters, which result in regions of enhanced biological productivity relative to the surrounding waters (DAWE, 2020b).

1.4.2. Commercial Fisheries

The Spill EMBA lies within three fishing management jurisdictions – Commonwealth, Victoria and Tasmania.

1.4.2.1. Commonwealth-managed fisheries

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act* 1991 (Cth). AFMA jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the Australian Fishing Zone (AFZ)). Commonwealth commercial fisheries with jurisdictions to fish within the Spill EMBA are detailed in Table 1-11. Though certain fisheries possess jurisdiction to fish within in the Spill EMBA, analysis of publicly available and requested catch data indicates that not all fisheries have recently (within the last five years) actively fished within the Spill EMBA (Patterson *et al*., 2020). Table 1-11 also details whether the fishery is active.

Where there is evidence of recent fishing, a detailed description of the fishery is provided in Sections detailed within Table 1-11. Catch and effort data for these fisheries has been obtained from the Fisheries Status Reports published by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). ConocoPhillips Australia also commissioned SETFIA and Fishwell Consulting to provide an updated report on catch from fisheries (Appendix F).

Table 1-11 Commonwealth fisheries within the Spill EMBA

Commonwealth Fishery	Active Fishing within Spill EMBA (within the last five years)	Section description
Bass Strait Central Zone Scallop Fishery (BSCZSF)	✓	Appendix F, Table 1-12
Eastern Skipjack Fishery (ESF)	X	Appendix F Table 1-13
Eastern Tuna and Billfish Fishery (ETBF)	✓	Appendix F Table 1-14
Small Pelagic Fishery (SPF)	✓	Appendix F Table 1-15
Southern and Eastern Scalefish and Shark Fishery – Commonwealth Trawl Sector (SESSF – CTS)	✓	Commercial Fisheries Section 4.7
Southern and Eastern Scalefish and Shark Fishery – Shark Gillnet Sector and Shark Hook Sector (SESSF – CGS/CSHS)	✓	Commercial Fisheries Section 4.7
Southern and Eastern Scalefish and Shark Fishery SESSF – Scalefish Hook Sector (SESSF – SHS)	✓	Commercial Fisheries Section 4.7
Southern Bluefin Tuna Fishery (SBTF)	✓	Appendix F Table 1-16
Southern Squid Jig Fishery (SSJF)	✓	Appendix F Table 1-17

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).

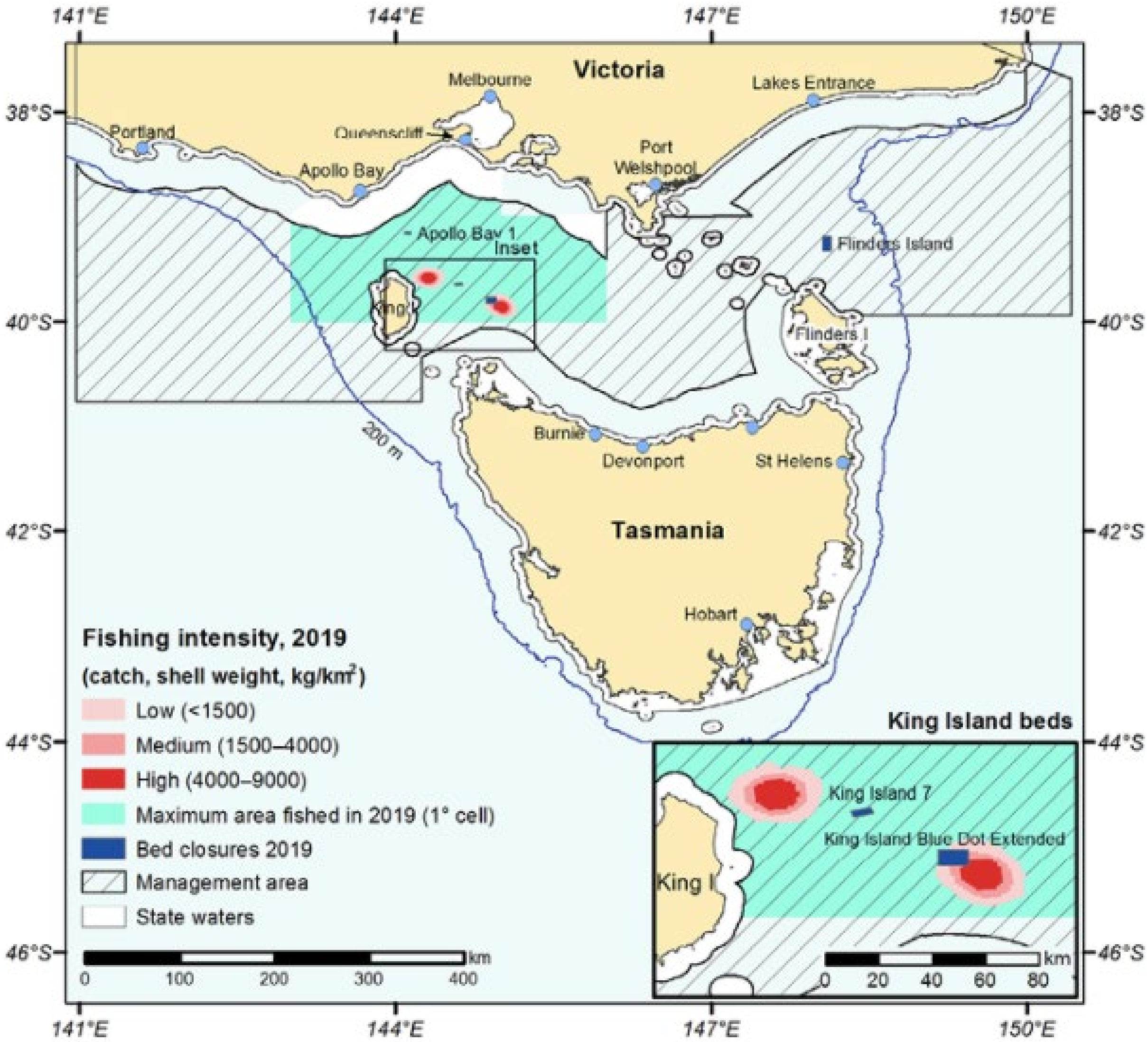
Bass Strait Central Zone Scallop Fishery (BSCZSF)

The Bass Strait Central Zone Scallop Fishery (BSCZSF) operates in the central area of Bass Strait between the Victorian and Tasmanian scallop fisheries. In 2019, fishing was permitted throughout the management area, except in 4 scallop beds that were closed to fishing under the harvest strategy. Fishing in 2019 was concentrated on beds east of King Island (Figure 1-12). This was a similar area to that fished since 2014. Fishing involves towed scallop dredges that target dense aggregations ('beds') of scallops.

Table 1-12 Bass Strait Central Zone Scallop Fishery (BSCZSF)

Title	Description
Primary landing ports	Devonport, Stanley, Apollo Bay, Melbourne, Queenscliff and San Remo.
Target species	Commercial Scallop (*Pecten fumatus*)
Fishing season	19th July to 31st December.
Licences Active vessels (2019-2020)	48 fishing permits, 12 vessels were active in the fishery in 2019, a decrease from 26 active vessels in 2009, reflecting the 'boom or bust' nature of the fishery.
Recent catch within fishery	• 2019 – 2,931 tonnes with $6.3 million. • 2018 – 3,253 tonnes worth $6.7 million. • 2017 – 2,929 tonnes worth $6.7 million. • 2016 – 2,885 tonnes worth $4.6 million. • 2015 – 2,260 tonnes worth $2.8 million.
Overlap with Spill EMBA	There is overlap between the Spill EMBA and the King Island scallop fishing grounds with the Spill EMBA intersecting with 47% of the total fishery. The majority of catch occurs during September – December east of King Island. Scallop spawning occurs from winter to spring (June to November), with timing dependent on environmental conditions such as wind and water temperature.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).



Source: DAWE (2020a)

Figure 1-12 Area and relative fishing intensity in the Bass Strait Central Zone Scallop Fishery, 2019 (Martin & Curtotti, 2020).

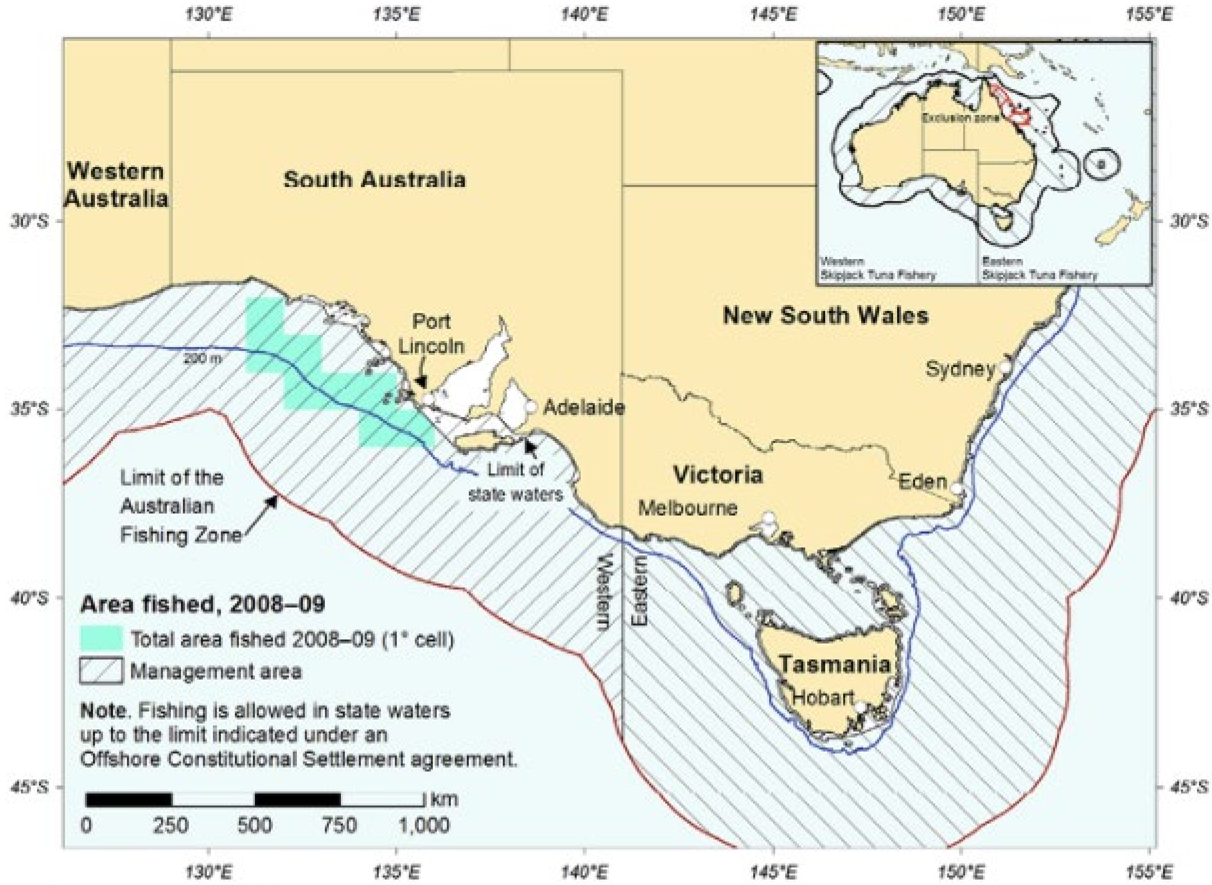
Eastern Skipjack Fishery (ESF)

Two stocks of Skipjack Tuna (*Katsuwonus pelamis*) are thought to exist in Australian waters: 1 on the east coast that is part of a broader stock in the Pacific Ocean and 1 on the west coast that is part of a larger stock in the Indian Ocean. The 2 stocks are targeted by separate fisheries: The Eastern Skipjack Tuna Fishery (ESTF) and the Western Skipjack Tuna Fishery (WSTF). The Eastern fishery extends from the border of Victoria and South Australia to Cape York, Queensland (Figure 1-13). There has been no fishing effort in the STF since the 2008–09 fishing season. Additional detail in Table 1-13.

Table 1-13 Eastern Skipjack Fishery (ESF)

Title	Description
Primary landing ports	Port Lincoln was the main landing port until its tuna cannery closed down
Target species	Skipjack Tuna (*Katsuwonus pelamis*)
Fishing season	Not currently active.
Licences Active vessels (2019-2020)	There are 17 permits in the eastern zone, though no vessels currently work the fishery.
Recent catch within fishery	Not currently active. The last fishing effort in the fishery occurred in 2008-09.
Overlap with Spill EMBA	See Above
Stakeholder concerns	N/A

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).



Note: The last effort in the fishery occurred in 2008–09.

Source: DAWE (2020b)

Figure 1-13 Area fished in the Skipjack Tuna Fishery, 2008–09 to 2018–19 (Patterson & Mobsby, 2020).

Eastern Tuna and Billfish Fishery (ETBF)

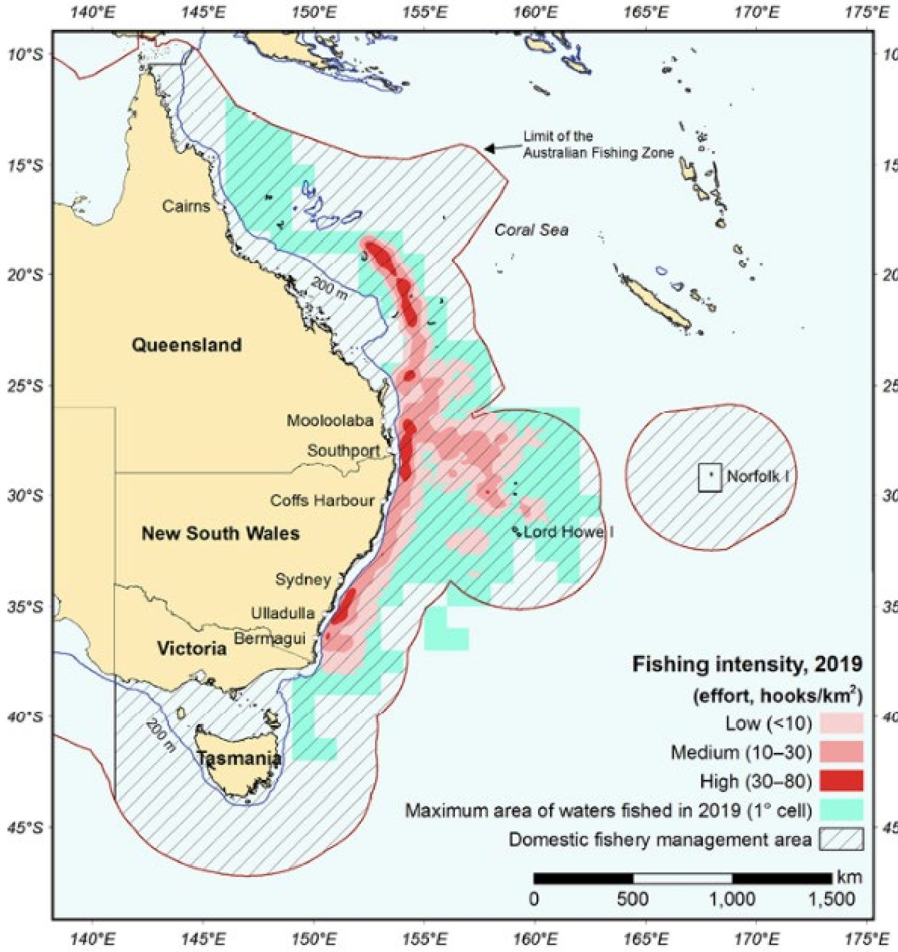
The Eastern Tuna and Billfish Fishery (ETBF) operates in the Exclusive Economic Zone and adjacent high seas, from Cape York to the Victoria – South Australia border, including waters around Tasmania and the high seas of the Pacific Ocean (Figure 1-14). Pelagic longline is the key fishing method, with small quantities taken using minor line methods (such as handline, troll, rod and reel). Additional detail in Table 1-14.

Table 1-14 Eastern Tuna and Billfish Fishery (ETBF)

Title	Description
Primary landing ports	No Victorian or Tasmanian ports are used to land catches.
Target species	Albacore Tuna (*Thunnus alulunga*), Bigeye Tuna (*T. obesus*), Yellowfin Tuna (*T. albacares*), Broadbill Swordfish (*Xiphias gladius*), Striped Marlin (*Tetrapturus audux*)
Fishing season	12-month season begins 1st March.
Licences Active vessels (2019-2020)	Active vessel numbers were 37 in 2019 (down from about 150 in 2002).
Recent catch within fishery	• 2019 – 4,341 tonnes worth $32.1 million. • 2018 – 4,046 tonnes worth $38.4 million.

	• 2017 – 4,624 tonnes worth \$35.7 million. • 2016 – 5,139 tonnes worth \$47.1 million. • 2015 – 5,408 tonnes worth \$33 million.
Overlap with Spill EMBA	The Spill EMBA intersects an area of low fishing intensity.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).



Source: DAWE (2020c)

Figure 1-14 Fishing intensity in the Eastern Tuna and Billfish Fishery, 2019 (Larcombe et al., 2020)

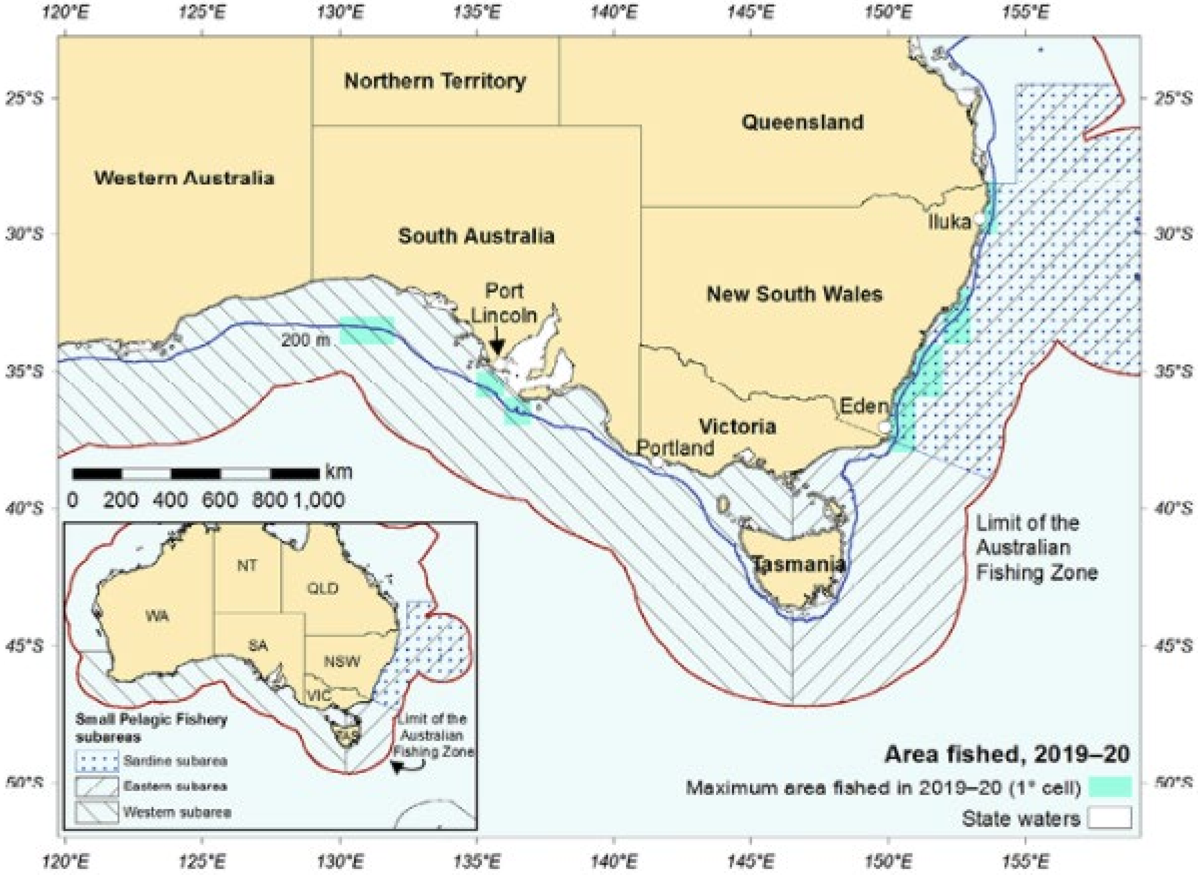
Small Pelagic Fishery (SPF)

The Small Pelagic Fishery (SPF) extends from southern Queensland to southern Western Australia within Commonwealth waters (Figure 1-15) with the fishery having 3 subareas, each with its own stock-level total allowable catch (TAC). The fishery includes purse-seine and midwater trawl fishing vessels with the latter being the main method. Additional detail in Table 1-15.

Table 1-15 Small Pelagic Fishery (SPF)

Title	Description
Primary landing ports	The main landing ports are Iluka and Ulladulla in NSW
Target species	Australian Sardine (*Sardinops sagax*), Jack Mackerel (*Trachurus declivis*), Blue Mackerel (*Scomber australasicus*), Redbait (*Emmelichthys nitidus*)
Fishing season	12-month season begins 1st May.
Licences Active vessels (2019-2020)	Thirty-one (31) entities held licences in 2019-20 using four active vessels.
Recent catch within fishery	• 2019-20 – 16,093 tonnes. • 2018-19 – 9,424 tonnes. • 2017-18 – 5,713 tonnes. • 2016-17 – 8,038 tonnes. • 2015-16 – 10,394 tonnes.
Overlap with Spill EMBA	The Spill EMBA intersects an area with reported catch. A Total Allowable Commercial Catch (TACC) in recent years has not been reached. Some catch and effort values are confidential due to the small number of fishers.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).



Note: Some effort data are not shown on this map for confidentiality reasons.

Source: DAWE (2020d)

Figure 1-15 Area fished in the Small Pelagic Fishery, 2019–20 fishing season (ABARES, 2020b).

Southern Bluefin Tuna Fishery (SBTF)

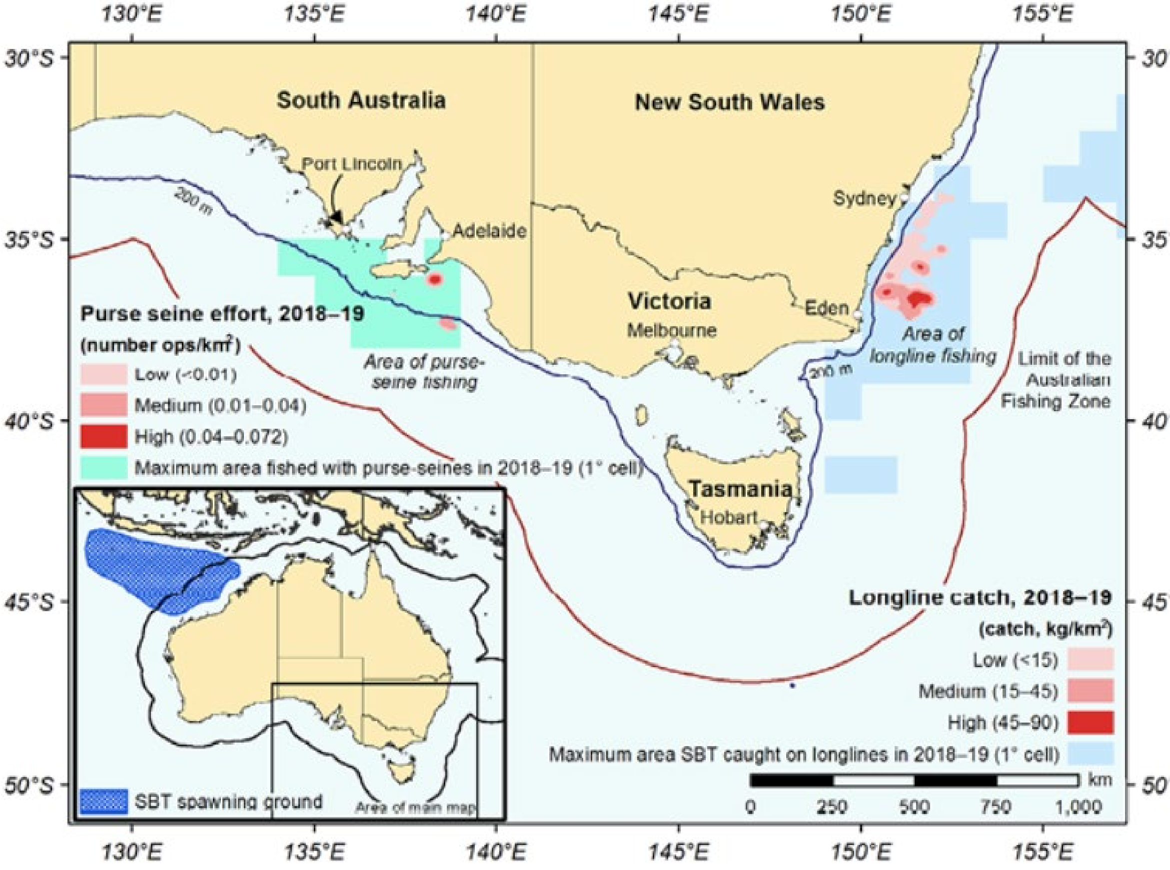
The Southern Bluefin Tuna Fishery extends throughout all waters of the AFZ (Figure 1-16). However, the nearest fishing effort to the Spill EMBA is concentrated along the NSW south coast around the 200 m depth contour and southeast off Kangaroo Island, SA. On the east coast of Australia, pelagic longline fishing is the key fishing method. Additional detail in Table 1-16 Southern Bluefin Tuna Fishery (SBTF).

Table 1-16 Southern Bluefin Tuna Fishery (SBTF)

Title	Description
Primary landing ports	Purse seine catch in the Great Australian Bight for transfer to aquaculture farms off Port Lincoln in South Australia with Port Lincoln is the primary landing port.
Target species	Southern Bluefin Tuna (*Thunnus maccoyii*)
Fishing season	12-month season begins 1st December.
Licences Active vessels (2018-2019)	27 active vessels.

Recent catch within fishery	No recent fishing effort in Bass Strait. The latest data for the east coast pelagic longline catches are: • 2018-19 – 6,074 tonnes worth $43.41 million. • 2017-18 – 6,159 tonnes worth $39.73 million. • 2016-17 – 5,334 tonnes worth $38.57 million. • 2015-16 – 5,636 tonnes worth $37.29 million. • 2014-15 – 5,519 tonnes worth $37.29 million.
Overlap with Spill EMBA	The Spill EMBA intersects an area of reported catch only (long-line).
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).



Source: DAWE (2020e)

Figure 1-16 Purse-seine effort and longline catch in the Southern Bluefin Tuna Fishery, 2018–19 fishing season (ABARES, 2020a)

Southern Squid Jig Fishery

The SSJF lies in AFZ waters extending from the Queensland/NSW border to the SA/WA border (excluding coastal waters) targeting Arrow Squid by squid jig methods (Figure 1-17). The target species is Arrow Squid (*Nototodarus gouldi*) sometimes also known as Gould's Squid. Fishing is carried out in continental shelf waters in depths targeting 60 – 120 m (Patterson *et al*., 2020). Waters outside of Port Phillip Bay is usually fished in February and early March and in western Victoria from January to June with highest catches traditionally concentrated in April and May (ABARES, 2018). The squid are present sporadically in high abundances in Tasmanian state waters in late summer/early autumn (FRDC, 2018). The species' short life span, fast growth and sensitivity to environmental conditions result in highly variable recruitment and strongly fluctuating stock sizes (Jackson and McGrath-Steer, 2003), making it difficult to estimate biomass before a fishing season. The success of squid jigging is greatly affected by weather; heavy winds and swells in Bass Strait in winter effectively halt the jig fishery. Moon phase also influences the catchability of Gould's squid with lower catch rates close to the full moon (ABARES, 2018). Squid are also caught by the Commonwealth Trawl Sector (CTS) and the Great Australian Bight Trawl Sector (GABTS) and in recent years more squid has been landed by these fisheries than the SSJF. Most fishing takes place off Portland (March to June) at night between depths of 60 and 120 m (Patterson *et al*., 2018). Additional detail in Table 1-17.

Table 1-17 Southern Squid Jig Fishery

Title	Description
Primary landing ports	Portland, Queenscliff (Vic); Triabunna (Tas)
Target species	Arrow Squid (*Nototodarus gouldi*)
Fishing season	1 January to 31 December. Actual fishing January and June (highest catch generally March and April).
Licences Active vessels (2018-2019)	Eight active vessels
Recent catch within fishery	• 2019 – 722 tonnes worth $2.89 million. • 2018 – 1,649 tonnes worth $5.26 million. • 2017 – 828 tonnes worth $2.24 million. • 2016 – 981 tonnes worth $2.57 million. • 2015 – 824 tonnes worth $2.33 million.
Overlap with Spill EMBA	The Spill EMBA intersects an area of reported catch only
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from these fishers or industry representatives.

Sources: Patterson et al. (2020, 2019, 2018; 2017; 2016), SETFIA and Fishwell Consulting (2020).

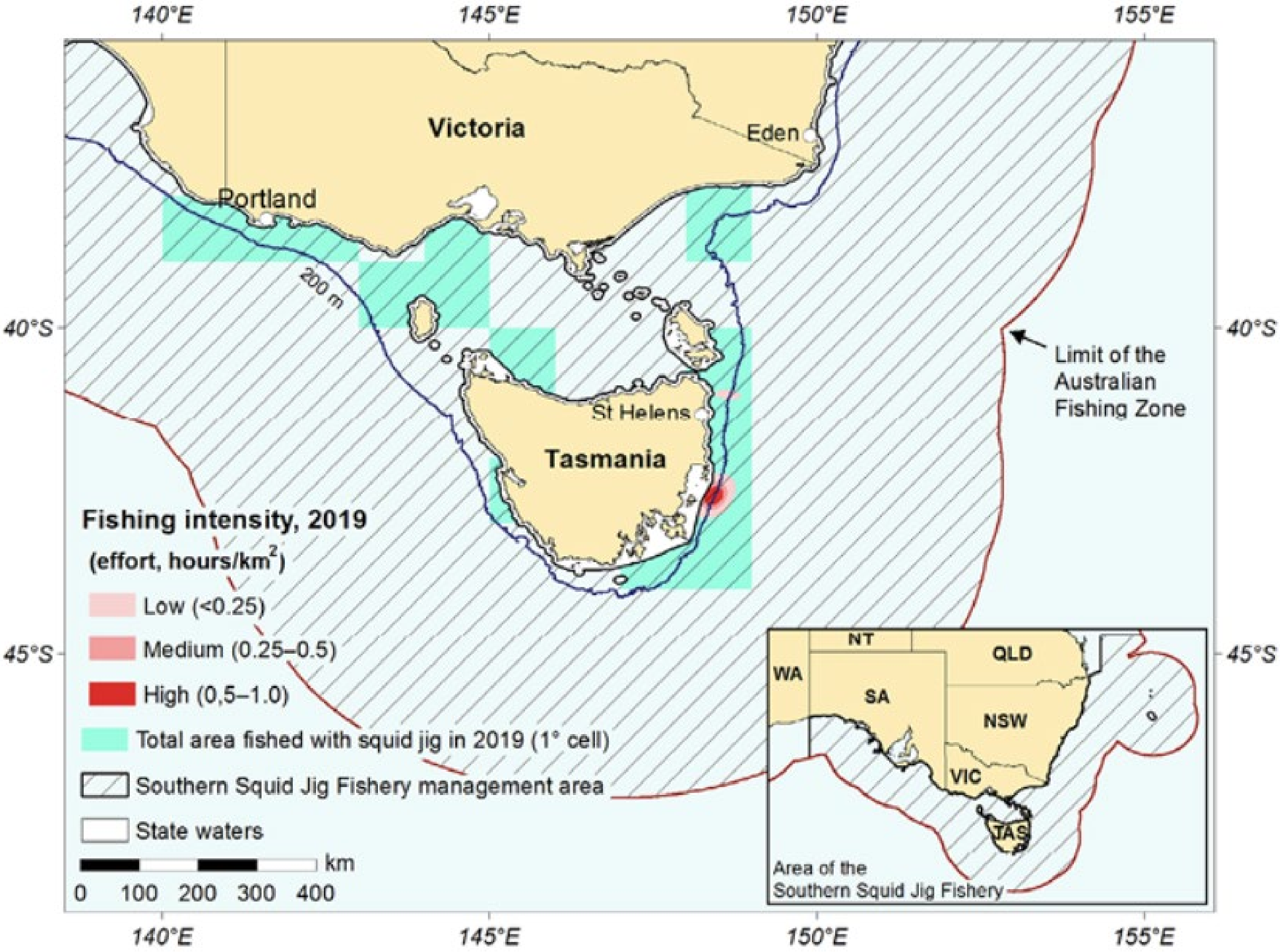


Figure 1-17 Fishing intensity in the Southern Squid Jig Fishery and (b) Commonwealth Trawl Sector squid catch, 2019

1.4.2.2. Victorian-managed Fisheries

Victorian-managed commercial fisheries with access licences that authorise harvest in the Spill EMBA are detailed within Table 1-18. Though certain fisheries possess jurisdiction to fish within the Spill EMBA, analysis of publicly available and requested catch data indicates that not all fisheries have recently actively fished within the Operational Area and/or the Spill EMBA.

Table 1-18 Victorian fisheries within the Spill EMBA

Victorian-managed Fisheries	Active Fishing within Spill EMBA	Section description
Abalone	✓	Appendix F, Table 1-19
Giant Crab	✓	Commercial Fisheries Section 5.7
Inshore trawl	✓	Appendix F, Table 1-20
Ocean Access (General)	✓	Appendix F, Table 1-21
Ocean Purse Seine	✓	Appendix F, Table 1-22
Pipis (the entire Victorian coastline)	✓	Appendix F, Table 1-23
Scallop	✓	Appendix F, Table 1-24
Southern Rock Lobster	✓	Commercial Fisheries Section 5.7
Wrasse	✓	Appendix F, Table 1-25

Source: SETFIA and Fishwell Consulting (2020), VFA (2020).

Abalone Fishery

Abalone diving activity occurs close to shoreline (generally no greater than 30 m depth) using hookah gear (breathing air supplied via hose connected to an air compressor on the vessel). Note, commercial divers do not use SCUBA gear. The Abalone Fishery is one of Victoria's most valuable commercial fisheries with almost all of the catch exported to international markets, predominately in Asia. The Commercial Dive fishery is discussed in Section 4.8 with additional detail in Table 1-19.

Table 1-19 Victorian Abalone Fishery

Title	Description
Primary landing ports	N/A
Target species	Blacklip Abalone (*Haliotis rubra*) is the primary target, with Greenlip Abalone (*H. laevigata*) taken as a bycatch.
Fishing season	12-month season, beginning 1st April.
Licences Active vessels (2019-2020)	• 14 in the western zone • 34 in the central zone • 23 in the eastern zone.
Recent catch within fishery	Across all Victorian zones, the catches for the last five seasons with available data were: • 2018/19 – 694 tonnes valued at $31.3 million. • 2017/18 – 756 tonnes valued at $26.9 million. • 2016/17 – 721 tonnes valued at $20.49 million.

	• 2015/16 – 725 tonnes valued at $19.8 million.
Overlap with Spill EMBA	The fishery is split within three zones, Western, Central and Eastern Zones. The Spill EMBA intersects 47.26% of the total fishery area.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

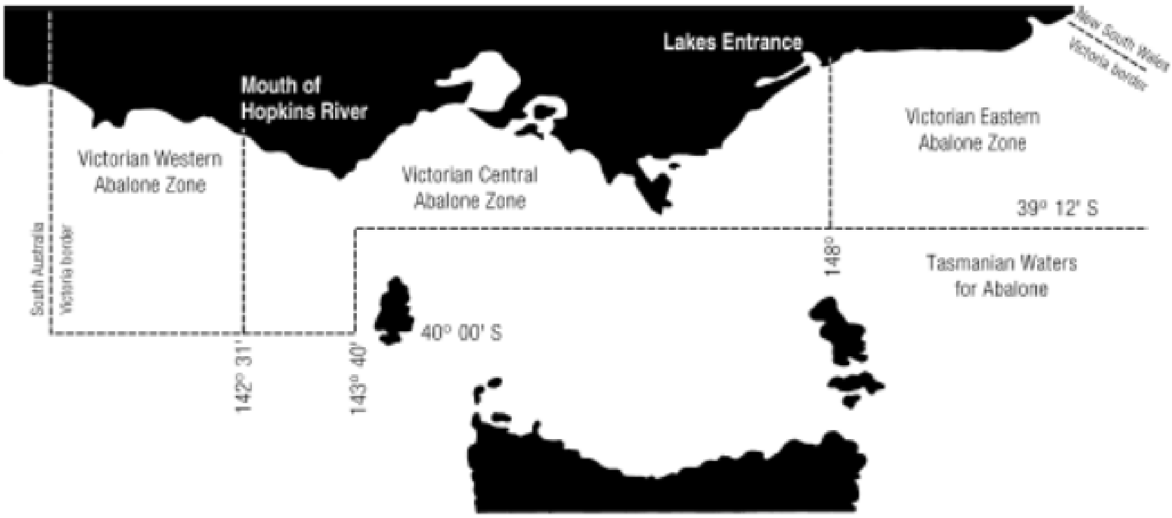


Figure 1-18 Overall area of the abalone fishery, including the three commercial zones.

Inshore Trawl Fishery

The inshore trawl fishery exclusively trawls various net types to target both demersal and non-pelagic finfish. The fishery covers the entire Victorian coastline, excluding marine reserves, bays and inlets. Additional detail in Table 1-20

Table 1-20 Victorian Inshore Trawl Fishery

Title	Description
Primary landing ports	Most operators are based at Lakes Entrance.
Target species	Key species are Eastern King Prawn (*Penaeus plebejus*), School Prawn (*Metapenaeus macleayi*) and Shovelnose Lobster/Balmain Bug (*Ibacus peronii*). Minor bycatch of Sand Flathead (*Platcephalus bassensis*), School Whiting (*Sillago bassensis*) and Gummy Shark (*Mustelus antarcticus*).
Fishing season	Year-round, although the majority of prawn fishing occurs in the warmer months up until Easter.
Licences Active vessels (2019-2020)	54 fishery access licences, ~15 active
Recent catch within fishery	The catch of eastern school prawn in 2015 was 75 t, the largest for the previous 10 years. Limited data exists for this fishery
Overlap with Spill EMBA	~45%

Title	Description
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

Giant Crab Fishery

A detailed description of the Victorian Giant Crab fishery can be found in Section 4.7. The Spill EMBA overlaps the management area of the Victorian Giant Crab fishery by 30.58%.

Ocean Access (General) Fishery

The Victorian Ocean Access (General) fishery covers the entire Victorian coastline, excluding marine reserves, bays and inlets. The fishery utilises mainly longlines (200 hook limit), but also haul seine nets (maximum length of 460 m) and mesh nets (maximum length of 2,500 m per licence). Additional detail in Table 1-21.

Table 1-21 Victorian Ocean Access (General)

Title	Description
Primary landing ports	Various, Fishing usually conducted as day trips from small vessels (<10 m).
Target species	Gummy Shark (*Mustelus antarcticus*), School Shark (*Galeorhinus galeus*), Australian Salmon (*Arripis trutta*), Snapper (*Pagrus auratus*). Small bycatch of Flathead (*Platycephalidae spp*).
Fishing season	Year-round.
Licences Active vessels (2019-2020)	157 fishery access licences.
Recent catch within fishery	There is insufficient catch data (catch data is combined with other fisheries and therefore unable to be distinguished on a standalone basis).
Overlap with Spill EMBA	~47.3%
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

Ocean Purse Seine Fishery

Purse seine is generally a highly selective method that targets one species at a time, thereby minimising bycatch. The purse seine method does not touch the seabed. A lampara net may also be used. Only one licence is active in Victorian waters (based out of Lakes Entrance), with fishing focused close to shore and during the day. This licence is held by Mitchelson Fisheries Pty Ltd, a family business that catches primarily sardines, salmon, mackeral, sandy sprat, anchovy and white bait using the Maasbanker purse seine vessel. Additional detail in Table 1-22

Table 1-22 Victorian Ocean Purse Seine

Title	Description
Primary landing ports	Lakes Entrance
Target species	Australian Sardine (*Sardinops sagax*), Australian Salmon (*Arripis trutta*) and Sandy Sprat (*Hyperlophus vittatus*) are the main species. Southern Anchovy (*Engraulis australis*) caught in some years.
Fishing season	Year-round.
Licences Active vessels (2019-2020)	1 active
Recent catch within fishery	Confidential data (due to operation of only one fisher).
Overlap with Spill EMBA	Zero overlap with licence holder
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

Pipis Fishery

Pipi is the common name given to the small bivalve, *Donax deltoides*, which is found on high-energy sandy beaches in the intertidal zone. Pipi have naturally large spatial and temporal variations in recruitment, settlement and distribution, influenced by environmental factors. Pipi are found from the Eyre Peninsula to Kingston in South Australia, through Tasmania and Victoria, to Fraser Island in south-eastern Queensland (VFA, 2021b). Additional detail in Table 1-23

Table 1-23 Victorian Pipis Fishery

Title	Description
Primary landing ports	N/A
Target species	Pipi (*Donax deltoids*)
Fishing season	Year-round.
Licences Active vessels (2019-2020)	Other than three specialised bait fisheries only Ocean Access Fishery licence holders are permitted to harvest pipis.
Recent catch within fishery	There is no publicly available information regarding catch data and associated value. The Total Allowable Catch for the 2020/2021 season has been set at 10 tonnes in Discovery Bay Western Zone, 40 tonnes in Discovery Bay Eastern Zone and 2 tonnes in the Venus Bay Commercial Zone
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

Scallop Fishery

Commercial fishing for scallops has been part of the Victorian fishing industry since the early 1970's. In 1986, management of the Bass Strait Scallop Fishery was split between the Commonwealth, Tasmania and Victoria under an Offshore Constitutional Settlement (OCS). Through the OCS, three zones emerged: The Commonwealth central zone, a Victorian zone and a Tasmanian zone (Figure 1-19). However, no record landing data could be found since 2013.

The waters of the Victorian zone extend out to 20 nautical miles from the high tide water mark but exclude the bays and inlets along the coast where commercial fishing for scallops is prohibited. Towed scallop dredges (typically 4.5 m wide) that target dense aggregations ('beds') of scallop. A tooth-bar on the bottom of the mouth of the dredge lifts scallops from the seabed and into the dredge basket

The fishery is characterised by highly variable catches due to severe fluctuations in the resource. In some years, there are so few scallops that fishing cannot take place as it would put undue pressure on stocks and threaten the long-term survival of the stock and fishery (VFA, 2021c). While scallops are still present in the region, they are believed to be present in much lower numbers than historically. Scallops have highly variable levels of natural mortality, with an historical 'boom' or 'bust' nature. Fishing activity in the fishery is currently low, although the VFA is implementing management arrangements designed to increase activity across the fishery. Additional detail in Table 1-24.

Table 1-24 Victorian Scallop Fishery

Title	Description
Primary landing ports	Vessels are typically based out of Lakes Entrance or Port Welshpool, although licence holders may fish the entire coastline.
Target species	Commercial Scallop (*Pecten fumatus*).
Fishing season	12-month season, beginning 1st April. Fishing usually occurs during the winter months but can occur from May to the end of November.
Licences Active vessels (2019-2020)	91 licences
Recent catch within fishery	Quotas of zero were put in place for the 2010/11, 2011/12 and 2012/13 seasons with subsequent landing data recorded
Overlap with Spill EMBA	Highest fishing effort is concentrated in the eastern waters of the state, with most vessels launching from Lakes Entrance and Port Welshpool. The Spill EMBA intersects 60.21% of the total fishery area.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

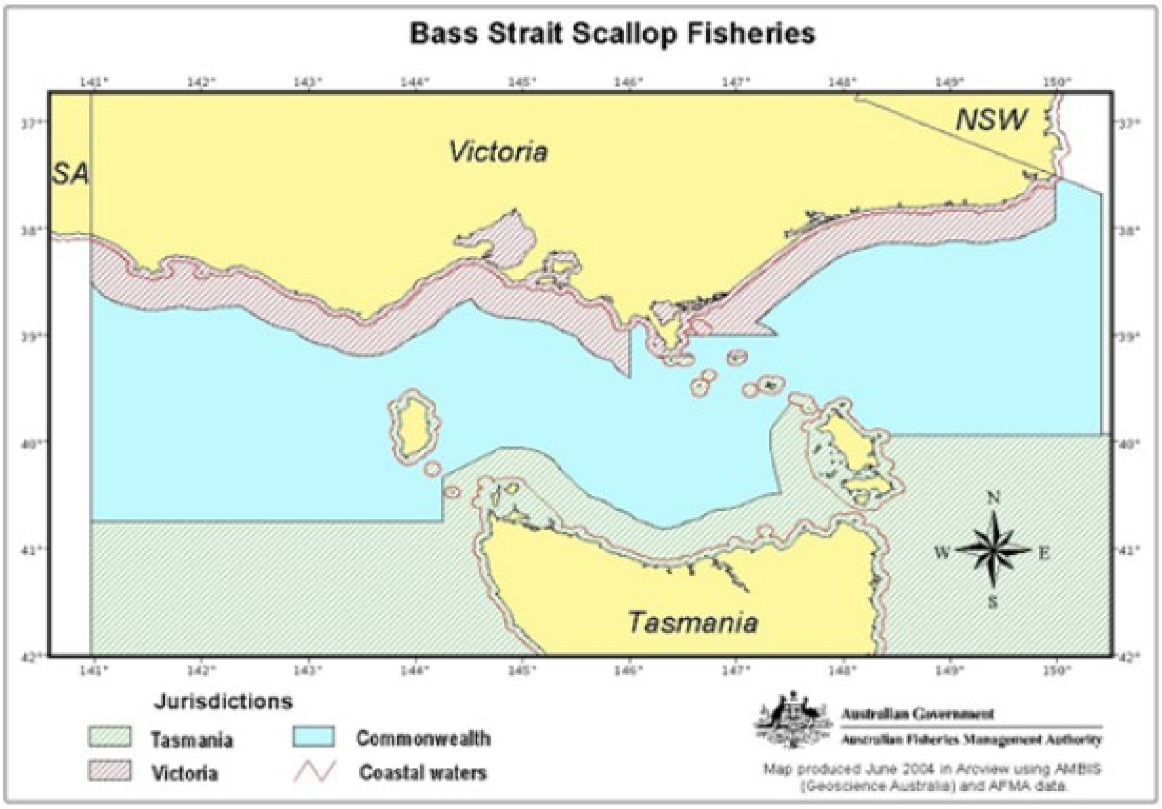


Figure 1-19 Bass Straight Scallop Fisheries

Southern Rock Lobster (SRL)

A detailed description of the Victorian SRL fishery can be found in Section 4.7. The Spill EMBA overlaps the management area of the Victorian SRL fishery.

Wrasse Fishery

The Victorian Wrasse (Ocean) Fishery was established in the 1990s when a domestic market based on live trade to restaurants and seafood outlets was created. The fishery extends along the entire length of the Victorian coastline and out to 20 nautical miles offshore, except for marine reserves. The fishery is divided into three commercial management zones; licence holders can fish in any of these zones. Most wrasse is harvested by hook and line although commercial rock lobster fishers who also hold a commercial wrasse licences can keep those fish that they catch in their rock lobster pots. The Preferred water depths for blue-throat wrasse is 20-40 m, while saddled wrasse prefer depths of 10-30 m. Additional detail in Table 1-25

Table 1-25 Victorian Wrasse Fishery

Title	Description
Primary landing ports	Various
Target species	Blue-Throat Wrasse (*Notolabrus tetricus*), Saddled Wrasse (*N. fucicola*), Orange-Spotted Wrasse (*N. parilus*).
Fishing season	Year-round.
Licences Active vessels (2019-2020)	22 fishery access licences.
Recent catch within fishery	• 2018/19 – 33 tonnes valued at $672,000. • 2017/18 – 38 tonnes valued at $767,000. • 2016/17 – 24 tonnes valued at $557,000. • 2015/16 – 30 tonnes valued at $627,000. • 2014/15 – 29 tonnes valued at $490,000.
Overlap with Spill EMBA	In recent years, catches have been highest off the central coast (Port Phillip Heads, Western Port and Wilson's Promontory) and the west coast. The Spill EMBA intersects 22.86% of the total fishery area.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Source: VFA (2020), SETFIA and Fishwell Consulting (2020).

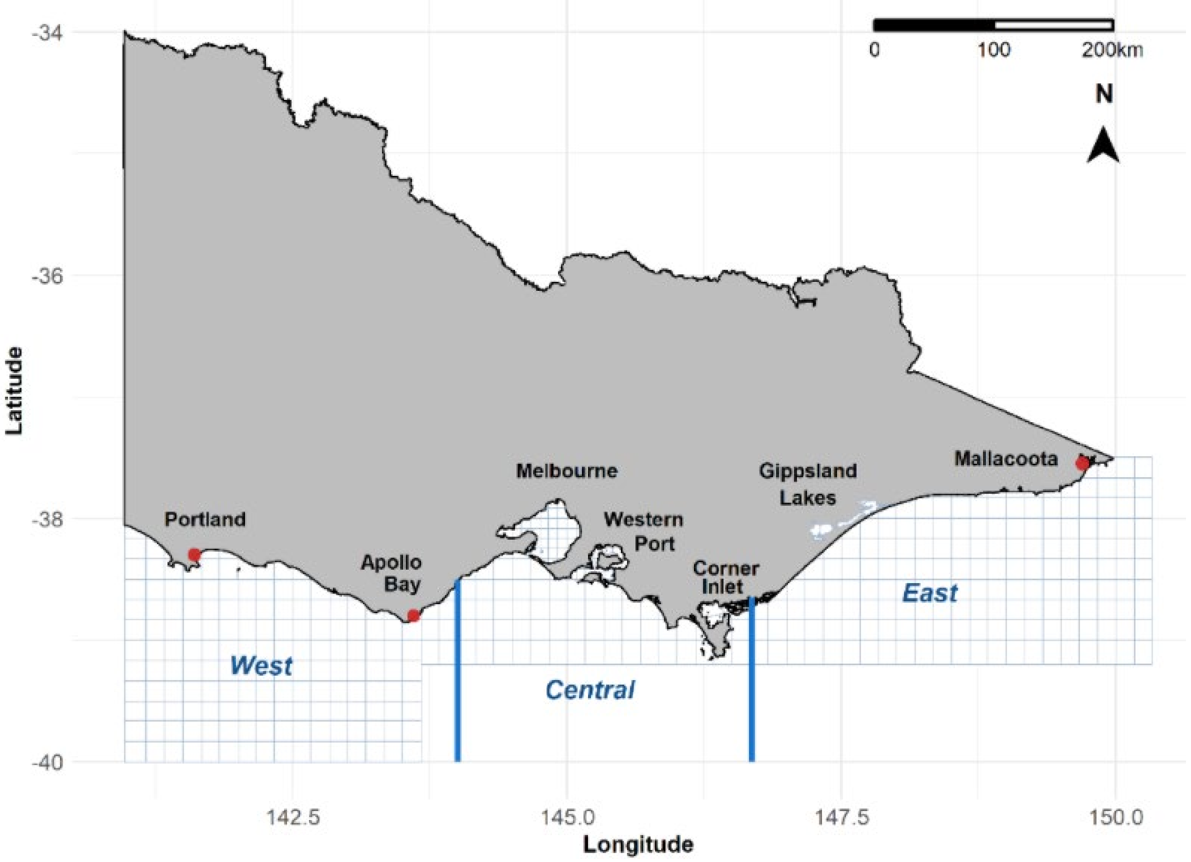


Figure 1-20 Victorian Wrasse (Ocean) Fishery Zones

1.4.2.3. Tasmanian-managed Fisheries

Tasmanian-managed commercial fisheries with access licences that authorise harvest in the Spill EMBA are detailed within

Table 1-26. Though certain fisheries possess jurisdiction to fish within the Spill EMBA, analysis of publicly available and requested catch data indicates that not all fisheries have recently actively fished within the Operational Area and/or the Spill EMBA.

Table 1-26 Tasmanian fisheries within the Spill EMBA

Victorian-managed Fisheries	Active Fishing within Spill EMBA	Section description
Abalone	✓	Other Marine Users Section 4.8
Commercial Dive Fishery	✓	Other Marine Users Section 4.8
Giant Crab	✓	Commercial Fisheries Section 4.7
Octopus	✓	Appendix F, Table 1-27
Scalefish	✓	Appendix F, Table 1-28
Scallop	N/A	Appendix F, Table 1-29
Seaweed	✓	Appendix F, Table 1-30
Shellfish	X	Appendix F, Table 1-31
Southern Rock Lobster	✓	Commercial Fisheries Section 4.7

Abalone Fishery

A detailed description of the Tasmanian Abalone fishery can be found in Section 4.8.2.4. The Spill EMBA overlaps the management area of the Tasmanian Abalone fishery.

Commercial Dive Fishery

A detailed description of the Tasmanian Commercial Dive fishery can be found in Section 4.8.2.4. The Spill EMBA overlaps the management area of the Tasmanian Commercial Dive fishery.

Giant Crab

A detailed description of the Tasmanian Giant Crab fishery can be found in Section 4.7. The Spill EMBA overlaps the management area of the Tasmanian Giant Crab fishery by.

Octopus Fishery

The Tasmanian Octopus Fishery operates off the north coast of Tasmania and in the Bass Strait, primarily targeting Pale Octopus (Octopus pallidus), with Maori Octopus (*Macroctopus maorum*) and Gloomy Octopus (*Octopus tetricus*) landed as by-product. The Scalefish Fishery Management Plan (revised in

2015) provides the management framework for the fishery. The commercial fishery has been a sole operator fishery since its commencement in 1980, with two vessels (IMAS, 2016). The fishery covers the entire Tasmanian coastline and shares the same reporting grid as the Scalefish fishery. Additional detail in Table 1-27.

Table 1-27 Tasmanian Octopus Fishery

Title	Description
Primary landing ports	Not known
Target species	Pale Octopus (*Octopus pallidus*).
Fishing season	Year round
Licences Active vessels (2019-2020)	2 active licences
Recent catch within fishery	• 2018/19 – 129 tonnes. • 2017/18 – 64 tonnes. • 2016/17 – 81 tonnes. • 2015/16 – 74 tonnes. • 2014/15 – 90 tonnes.
Overlap with Spill EMBA	Catch data reported in the fishery's 2018/19 assessment indicates that fishing activity occurs in the SPILL EMBA. The Spill EMBA intersects 35.65% of the total fishery area.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: DPIPWE, 2020; SETFIA and Fishwell Consulting, 2020;

Scalefish Fishery

The Tasmanian Scalefish Fishery is a multi-species and multi-gear fishery that is predominantly made up of small owner operated commercial businesses and a large and diverse recreational fishery (DPIPWE, 2021b). The fishery targets multiple species and therefore uses multiple gear-types including drop-line Danish seine, fish trap, hand-line and spear. The fishery covers the entire Tasmanian coastline and shares the same reporting grid as the Octopus fishery. Additional detail in Table 1-28.

Table 1-28 Tasmanian Scalefish Fishery

Title	Description
Primary landing ports	Not known
Target species	Multi-species fishery including Banded Morwong (*Cheilodactylus spectabilis*), Tiger Flathead (*Neoplatycephalus richardsoni*), Southern School Whiting (*Sillago flindersi*) Australian Salmon (*Arripis trutta*), Barracouta (*Thyrsites atun*), Bastard Trumpeter (*Latridopsis forsteri*) and Blue Warehou (*Seriolella brama*).
Fishing season	Year-round but some seasonal closures depending on the target species.
Licences Active vessels	259 vessels operating in 2017/18 across the fishery.
Recent catch within fishery	2017/18 – 318 tonnes 2016/17 – 312 tonnes 2015/16 – 348 tonnes

	2014/15 – 273 tonnes 2013/14 – 320 tonnes
Overlap with Spill EMBA	The Spill EMBA intersects areas of reported catch from the northwest, west, northeast and east regions, based on the fishery's 2017/18 assessment report. The Spill EMBA intersects 36.65% of the fishery.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: DPIPWE, 2020; SETFIA and Fishwell Consulting, 2020;

Scallop Fishery

The Scallop Fishery Advisory Committee (ScFAC) and a majority of industry members of the ScFAC recommended that the area from White Rock (*Ill des Phoques*) north to the boundary of the Great Oyster Bay Shark Refuge Area and the area north of Babel Island up towards the Sisters on the eastern side of Flinders Island be open to commercial scallop fishing during 2020. However, the Minister for Primary Industries and Fisheries has not supported this recommendation, therefore the Tasmanian Scallop Fishery will not be open for commercial harvest during 2020. Additional detail in Table 1-29.

Table 1-29 Tasmanian Scallop Fishery

Title	Description
Primary landing ports	N/A
Target species	Commercial Scallop (*Pecten fumatus*).
Fishing season	Fishery closed.
Licences Active vessels (2019-2020)	N/A
Recent catch within fishery	Closed since 2016.
Overlap with Spill EMBA	Fishery currently closed for stock Assessment.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: DPIPWE, 2020; SETFIA and Fishwell Consulting, 2020;

Seaweed Fishery

The two main harvested species of seaweed in Tasmania are Bull Kelp and Undaria. Bull Kelp is a native species and is collected primarily on King Island and on northern regions of the Tasmanian west coast. According to the Department of Primary Industries, Parks, Water and Environment (DPIPWE), Bull Kelp harvesting generates approximately $2 million in income to King Island (DPIPWE 2019). Bull Kelp is primarily used as a thickening solution for a range of products, including sauces, syrups, cosmetics, gardens and pastures. Undaria is not native to Australian waters and was likely introduced from ballast water. It is considered a marine pest (DIPWE 2019).

It was determined by DPIPWE after an initial survey in 1994 that an eradication program was not feasible and as a result provisions were made to commercialise the species (DPIPWE 2015). Undaria is also known as 'wakame'—a delicacy in Japan and the Republic of Korea (Pereira and Yarish 2008). In 2017–18 it was estimated that approximately 1,895 tonnes of seaweed were harvested in Tasmania.

Seaweeds are harvested as they wash ashore. The collection of native seaweed species if they are attached to substrate or the sea is prohibited. Bull kelp is dried, and alginates are extracted which are used in thickening solutions.

Kelp harvesting on King Island generates about $2.5M annually by one company – Kelp Industries Pty Ltd (exclusive licence). Additional detail in Table 1-30.

Table 1-30 Tasmanian Seaweed Fishery

Title	Description
Primary landing ports	N/A
Target species	Bull kelp (*Nereocystis luetkeana*) and Wakame (*Undaria pinnatifida*).
Fishing season	Year round
Licences Active vessels (2019-2020)	80 individuals who have a fishing licence (marine plant) to collect cast bull kelp
Recent catch within fishery	The annual average harvest on King Island is above 1200 tonnes (dried weight) and supplies ~5% of the world production of alginates.
Overlap with Spill EMBA	Kelp harvesting occurs on the west coast of Tasmania and King Island. Undaria pinnatifida harvesting occurs on the east coast of Tasmania. On King Island seaweed is harvested between Cape Wickham and approximately 5 km due south of Ettrick Beach, the south coast of King Island from Surprise Bay to the east of Stokes point and the south-east coast of King Island from three areas around red Hut Point, Grassy harbour and City of Melbourne Bay.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: DPIPWE, 2020; SETFIA and Fishwell Consulting, 2020;

Shellfish Fishery

The Shellfish Fishery occurs in designated zones at Georges Bay and Ansons Bay on the east coast of Tasmania. The shellfish targeted by the fishery can be collected by hand in shallow water using a basket rake and in deeper waters a dredge can be used. Additional detail in Table 1-31.

Table 1-31 Tasmanian Shellfish Fishery

Title	Description
Primary landing ports	N/A
Target species	Pacific oyster (*Crassostrea gigas*), Native Oyster (*Ostrea angasi*), Venerupis Clam (*Venerupis largillierti*) and Katelysia Cockle (*Katelysia scalarina*).
Fishing season	Year round
Licences Active vessels (2019-2020)	• Venerupis Clam fishery in Georges Bay – 2 licences • Native Oyster (*Angasi)* fishery in Georges Bay – 2 licences. • Katelysia Cockles in Ansons Bay – 3 licences.
Recent catch within fishery	Available data of catches for five seasons include: • 2014/15 – 25 tonnes • 2013/14 – 42 tonnes • 2012/13 – 49 tonnes • 2011/12 – 44 tonnes • 2010/11 – 44 tonnes
Overlap with Spill EMBA	The designated zones occur off the east coast of Tasmania. There is no intersect between the Spill EMBA and the fishery.
Stakeholder concerns	There have been no concerns raised by fishers during the consultation process and no public submissions were received from fishers or industry representatives.

Sources: DPIPWE, 2020; SETFIA and Fishwell Consulting, 2020;

Southern Rock Lobster (SRL)

A detailed description of the Tasmanian SRL fishery can be found in Section 4.7. The Spill EMBA overlaps the management area of the Tasmanian SRL fishery by 30.58%.

1.4.3. Heritage and Cultural Features

1.4.3.1. World and National Heritage Listed Places

World Heritage Listed properties are examples of sites that represent the best examples of the world's cultural and heritage values, of which Australia has 19 properties (DAWE, 2020d). In Australia, these properties are protected under Chapter 5, Part 15 of the EPBC Act.

There are no World Heritage Properties within the Spill EMBA (DAWE, 2020d). The closest are located onshore in Melbourne (Royal exhibition Building and Carlton Gardens) and the Tasmanian Wilderness area.

Commonwealth Heritage-listed places are natural, indigenous and historic heritage places owned or controlled by the Commonwealth. In Australia, these properties are protected under EPBC Act. No properties on the Commonwealth Heritage List occur within the Spill EMBA.

The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation (DAWE, 2020e). These places are protected under Chapter 5, Part 15 of the EPBC Act. No National Heritage-listed properties occur in the Spill EMBA.

The Western Tasmania Aboriginal Cultural Landscape is intersected by the Spill EMBA (at its shoreline) and described below.

The PMST report lists the Point Nepean Defence Sites and Quarantine Station Area National Heritage-listed property as intersected by the Spill EMBA. However, this site is located onshore above the high-water mark and will therefore not be intersected by the Spill EMBA.

The Western Tasmania Aboriginal Cultural Landscape

During the late Holocene Aboriginal people on the west coast of Tasmania developed a specialised and more sedentary culture based on a dependence on seals, shellfish and land mammals. This way of life is represented by shell middens that lack the remains of bony fish but contain 'hut depressions' which sometimes formed semi-sedentary villages (DAWE, 2020e). Nearby some of these villages are circular pits in cobble beaches which the Aboriginal community believes are seal hunting hides. The remains of the shell middens in the Western Tasmania Aboriginal Cultural Landscape and its accompanying hut depressions provide evidence of an unusual, specialized and more sedentary Aboriginal community that began almost 2,000 years ago and continued until the 1830s. Archaeological studies of the area found evidence of early villages built near an Elephant Seal colony. Based on the large number of seal bones in the middens, it is believed the Elephant Seals where a major source of Aboriginal people's diet in the area (DAWE, 2020e). The Western Tasmania Aboriginal Cultural Landscape also contains other stone artefact scatters, stone arrangements, rock engravings and shelters and human burials that provide further insight into this unique way of life.

1.4.3.2. Aboriginal Heritage

Victoria

Gunaikurnai people are the traditional owners of Gippsland. There are currently approximately 3,000 Gunaikurnai people and the territory includes the coastal and inland areas to the southern slopes of the Victorian Alps. Gunaikurnai people are made up of five major clans (GLaWAC, 2020). The Victorian

Aboriginal Heritage Register contains details of Aboriginal cultural heritage places and objects along the coastline. However, the register is not publicly accessible in order to protect culturally sensitive information.

The Gippsland, northern Tasmanian and Bass Strait islands coastlines are of Aboriginal cultural heritage significance. Coastal fishing is an important part of Aboriginal culture with fishing methods including hand gathering, lines, rods and reels, nets, traps and spears (DoE, 2015b). It has been estimated that between 5,000 and 10,000 indigenous Australians occupied Tasmania prior to European settlement. Indigenous peoples in the area fished and collected shellfish, and seals and mutton birds were also important sources of food (DoE, 2015b).

Crustaceans (e.g., SRL, crab) and shellfish formed an important part of the diet of Aboriginal people living along the coast. There are numerous areas containing Aboriginal shell middens (i.e. the remains of shellfish eaten by Aboriginal people) along the sand dunes of the Gippsland coast. Coastal shell middens are found as layers of shell exposed in the side of dunes, banks or cliff tops or as scatters of shell exposed on eroded surfaces. These areas may also contain charcoal and hearth stones from fires, and items such as bone and stone artefacts, and are often located within sheltered positions in the dunes, coastal scrub and woodlands. Other archaeological sites present along the Gippsland coast include scar trees and assorted artefact scatters (NSR Environmental Consultants, 2001).

Tasmania

Aboriginal people have inhabited Tasmania for at least 35,000 years. At the end of the last ice age the sea level rose, and Tasmania became isolated from the mainland of Australia. They survived in the changing landscape partly due to their ability to harvest aquatic resources, such as seals and shellfish. Following conflict between the European colonists and the Tasmanian Aboriginal peoples, leading to the relocation of people to missions on Bruny Island, Flinders Island and other sites, and finally to Oyster Cove, their numbers diminished drastically. The Aboriginal Heritage Register lists over 13,000 sites; however, there is no searchable database to identify any sites in the Spill EMBA.

There are known sites that occur on the west coast of Tasmania associated with the West Tasmanian Aboriginal Cultural Landscape (as described in National Heritage-Listed properties Section 1.4.3).

King Island

Archaeological evidence suggests that the island was inhabited by Aboriginal people during the Pleistocene when King Island was connected to Tasmania, however by the time of earliest European occupation in the early 18th Century, no Aboriginal people inhabitants were observed (Huys, 2012). Stone artefacts have been recorded on the island along southwestern coastal cliffs, at the Petrified Forest and elsewhere on the island in different dune formations.

Aboriginal heritage sites on King Island typically contain low density stone artefact scatters with isolated midden finds. These sites are mostly located in close proximity to freshwater sources, particularly freshwater lagoons found in numerous locations on the island (Sim, 1991). On King Island there is less visibility of Aboriginal heritage in coastal areas as the west and southwest coast has been inundated by dune formation with middens (shellfish and bones) only exposed through dune blowouts (Sim, 1991).

Locations on King Island where Aboriginal middens have been observed include Cataraqui Monument (a quarry site 500 m from the Cataraqui Point headland), Quarantine Bay (shellfish midden located 15 m above sea level and 350 m inland), Seal Bay at Middle Point (warrener shell midden located 30 m inland and 5 m above sea level) and New Year Island (Sim, 1991). Sea caves (Cliff Cave, Iron Monarch and Blister Cave) examined for Aboriginal heritage indicate caves were not used in pre-historic times, except one possible artefact at the entrance to Iron Monarch. Human remains dating to 14,270 BC have been found in the Cliff Cave at a depth of 2.9 m and on New Year Island resulting from a dune blowout in the 1970s (Sim, 1991).

1.4.3.3. Native Title

In 2010, the Federal Court recognised that the Gunaikurnai holds native title over much of Gippsland. On the same day the state entered into an agreement with the Gunaikurnai under the *Traditional Owner Settlement Act* 2010. The agreement area extends from west Gippsland near Warragul and Inverloch east to the Snowy River and north to the Great Dividing Range. It also includes 200 m of sea country offshore. The determination of native title under the *Native Title Act* 1993 (Cth) covers the same area (GLaWAC, 2020).

The agreement and the native title determination only affect undeveloped Crown land within the Gippsland region.

The Gunaikurnai and Victorian Government Joint Management Plan was approved by the Minister for Energy, Environment and Climate Change in July 2018. The plan guides the partnership between the Gunaikurnai people and the Victorian Government in the joint management of the ten parks and reserves for which the Gunaikurnai have gained Aboriginal Title as a result of their 2010 Recognition and Settlement Agreement with the Victorian Government.

An additional native title claim area is intersected by the Spill EMBA that includes Cape Otway and the waters 100 m seaward from the mean low-water mark of the coastline. In 2012, the Eastern Maar traditional owner group lodged a native title determination application in the Federal Court of Australia which was registered on 20 March 2013. The Eastern Maar Aboriginal Corporation manages these native titles rights for Eastern Maar Peoples. The Eastern Maar traditional owner group and the State of Victoria have agreed to negotiate a Recognition and Settlement Agreement under the *Traditional Owner Settlement Act* 2010.

There are no registered native title claims in Tasmania.

1.4.3.4. Maritime Archaeological Heritage

Shipwrecks over 75 years old are protected within Commonwealth waters under the *Underwater Cultural Heritage Act* 2018 (Cth), in Victorian waters under the Victorian *Heritage Act* 1995 (Vic), and in Tasmanian waters under the *Historic Cultural Heritage Act* 1995 (Tas). A search of the Australian National Shipwreck Database (DAWE, 2021g) found a total of 478 wrecks with 77 over 75 years old. Most of these wrecks occur in shallow waters on reefs or bays along the coast, on King Island or on beaches in exposed coastal areas. Wrecks are presented in Section 4.8.

Significant shipwrecks along the coast of King Island which forms part of the King Island Maritime Trail (Shipwrecks and Safe Havens) include those detailed below:

- Blencathra (1875)
- British Admiral (1874)
- Carnarvon Bay (1910)
- Cataraqui (1845)
- Loch Leven (1871)
- Netherby (1866)
- Neva (1935)
- Sea Elephant Bay (1802)
- Shannon (1906).

1.4.4. Onshore Protected Areas

1.4.4.1. Ramsar Wetlands

Australia has 66 wetlands of international importance ('Ramsar wetlands') that cover more than 8.3 million hectares (as of February 2021) (DAWE, 2020c). Ramsar wetlands are those that are representative, rare or unique wetlands, or are important for conserving biological diversity, and are included on the List of Wetlands of International Importance developed under the Ramsar Convention. These wetlands are protected under the EPBC Act.

Ramsar sites that intersect the Spill EMAB are detailed below and displayed in Section (4.8).

1.4.4.2. Tasmanian Protected Areas

Lavinia

The Lavinia Ramsar site is located on the northeast coast of King Island and is situated between Boulder Point at its northern end and Cowper Point, ~12 kilometres north of Naracoopa, at its southern end (Newall and Lloyd, 2012). The northern section of the site extends approximately 8 km inland. The site is made up of four distinct (and at times overlapping) ecosystem units (Newall and Lloyd, 2012). These are the:

- Sea Elephant Estuary; Ecosystem
- Coastal Strip Ecosystem
- Dunes Ecosystem
- Northern Sandsheet Ecosystem.

The Sea Elephant Estuary receives its freshwater from the largest river on King Island (the Sea Elephant River) and drains into Bass Strait midway along the east coast. As well as containing significant saltmarsh areas that provide feeding and roosting habitat for the critically endangered orange-bellied parrot (Neophema chrysogaster) the estuary contains a coastal lagoon and an actively developing sand spit. Socio-economic values of the estuary include recreational fishing and a commercial aquaculture facility (an oyster farm) (Newall and Lloyd, 2012).

The Coastal Strip Ecosystem covers the entire coast of the site, from Boulder Point in the north to Cowper Point in the south. This ecosystem includes the coastal calcareous sand beaches of the site as well as the foredunes. The Coastal Strip contains important seabird rookeries and overlaps with the Sea Elephant Estuary Ecosystem (Newall and Lloyd, 2012),

The Dunes Ecosystem consists of three main subcomponents – the New Dunes, the Old Dunes and the Interdunal Swamps (Nook Swamp). The Old Dunes formed approximately 120,000 years ago during considerably higher sea levels and are situated inland of the New dunes (Pemberton, 2004), which commenced forming within the last 10,000 years and form a rim around King Island. Between the Old and New Dune systems, there is a series of lagoons, lakes wetlands and peatlands, forming in the Interdunal depressions (Newall and Lloyd, 2012).

The Northern Sandsheet Ecosystem is a Quaternary sand plain which forms flat to undulating country inland of the Dunes Ecosystem. The plains are thought to have originated during periods of relatively high Quaternary sea levels, in which marine-estuarine sedimentation occurred and formed the plain onto which terrestrial sediments were subsequently deposited. Vegetation of the ecosystem includes an extensive successional mosaic of sedgeland, heath and scrub (Duncan, 1986) and also heathy woodlands (D'Costa *et al*., 1993).

The key threats to the site include:

- Fire;
- Recreational vehicle use;
- Feral cats;
- Aquaculture;
- Climate change;
- Weeds;
- Dieback fungus (Phytophthora cinnamomic); and
- Past land clearance.

The site is currently used for conservation and recreation, including boating, fishing, camping and off-road driving. There are artefacts of Indigenous Australian occupation on King Island that date back to the last ice age when the island was connected to Tasmania and mainland Australia via the Bassian Plain.

The critical components and processes identified in the Ramsar site by Newall and Lloyd (2012) include:

- Wetland vegetation communities;
- Regionally rare plant species;
- Scrambling ground fern;
- Swamp fireweed;
- Regionally rare bird species;
- Striped marsh frog;
- Orange-bellied parrot;
- King Island scrubtit;
- Green and gold frog;
- Waterbirds and seabirds; and
- Migratory birds.

1.4.4.3. Victorian Protected Areas

Western Port

The Western Port Ramsar site is intersected by the Spill EMB and is located ~60 km southeast of Melbourne and 185 km northeast of the acquisition area. In 1982 a large portion of Western Port Bay was specified of international importance especially as waterfowl habitat. The area consists of large shallow intertidal areas divided by deeper channels with adjacent narrow strips of coastal land (DELWP, 2017). Western Port supports four wetland types including (Hale, 2016):

- Marine subtidal aquatic beds (underwater vegetation) (15,000 ha);
- Intertidal mud, sand or salt flats (27,000 ha);
- Intertidal marshes (1,144 ha); and
- Intetidal forested wetlands.

Westernport Bay is valued for its terrestrial and marine flora and fauna, cultural heritage, recreational opportunities and scientific value. The area has substantial intertidal areas supported by mangroves, saltmarsh, seagrass communities and unvegetated mudflats, which are significant as shorebird habitat.

Additionally, the saltmarsh and mangroves filter pollutants, trap and process nutrients, stabilise sediments and protect the shoreline from erosion (DELWP, 2017). The intertidal mudflats provide a significant food source for migratory waders, making it one for the most significant areas in south-east Australia for these birds. The interaction between critical processes and components provide habitat for many waterbirds. The mangrove and saltmarsh vegetation are of regional, national and international significance because of the role in stabilising the coastal system, nutrient cycling in the bay and providing wildlife habitat (Ross, 2000). There are three state marine parks within the Ramsar site (Yaringa, French Island and Churchill Island MNPs). There are numerous community and government projects that help monitor, protect, raise awareness and educate the community about the Ramsar site wetland (Brown and Root, 2010).

Western Port is protected under the Western Port Ramsar Site Management Plan (DELWP, 2017), which describes the values as:

- Supports a diversity and abundance of fish and recreational fishing;
- The soft sediment and reef habitats support a diversity and abundance of marine invertebrates;
- Supports bird species, including 115 waterbird species, of which 12 are migratory waders of international significance;
- Provides important breeding habitat for waterbirds, including listed threatened species;
- Provides habitat to six species of bird and one fish species that are listed as threatened under the EPBC Act;
- Rocky reefs comprise a small area within the Ramsar site, but includes the intertidal and subtidal reefs at San Remo, which support a high diversity, threatened community and Crawfish Rock, which supports 600 species (Shapiro, 1975);
- The Western Port Ramsar Site has three MNPs, one National Park and has been designated as a Biosphere Reserve under the UNESCO’s Man and the Biosphere program;
- The Ramsar site is within the traditional lands of the Boonwurrung, who maintain strong connections to the land and waters; and
- The site contains the commercial Port of Hastings that services around 75 ships per year and contributes around $67 million annually to the region’s economy.

The threats to the Ramsar site are summarised in the Ecological Character Description (Brown and Root, 2010) as:

- Historical site and catchment alterations;
- Catchment and coastal erosion;
- Deteriorating water quality;
- Shipping;
- Recreational activities;
- Pest plants and animals;
- Climate change;
- Urban development;
- Grazing; and
- Recreational and commercial fishing.

Port Phillips Bay (Western Shoreline) and Bellarine Peninsula

The Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site is intersected by the Spill EMBA and is located in the western portion of Port Phillip Bay, near the city of Geelong in Victoria. The description below provides the values and baseline ecological character of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site. In the absence of a dedicated Ecological Character Description developed in accordance with the Victorian Department of Sustainability and Environment's Framework for Describing the Ecological Character of Ramsar Wetlands (DSE, 2008), the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan (DELWP, 2018) has been used as a basis for this description.

The site provides important connective habitat for migratory bird species, habitat for fauna staging and foraging, is home to indigenous cultural sites, provides use of resources, and a site for commercial and recreational activities and education initiatives. The ecological character of the Ramsar site is reliant on the management of human activities and health of environment and water ways.

The Port Phillip Bay Ramsar site consists of a number of component areas that include: parts of the shoreline, intertidal zone and adjacent wetlands of western Port Phillip Bay, extending from Altona south to Limeburners Bay; and parts of the shoreline, intertidal zone and adjacent wetlands of the Bellarine Peninsula, extending from Edwards Point to Barwon Heads and including the lower Barwon River. It is protected under the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site Management Plan (DELWP, 2018), which defines the key values as:

- Representativeness – it includes all eight wetlands types.
- Natural function – the interactions of physical, biological and chemical components of wetlands that enable them to perform certain natural functions and making them a vital element of the landscape.
- Flora and fauna – contain the genetic and ecological diversity of the flora and fauna of the region, with at least 332 floral species (22 state threatened species) and 304 species of fauna (29 threatened species).
- Waterbirds – provides habitat for migratory shorebirds, including some of international and national importance.
- Cultural heritage – many aboriginal sites, particularly shell middens and artefact scatters have been found at the site.
- Scenic – provide vistas of open water and marshland in a comparatively pristine condition.
- Economic – use of natural resources in agriculture, fisheries, recreation and tourism.

- Education and interpretation – offer a wide range of opportunities for education and interpretation of wildlife, marine ecosystems, geomorphological processes and various assemblages of aquatic and terrestrial vegetation.
- Recreation and tourism – provide activities such as recreational fishing, birdwatching, hunting, boating, swimming, sea kayaking and camping and activities by commercial operators.
- Scientific – site for long-term monitoring of waterbirds and waders.

1.4.5. Marine and Coastal Industries

1.4.5.1. Coastal Settlements

The larger coastal settlements within the Spill EMBA are described in Table 1-32 based on ABS data (ABS, 2020).

Table 1-32 Coastal settlements within the vicinity of the Spill EMBA

Settlement Region	Description
Colac-Otway	Torquay has a population of 13,258 people and a median age of 39. Of those in the labour force, 55.2% work full-time with 35.5% working part-time. The agriculture, forestry and fishing industries employ 0% of the workforce. The primary and secondary education industries employ 5.9% of the workforce. Professionals, managers and technicians and trade workers make up 56.4% of occupations.
Port Phillip Bay	Mornington Peninsula (Shire) has a population of 154,999 people and a median age of 46. Of those in the labour force, 53.5% work full-time with 36.3% working part-time. The agriculture, forestry and fishing industries employ 0% of the work. Hospitals, primary education and supermarket and grocery stores employ 9.4% of the workforce. Professionals, technicians and trade workers and managers make up 50.6 of occupations. Queenscliff has a population of 1,315 people and a median age of 59. Of those in the labour force, 45.6% work full-time with 45.6% working part-time. The accommodation, cafes and restaurants and primary education industries employ 16.8% of the workforce. Professionals, managers and clerical and administrative workers make up 59% of occupations.
Bass Coast	Wonthaggi has a population of 4,965 people and a median age of 52, occupying 2,400 dwellings. The greatest proportion of the population are employed as technicians, trade workers and labourers. Cape Paterson has a population of 891 people and a median age of 52. There are 1,077 private dwellings and the median weekly household income is $897. Professionals and technicians and trades workers were the two most common occupations at 22.4% and 17.6%, respectively. Inverloch, with a population of 5,437, had 47.6% of its 4,290 dwellings permanently unoccupied. The area is a popular tourist destination, particularly for swimming, kitesurfing and windsurfing in the calm waters of Anderson Inlet. Fishing and surfing are also popular.
King Island	The closest coastal settlement is King Island, which is located to the northwest of Tasmania. King Island is located approximately 80 to 90 km from the Victoria and Tasmania coastlines and is predominantly rural, with three small townships. About half of the population (of 1,585 people) live in the township of Currie, located on the west coast, with two smaller townships at Grassy and Naracoopa located on the east coast. The island is renowned for excellence in the production of food products. Beef and dairy farms cover the island, which employs 29.7% of the workforce. The island has a small fishing industry, mostly focused on SRL and giant crab, which employs 4.1% of the workforce. In its submission to ConocoPhillips during the public exhibition of the EP, the King Island Council states that there are 18 SRL fishing vessels based at the island, all of which are locally owned and operated. King Island Dairy and JBS Australia are the two major employers on the island.

	The kelp industry is a major part of the island's economy, generating $2.5M annually, which is supported by up to 80 individuals who have a fishing license (marine plant) to collect cast bull kelp on the island. Tourism is a growth industry for the island (KIRDO, 2014), with golf courses being a key drawcard.

1.4.5.2. Commercial Shipping

The South-east Marine Region (which includes Bass Strait) is one of the busiest shipping regions in Australia (DoE, 2015b). Shipping consists of international and coastal cargo trade, passenger services and cargo and vehicular ferry services across Bass Strait (DoE, 2015b). Details of shipping routes are address in Section 4.8.2 with vessel tracking for the Spill EMBA in Section (4.7).

1.4.5.3. Offshore Energy Exploration and Production

Offshore energy production and exploration activities within the vicinity of the Operational Area and within the Spill EMBA are described in Sections 4.7 and Section 4.8.4 in Other Marine Users.

The closest developments are the Otway Gas Field Development, operated by Beach Energy, located 70 km south of Port Campbell and 25 km west of the nearest Operational Area boundary. This consists of a the remotely operated Thylacine platform, offshore and onshore pipelines and a gas processing plant located 6.4 km northeast of Port Campbell. Over its operating life, the development is expected to supply 950 billion cubic feet (bcf) of raw gas, 885 PJ of sales gas, 12.2 million barrels of condensate and 1.7 million tonnes of LPG to the market. The fields are estimated to contain sufficient natural gas to provide more than 10% of current annual demand in south-eastern Australia over a period of 10 years. First gas sales commenced September 2007 (Cooper, 2017).

In 2016, Origin (now Beach Energy) also completed its Halladale and Blackwatch gas field development. The Halladale production well is located 13 km north of the Netherby production well. It was directionally drilled from an adjacent onshore location, with a pipeline laid between the onshore drill site and the Iona Gas Plant (Cooper, 2017).

The Minerva Gas Development is operated by Cooper Energy (previously BHP Billiton) and commenced production in April 2005. This consists of two subsea wells in shallow waters (60 m deep and 10 km from the coast) that are tied back to an onshore gas plant (4.5 km inland) via a single pipeline. The gas plant has the capacity to produce 150 TJ gas and 600 barrels of condensate per day (Cooper, 2017).

The Casino-Henry-Netherby Field Development, operated by Cooper Energy (previously Santos), is located 17–25 km offshore from Port Campbell in water depth ranging from 65–71 m. The offshore development consists of 4 subsea wells which transport gas via a 250mm gas pipeline to the Iona Gas Plant (Cooper Energy, 2020).

A review of environmental plans on the NOPSEMA website (NOPSEMA, 2021xx) found the following EPs that are either under assessment or have been approved within the vicinity of the Operational Area (Table 1-33).

Table 1-33: Seismic Environment Plans within the vicinity of the Operational Area

Activity	Description	Distance from Operational Area	Temporal overlap
Otway Basin 2DMC Marine Seismic Survey	Schlumberger Australia Pty Limited (Schlumberger) proposed to acquire Otway Basin 2DMC MSS, with an estimated survey duration of 100 days which will be acquired in the period from November 2019 to June 2020 (SLR 2019). Project was completed in 2020.	0.07% overlap	None
Otway Deep Marine Seismic Survey	Geophysical company Spectrum Geo (Spectrum) has proposed to undertake the Otway Deep three-dimensional (3D) marine seismic survey (MSS) in the Commonwealth waters of the Otway Basin. The duration of the activity is proposed as a maximum of 120 days per survey season between 1 October 2018 to end February 2022. The survey season was defined as the window from the beginning of October to end of February, with avoidance of the period from 1 March to end of September (RPS, 2019). At the time of writing this survey has not commenced and is not planned to occur in October 2021.	0.34% overlap	None
Dorrigo 3D Marine Seismic Survey	3D Oil Limited proposed to undertake the Dorrigo three-dimensional (3D) marine seismic survey (MSS) in the Commonwealth waters of the Otway Basin within Exploration Permit T/49P which lies adjacent to Tasmania. The Dorrigo MSS was expected to take up to 35 days between 1 September and 31 October 2019 (3D Oil, 2019). The Sequoia MSS replaces this activity.	NA	None
Prion Seismic Survey	Beach Energy is planning to undertake a three-dimensional (3D) marine seismic survey (the Prion Survey) to enable assessment of the natural gas reservoirs in Commonwealth offshore retention licenses T/RL2, T/RL3, T/RL4 and T/RL5. The survey will take around 50 days, subject to weather. According to the EP Summary, it is expected to be completed between October 2020 and December 2021, with timing to be confirmed after consultation with stakeholders, receipt of regulatory approvals, and confirmation of vessel availability. The EP was submitted in January and is under assessment. ConocoPhillips Australia have attempted to confirm whether this survey will go ahead in 2021. There is currently only one seismic survey vessel contracted to operate within Australian waters during the latter half of 2021; and that vessel has been contracted by ConocoPhillips Australia. Therefore, it is ConocoPhillips Australia's understanding that it is very unlikely that the Prion seismic survey could occur concurrently with the Sequoia MSS.	~112 km Opposite side of King Island	None
Activity - T/30P Geophysical and Geotechnical Seabed Survey	Beach Energy propose to undertake a geophysical and geotechnical survey (site survey) over a portion of their T/30P permit and open acreage in the Otway Basin in Commonwealth waters. It includes High resolution two-dimensional shallow reflective imaging (2D survey) to inform shallow gas hazards. The EP was accepted by NOSPEMA in January 2021. The surveys were proposed to be undertake between 1 February and 30 June 2021.	~33 km	None

	However, the survey has not been undertaken at time of writing; and it is not possible to undertake the survey within the timeframe specified in the EP. Therefore, it is unlikely that this survey will go ahead in 2021.		

In addition, the Spill EMBA intersects the Star of the South Wind Farm project area (~287 km east- northeast of the Operational Area, Section 4.7), which is the first proposed offshore wind farm in Australia. The project involves installation of offshore wind turbines and offshore substations, submarine cables from the wind farm to the Gippsland coast and a transmission network of cables and substations connecting to the La Trobe Valley. The project is currently in its feasibility phase with preliminary site investigations such as metocean, geophysical, geotechnical and environmental studies underway.

1.4.5.4. Other Infrastructure

The Victorian Desalination Plant, located at Wonthaggi, is located ~198 km northeast of the Operational Area. Operation of the plant commenced in December 2012. The seawater intake and outlet structures are connected to the onshore plant via a 1.2 km and 1.5 km underground tunnel, respectively. The two intake structures are 8 m high, 13 m in diameter, situated 50 m apart and located in a water depth of 20 m. They draw in water at very low speeds (the suction effect is not strong enough to draw fish in) (Figure 1-21).

The Indigo telecommunications cable runs east-west west of King Island Figure 1-21 This cable facilitates international and trans-Australian connectivity with a two fibre pair 'Open Cable' design that utilises spectrum sharing technology and spans approximately 9,000 km, connecting Singapore to Perth and Perth to Sydney.

The two discrete systems are known as Indigo West (Singapore to Perth) and Indigo Central (Perth to Sydney). The northern part of the acquisition area overlaps 21 km of the cable.

There are two Telstra telecommunications cables to the west of King Island (Figure 1-21).

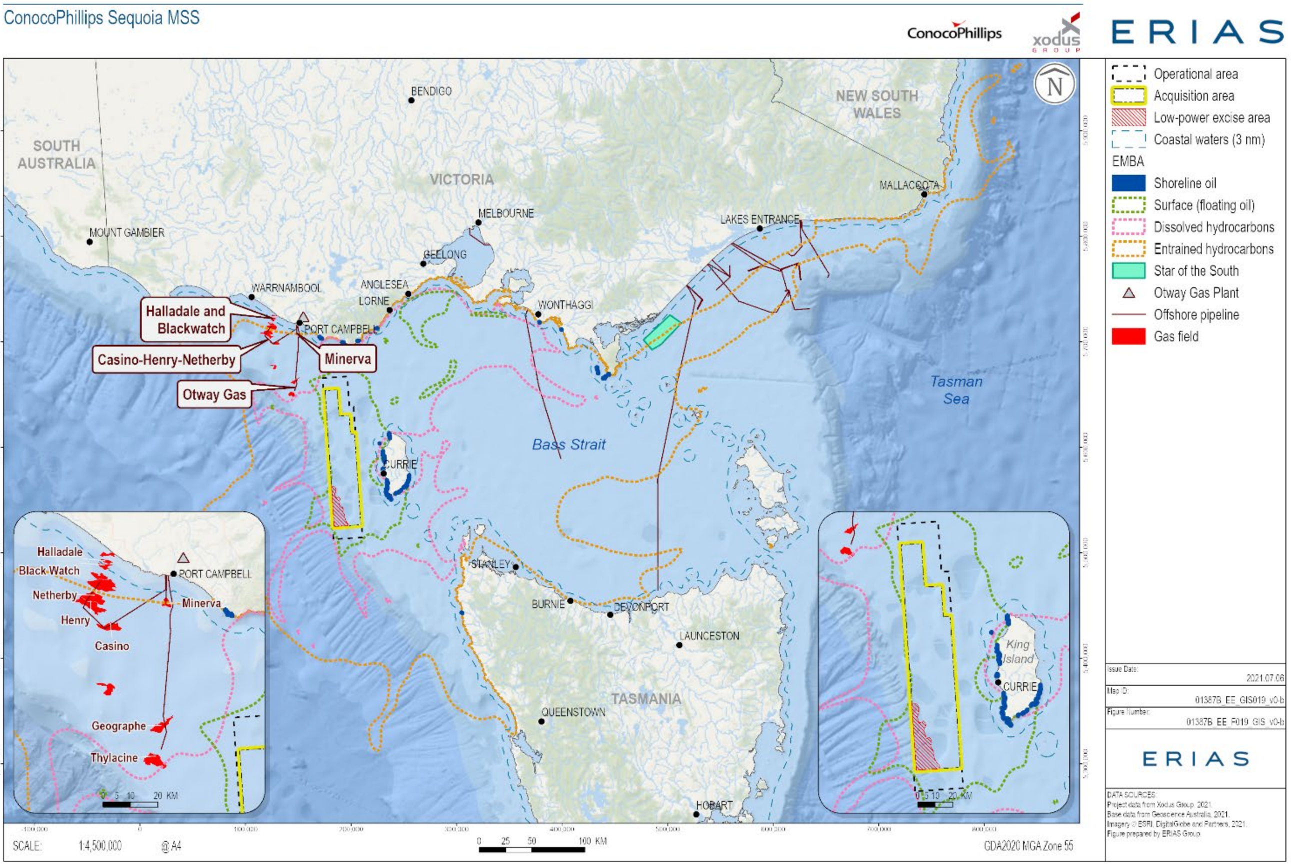


Figure 1-21: Other infrastructure within the Spill EMBA

1.4.5.5. Defence Activities

There are two significant offshore training areas that overlap the Spill EMBA (**Error! Reference source not found.**). The West Head Gunnery Range located on the Mornington Peninsula is a gunnery school for the Royal Australian Navy with a designated offshore practice and training area. The Eastern Australian Exercise Area is situated in Jervis Bay where the Royal Australian Navy (RAN) conducts a wide range of activities, including missile firings, weapons systems engagements, sub-surface activities and anti-air warfare training. The Royal Australia Air Force (RAAF) also exercise in the area, using the ranges for missile firings.

UXO sites within the Spill EMBA and that overlap the Operational Area are detailed in Section 4.8.3.1 – Other Marine Users. The three closest UXO sites identified outside of the Operational Area are summarised below and displayed in Section 4.7 (DoD EIG, 2021).

- SDG087 Sea Dumping - King Island (~30 km from Operational Area). This site is an area used for the dumping at sea of ordnance and other items. This site was used for the dumping at sea of ammunition including cartridges, projectiles and fuses (UXO Category: *Other Sea Dumping Sites*)
- SDC006 Sea Dumping - Off King Island (~52 km from Operational Area). This site is an area used for the dumping at sea of ordnance and other items. This site was used for the dumping of chemical munitions including 1,634 tons of chemical munitions.
- SDG136 Sea Dumping - Victorian Coast (~65 km from Operational Area). This site is an area used for the dumping at sea of ordnance and other items. Site of post WWII Sea Dumping Activity

1.4.6. Tourism and Recreation

King Island's economy supports 708 jobs (Nicol *et al*., 2013). The Island's main industries include agriculture and fishing, which employed 164 people and manufacturing 130 in 2011 (Nicol *et al*., 2013). Of the 708 people employed in King Island, it is estimated that tourism supports 34 jobs (4.9% of King Island employment) (Nicol *et al*., 2013). The following tourism statistics are available for King Island (King island Council, 2016):

- Total visitors to the island during 2015/16 was approximately 13,500 with 64% of this population staying 3 nights or less (short-break holiday)
- Purpose of visit: Business (33%), holiday (49%) and visiting relatives (16%)
- Origin of visitors: Victoria (39%), Tasmania (29%) and NSW (16%) with international visitors (3%)
- High season for tourism on the island is mid-October to mid-April
- Activities undertaken on the island during visits included recreational walks (29%); visiting arts and crafts shops (21%); food related festivals/tourism (16%); bird watching particularly penguins (9%); golf (8%); game bird hunting (6%); surfing (3%) and diving/snorkelling (2%)
- Places most visited were Lavinia Beach/Penny's Lagoon and the Calcified Forest/Seal Rocks Reserve.

The tourism sector is estimated to generate $5 million in annual economic output from a total output of $190.6 million (Nicol *et al*., 2013). The King Island tourism sector is estimated to contribute just over 0.2% of the Tasmanian tourism output (Nicol *et al*., 2013).

Diving

There are a number of operators around the region including Warrnambool Sub Aqua Club that offer dive charters in and around King Island. Popular spots to dive include the three kings on the northern tip of the island and near Currie towards Phoques Bay on the north west of the island.

Fishing

Tourist and recreational Fishing charters such as Southern coast charters and King Island fishing operate from King Island all year round from Port Fairy, 20 mins West of Warrnambool which include deep sea fishing, reef fishing ad tuna fishing in the offshore coastal waters.

The main fishing areas on King Island shown in Figure 1-22 are located at: Grassy Jetty, Bold Head, Naracoopa Jetty, Sea Elephant, Lavinia Point, Three Sisters, Phoques Bay, Currie and British Admiral Point.

Source: DPIPWE (2019)

Figure 1-22 Coastal Fishing location map

Other Tourism

Sightseeing charters are also active throughout the year taking tourists along the coast and to visit lady Julia Percy Island.

The Ocean Racing Club of Victoria (ORCV) holds an ocean yacht race to Grassy, King Island from Queenscliff on the Labour day weekend in March every year (ORCV, 2021).

Sequoia MSS
Oil Pollution
Emergency Plan

ABU2-000-EN-V01-D-00002

Rev 2   31 May 2021

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1. Framework

1.1. Purpose

In accordance with Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations), the implementation strategy for an environment plan (EP) must include an oil pollution emergency plan (OPEP). This OPEP has been developed specifically to respond to emergency conditions as described in the EP. The scope of this OPEP is consistent with the activities described in Section 2 of the EP.

This Oil Pollution Emergency Plan (OPEP) has been developed in association with the Sequoia MSS Environment Plan (EP; ABU2-000-EN-V01-D-00001, Rev 2), to meet the requirements of the OPGGS(E)R.

The purpose of this OPEP is to:

- Demonstrate that the intent of Regulation 14(8) of the OPGGS (E) Regulations has been met.
- Describe the oil spill emergency response arrangements and capabilities that are in place for the duration of the petroleum activity
- Provide high-level guidance and process support for the ConocoPhillips Australia IMT

The emergency condition identified in this OPEP is:

- Vessel collision, resulting in a worst-case 373 m3 MDO spill (Group II) to the marine environment at the sea surface.

The following OPEP details arrangements in place for the timely implementation of response measures required to reduce risks to as low as reasonably practicable (ALARP) and acceptable levels in the event of a vessel based MDO spill during the Sequoia MSS.

This OPEP interfaces with the following emergency plans:

- Vessel SOPEP – for spills contained on the vessel or spills overboard that can be managed by the vessel;
- Project-specific bridging emergency response plan (ERP);
- ConocoPhillips Australia Crisis and Incident Management Plan (ABUE-450-HS-N05-C-00119).
- The National Plan for Maritime Environmental Emergencies (‘NatPlan’) (AMSA, 2020) – AMSA is the jurisdictional authority and control agency for spills from vessels originating in or affecting Commonwealth waters;
- The Victorian State Maritime Emergencies (Non-search and Rescue) Plan (‘VicPlan’) (EMV, 2016) – the DJPR is the Control Agency for spills that affect Victorian State Waters; and
- The Tasmanian Marine Oil and Chemical Spill Contingency Plan (‘TasPlan’) (EPA, 2019) – the Tasmanian EPA is the Control Agency for spills from vessels that affect Tasmanian State waters.

1.2. Scope

The Sequoia MSS will be undertaken in T49/P in the Otway, 22.8 km west of King Island; between August and October 2021.

This OPEP details arrangements in place for the timely implementation of response measures required to reduce risks to ALARP and acceptable levels in the event of a vessel-based marine diesel oil (MDO) spill during the Sequoia MSS.

The survey vessel and support vessels will have equipment on board for responding to emergencies, including but not limited to medical equipment, firefighting equipment and oil spill response equipment as defined in the vessel SOPEP (as relevant).

The seismic contractor in consultation with ConocoPhillips Australia will prepare a project-specific bridging document which will define how each organisation's emergency processes will interact. This document will contain key actions, responsibilities and contact details for responding to a vessel emergency, including an MDO spill.

In the event of an MDO spill, the Vessel Master will assume onsite command, will make the initial regulatory notifications to AMSA as defined in Section 2.5 and will act as onsite coordinator directed by AMSA. All persons aboard the vessel will be required to act under the direction of the Vessel Master.

The Vessel Master will notify the ConocoPhillips Australia GM HSE Incident Commander (IC), who will obtain approval from the ConocoPhillips Australia Crisis Manager to activate and mobilise the IMT.

1.2.1. Spill Scenario

The worst-case spill scenario for the Sequoia MSS is a vessel-based MDO release of 373 m3 due to vessel collision as a result of mechanical failure, navigational error or foundering due to weather.

MDO is predicted to undergo rapid evaporative loss and slicks are expected to break up.

Hydrocarbon properties are shown in Table 1-1.

Table 1-1: MDO Hydrocarbon Properties

Characteristic	Details			
Density (kg/m3)	829.1 at 15°C			
API	37.6			
Dynamic viscosity (cP)	4.0 at 25°C			
Pour point (°C)	-14			
Oil property category	Group II			
Oil persistence classification	Light persistent oil			
Component	Volatiles	Semi-volatiles	Low Volatiles	Residual Oil
Boiling Point (°C)	< 180	180-265	265-380	> 380
MDO (%)	6.0	34.6	54.4	5.0
Persistence	Non-persistent			Persistent

1.3. ConocoPhillips Australia Emergency Management Structure

The ConocoPhillips Australia Business Unit (ABU) Crisis and Emergency Management Plan arrangement use a graduated tiered response framework which classifies incidents based on the significance of the consequences, the risks involved and potential for escalation. There are three integrated elements in this framework, which combine to effectively manage events and emergencies for the Sequoia MSS:

- Seismic Vessel Emergency Response Teams (ERT)

- Incident Management Team (IMT)
- Crisis Management Team (CMT)

The significance of the emergency will determine the type, or tiered level of response that is activated.

ConocoPhillips Australia always maintains crisis and emergency management preparedness by having trained and competent personnel available to respond to emergency events. ABU also verifies that essential equipment and facilities are regularly maintained and ready for response.

Training and competency relevant for this OPEP is described in Section 6.10 of the EP.

Response preparedness and exercises are described in Section 6.9 of the EP.

Figure 1-1 shows ConocoPhillips's crisis, incident and emergency management interface.

The emergency response teams are described in further detail in the subsections below.

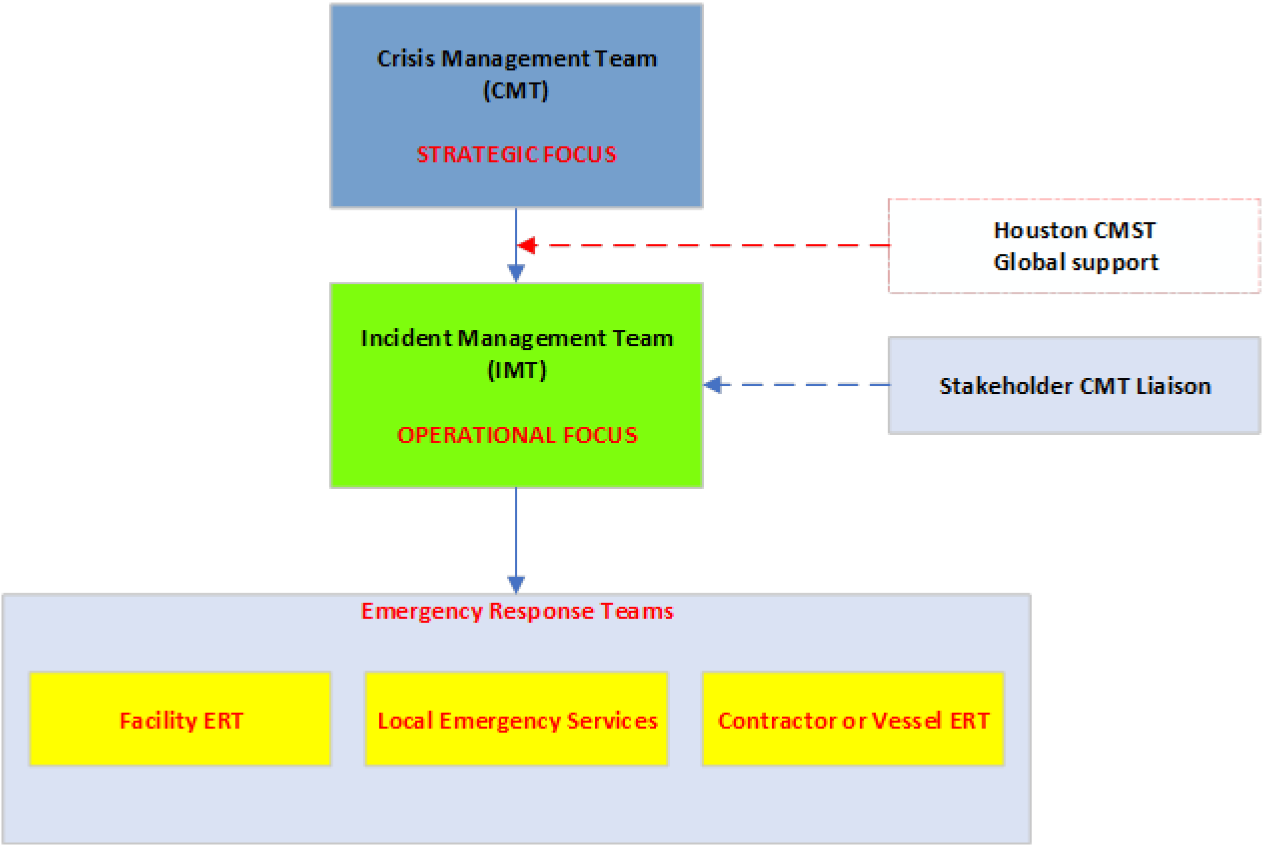


Figure 1-1: Crisis, Incident and Emergency Management Interface Arrangements

1.3.1. Emergency Response Team (ERT)

Response teams, under the control of the Vessel Master, are responsible for physically responding to and controlling emergency situations. Response Focus: Tactical.

The Emergency Response Team's (ERT) primary objectives are to:

- Respond to and control emergencies
- Identify emergency response priorities and develop tactical plans
- Assess the potential for escalation and impacts and liaise with local emergency services who may deploy resources to supplement vessel ERT.
- Provide regular information updates to the IMT.

When local emergency service crews are deployed and the Control Agency establishes an incident coordination centre to support their resources, ConocoPhillips Australia will make available a senior representative to attend the Control Agency's centre. The Sequoia Liaison Officer will provide a direct link to the ABU Incident Management Team in Brisbane.

1.3.2. Incident Management Team (IMT)

The IMT, under the leadership of the Incident Commander (IC), supports the ERT by undertaking the tactical control of the incident, providing support, technical expertise and developing operational strategies and plans. Response Focus: Operational.

The IMT primary objectives are to:

- Provide immediate operational support to the ERT
- Protect employees, contractors and members of the public from injury or illness because of an incident
- Minimise damage to assets and the environment
- Liaise with appropriate support agencies to assist ERT members in emergency situations
- Aid and support affected personnel and families
- Provide regular information updates to the CMT.

1.3.3. ABU Crisis Management Team (CMT)

The ABU CMT, under the leadership of the Crisis Manager, is responsible for managing the consequences of the incident for ConocoPhillips Australia at an enterprise level and involves the strategic, business interruption impacts, legal, reputation and the highest-level organisational liaison aspects of a crisis event. This involves developing an integrated strategic management approach to manage the consequences of the incident for:

- Public Information and stakeholder relationships directly related to our operating Facilities
- Business continuity impacts
- Legal considerations.

ABU CMT primary objectives are to:

- Consider the business continuity, strategic, legal and public image consequences of the incident for the ABU
- Attend to public media issues relating to the operating Facilities
- Develop a Crisis Management plan to coordinate all actions
- Communicate with internal and external stakeholders that relate directly to ABU operations

- Comply with applicable regulatory requirements
- Notify ConocoPhillips Australia Crisis Management and Emergency Response – Houston as appropriate.

1.3.4. Additional Organisational Support

Further support for managing emergency events, the Crisis Manager can request assistance via:

- Crisis Management Support Team (CMST)
- Global Incident Management Assist Team (GIMAT) - a specialist incident management team. Members are located globally and can be readily mobilised to support a business unit IMT that has exceeded its capacity to manage effectively.

2. Initial Response Requirements

An overview of the initial response requirements for vessel masters (VM), client site representative (CSR) and the ConocoPhillips Australia incident management team (IMT) is provided in Table 2 1. Table 2 1 has been developed to guide the response personnel through the key steps of this OPEP during a Level 2 or Level 3 spill (defined in Section 2.3).

Table 2-1 contains an initial response guide for vessel spills, where the Australian Maritime Safety Authority (AMSA) is the Control Agency, however also includes all the steps the IMT may be required to take, if AMSA requests support from the IMT. Information to support the initial and ongoing response requirements are included in this OPEP.

Note Table 2-1 is based on the following definitions for ‘Action by’ persons during spill from vessel (where AMSA as Control Agency):

- VM – Vessel Master (Contractor)
- ERT - Emergency Response Teams (Contractor)
- CSR – Client Site Representative (COP)
- GM HSE – General Manager, HSE (COP)
- IMT – Incident Management Team (COP)

For the Sequoia MSS, the ERT responsibilities and initial response processes will be managed via the vessel ERT with notification to the ConocoPhillips Australia GM HSE.

Refer to Section 6.1 of the EMP for a description of COP’s Emergency Response Framework.

Table 2-1: Initial response requirements for Vessel Master (VM), client site representative (CSR) and the ConocoPhillips Australia incident management team (IMT)

	VM	CSR	IMT	Response Actions	Resources or Info required	Description
1	√			Ensure it is safe and if so - Stop the spill	Vessel Ship Oil Pollution Emergency Plan (SOPEP) (or as relevant)	
2	√			Activate vessel SOPEP	Vessel SOPEP	
3	√			Classify the spill incident level	Section 2.2 Spill Classification	For incident 1, 2 or 3, VM can provide initial visual confirmation of spill extent and indicative volume of release.
4	√			Verbally notify AMSA	• See Section 2.5 External Agencies Notification • **Error! Reference source not found.** Jurisdictional boundaries for Jurisdictional Authority and Control Agencies. • ConocoPhillips Australia Emergency Contacts ABU-450-HS-L01-C-00001.	AMSA is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction and are to be notified immediately of all ship-sourced incidents through the AMSA Rescue Coordination Centre (RCC) Australia. **AMSA RCC:** +61 2 6230 6811 Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA's National Plan for Maritime Environmental Emergencies.
5	√	√		Verbally notify the CSR	Section 2.4.1 Internal Spill Notifications	
6	√	√		Deploy satellite tracking buoys (if required)	See Section 7 OSMP	Tracking buoys can be hired from AMOSC. Additional tracking buoys can be requested for deployment from the IC.
7		√	√	• CSR to notify IC (GM HSE) • IC (GM HSE) notify COP Crisis Management Team (CMT) Leader. • Crisis Manager approves IMT Activation • GM HSE notify IMT IC • IMT IC to activate IMT.	Section 2.4.1 Internal Spill Notifications	GM HSE +61 447 797 095
8	√	√		• Prepare marine pollution report (POLREP), submit to AMSA and copy to CSR. • CSR to forward POLREP to IC.	POLREP – Available here: https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil	
9	√	√		IMT to contact AMSA and confirm POLREP and offer support as per memorandum of understanding (MOU) (Section **Error! Reference source not found.**).	See Section 2.3 Jurisdictional Authority and Control Agency.	AMSA and ConocoPhillips Australia acknowledge that AMSA retains Control Agency responsibility for all ship sourced marine pollution incidents. ConocoPhillips Australia agrees to provide all available support to AMSA in AMSA's performance of its Control Agency responsibilities under the National Plan for Maritime Environmental Emergencies. 10

						All11 resources and capabilities within this OPEP can be implemented, upon AMSA's request. Should AMSA request IMT support, ConocoPhillips Australia IMT to progress with the steps below this row.
10			√	Develop situational awareness.	Section 3.1 Gain Situational Awareness	During the initial phase of a spill, obtaining and communicating information to allow the establishment of situational awareness is critical for response planning.
11			√	Notify Australian Marine Oil Spill Centre (AMOSC).	Section 2.5 ConocoPhillips Australia Emergency Contacts ABU-450-HS-L01-C-00001	AMOSC will provide support and guidance to the IMT during any Level 2 or Level 3 spill event. **AMOSC (24-hr)**: +61 (0) 438 379 328; **Email**: amosc@amosc.com.au Telephone call and e-mail confirmation to AMOSC required for mobilisation of response personnel and equipment, and call-out authorities will be required to confirm they are the IC to AMOSC. AMOSC will email a service contract for the request of AMOSC resources/personnel. This contract must be completed and signed by the IC and emailed to AMOSC, prior to AMOSC mobilisation.
12			√	Notify additional regulators and stakeholders	ConocoPhillips Australia Emergency Contacts ABU-450-HS-L01-C-00001	External agencies contact information is available in the Directory
13			√	Initiate OSMP 'Immediate Response Measures' - aerial, vessel, and satellite (as appropriate)	See Section 7 OSMP	Must be implemented as a priority, prior to the development of Incident Action Plans (IAPs). Additional details on Operational Monitoring and Evaluation are also provided in Section **Error! Reference source not found.**.
14			√	Obtain long-term weather forecasts.	For weather forecast service provider see the Bureau of Meteorology (BOM) website	Site–specific, long-term weather forecasts are available through BOM.
15			√	Implement oil spill trajectory modelling (OM01) – Operational Monitoring and Evaluation.	Transmit to spill modelling provider (RPS) via Oil Spill Trajectory Modelling Request Form. –	Additional details on spill trajectory modelling are also provided in Section **Error! Reference source not found.**. RPS modelling request activated via phone call, followed by email of modelling request form. 24/7 duty phone: 0408477196 **Email**: response@apasa.com.au NatPlan spill trajectory modelling can be requested – form available here: https://www.amsa.gov.au/forms/national-plan-spill-trajectory-modelling-request Contact AMSA Marine Pollution Duty Officer through AMSA Search and Rescue (24/7) on 1800 641 792.
16			√	Identify protection priorities	See Section 3.3 Protection Priorities	

17			√	Validate spill Strategic Net Environmental Benefit Analysis (NEBA) template to generate Operational NEBA	Section 4.1 and Operational NEBA template	The Operational NEBA template provides a summary of key considerations for relevant spill response techniques and will assist the IMT to determine the appropriate response strategies to include in the Incident Action Plan.
18			√	Develop IAP	Section 3 IAP	Resource's descriptions, capabilities and activation processes are provided in Section **Error! Reference source not found.** Spill Response Resources. Utilise this information during the development of the IAP.
19			√	Implement IAP	Section 6 Spill Response Resources	
20			√	Use spill surveillance and reconnaissance data (OM02) to update oil spill trajectory modelling (OM01) outputs	Section 7 OSMP and Table 7-1Table 7-1	
21			√	Use oil monitoring (OM03) program data to determine scientific monitoring (SM) activation	Section 7 OSMP and Table 7-1	
22			√	Terminate response	Section 5.4 Response termination	General response termination considerations are provided in Section **Error! Reference source not found.** Response termination. Response strategy specific termination criteria considerations are provided in Section **Error! Reference source not found.** Spill Response Resources. OMs and SMs termination criteria are provided in **Error! Reference source not found.** of Section **Error! Reference source not found.**.

2.1. Vessel SOPEP

MARPOL Annex I require a SOPEP to be in place on all vessels >400 gross tonne. MARPOL Annex II requires a SMEMP to be in place on all vessel >150 gross tonnage.

In general, a SOPEP/ SMEMP describes the steps to be taken:

- In the event that a hydrocarbon spill has occurred
- If a vessel is at risk of a hydrocarbon spill occurring
- For notification procedures in the event of a hydrocarbon spill occurring and provides all important contact details

Each vessel conducting work for the Sequoia MSS will hold a current SOPEP that will be the principal working document for the vessel and crew in the event of an MDO spill. The Vessel Master is responsible for activating and implementing the vessel SOPEP which includes information on about initial response, reporting requirements and arrangements for the involvement of third parties having the appropriate skills and facilities to effectively respond to oil spill issues.

2.2. Spill Classification

Spill classification under the NatPlan (AMSA, 2020), marine hydrocarbon spills and their response requirements are categorised into three levels, based on a combination of factors:

- The known or inferred spill size, scale and complexity
- The likely fate of the spill
- Environmental, socio-economic and cultural values within the vicinity
- The capability of equipment in the field in regard to the spill, and the level of support required to respond.

Table 2-2 summarises the hydrocarbon spill level response models adopted for this OPEP as per NatPlan Guidance. However, in general NatPlan identifies three levels of incidents as follows:

- Level 1- Incidents are generally able to be resolved through the application of local or initial resources only (e.g. first-strike capacity)
- Level 2 - Incidents are more complex in size, duration, resource management and risk and may require deployment of jurisdiction resources beyond the initial response
- Level 3 - Incidents are generally characterised by a degree of complexity that requires the Incident Controller to delegate all incident management functions to focus on strategic leadership and response coordination and may be supported by national and international resources

In the event of a spill occurring where effective response is considered beyond the immediate response capabilities of the vessel capability (i.e. a spill above Level 1), the response will be escalated immediately to the next level. Spill volumes are a guide only and not to be strictly applied.

Table 2-2: Incident Level Classification

CHARACTERISTIC	LEVEL 1	LEVEL 2	LEVEL 3
Volume	<10	10 to 1000	>1000
MANAGEMENT			
Jurisdiction	Single jurisdiction	Multiple jurisdictions	Multiple jurisdictions

Delegation	Incident Controller responsible for all functions	Some functions delegated or divisions created	All functions delegated and/or divisions created
Number of agencies	First-response agency	Routine multi-agency response	Agencies from across government and industry
Incident Action Plan	Simple/Outline	Outline	Detailed
Resources	Resourced from within one area	Requires intra-state resources	Requires national or international resources
TYPE OF EMERGENCY			
Type of response	First-strike	Escalated	Campaign
Duration	Single shift	Multiple shifts Days to weeks	Extended response Weeks to months
Hazards	Single hazard	Single hazard	Multiple hazards
RESOURCES AT RISK			
Human	Potential for serious injuries	Potential for loss of life	Potential for multiple loss of life
Environment	Isolated impacts or with natural recovery expected within weeks	Significant impacts and recovery may take months. Remediation	Significant area and recovery may take months. Remediation

Source: AMSA (2020)

2.3. Jurisdictional Authority and Control Agency

Any agency which has jurisdictional or legislative responsibilities for maritime environmental emergencies is obligated to work closely with the Control Agency to ensure that incident response actions are adequate.

The Control Agency responsibility does not always coincide with that of a Jurisdictional Authority. The Control Agency has the operational responsibility to take action in order to respond to an oil spill in the marine environment in accordance with the relevant contingency plan.

Table 2-3 defines the Jurisdictional Authority and Control Agency responsibilities within relevant jurisdictions as per NatPlan.

Control Agency – Commonwealth Waters

The NatPlan specifies that for spills in Commonwealth waters, resulting from a ‘Facility’, the Operator shall become the Control Agency. Where the spill is not from a Facility (i.e. a vessel spill), AMSA will become the Control Agency.

Under this EP, the only credible spill scenario is a vessel collision, with AMSA as Control Agency. In the instance that AMSA is the Control Agency, ConocoPhillips Australia has committed under Clause 7 of a memorandum of understanding (MoU) between ConocoPhillips Australia and AMSA, that ConocoPhillips Australia ‘agrees to provide all available support to AMSA in AMSA’s performance of its Combat (Control) Agency responsibilities’ (AMSA, 2020).

The MoU further states that for ship-sourced marine pollution events:

- AMSA is the designated Combat (Control) Agency for oil spills from vessels within the Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA’s Marine Pollution Response Plan.

- AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-sourced incidents.
- AMSA is to be notified immediately of all ship-sourced incidents through:
    - AMSA Rescue Coordination Centre (RCC) Australia (+61 2 6230 6811).

Control Agency – State Waters

Incidents involving an oil spill response could result in more than one agency having jurisdictional control across the oil spill response area. This situation is possible where a significant spill (Level 2 or 3) originates from the vessel in Commonwealth waters (where AMSA is the Control Agency) and transitions into (or threatens) state waters. Where there is potential for state water impact, the state will be the Control Agency for the response activity that occurs within state waters (Tasmania and Victoria).

Table 2-3: Jurisdictional boundaries for Jurisdictional Authority and Control Agencies

Jurisdictional boundary	Spill source	Jurisdictional Authority	Control Agency			Documentation
			Level 1	Level 2*	Level 3*	
Commonwealth waters (3 to 200 nm from territorial sea baseline)	Vessel	AMSA	Vessel, as per under vessel SOPEP.	State - with support from vessel contractor, ConocoPhillips Australia and AMOSC if required	State - with support from vessel contractor, ConocoPhillips Australia and AMOSC if required	Vessel SOPEP, NatPlan and ConocoPhillips Australia OPEP (this document)
State waters (territorial sea baseline to 3 nm, including some offshore atolls and islands)	Vessel	State Control Agency				Vessel SOPEP, and ConocoPhillips Australia OPEP (this document)

**AMOSC and government agencies may assist the relevant Control Agency for Level 2 and Level 3 spills, as appropriate to the spill characteristics.*

2.3.1. Victorian Arrangements

Under the EM Act 2013 (Vic), DJPR (Emergency Management Branch, EMB) is responsible for responding to oil and chemical spills in Victorian state waters.

In the event that the MDO spill crosses into Victorian state waters, DJPR will only assume Incident Control over the impacted area in State waters while AMSA will remain responsible for managing the spill outside Victorian coastal waters.

If an incident affecting wildlife occurs in Commonwealth waters close to Victorian State waters, AMSA will request support from DELWP to assess and lead a wildlife response if required. DELWP may also place a DELWP Liaison Officer in a state-based oil spill IMT and/or the ConocoPhillips Australia IMT.

In the event DJPR is leading an oil spill response within Victorian state waters, a joint IMT will be established between DJPR and AMSA. The joint IMT aims to ensure a coordinated response between lead agencies.

ConocoPhillips Australia will have representation embedded within the joint teams and provide feedback to ConocoPhillips Australia IMT.

As noted in the Victorian Animal Emergency Welfare Plan (DJPR/DELWP, 2019, Rev 2), DELWP will be the Control Agency for a wildlife response, using arrangements included in the Wildlife Response Plan for Marine Pollution Emergencies (DELWP, 2007).

2.3.2. Tasmanian Arrangements

Under the Pollution of Water by Oil and Other Noxious Substances Act 1987 (Tas), the DPIPWE (Tasmania EPA) is responsible for responding to oil and chemical spills in Tasmanian state waters.

In the event that an MDO spill in Commonwealth waters crosses into Tasmanian state waters, the EPA will only assume Incident Control over the impacted area in State waters while AMSA will remain responsible for managing the spill outside Tasmanian coastal waters in consultation with the State.

The Tasmanian Oiled Wildlife Response Plan (‘WildPlan’) is administered by the Resource Management and Conservation Division of DPIPWE and outlines priorities and procedures for the rescue and rehabilitation of oiled wildlife.

2.4. ConocoPhillips Australia Response Team Activation

Where a spill is assessed to be Level 2 or Level 3, the IMT shall be activated by the COPs GM HSE after approval is given by the Crisis Manager. Once the IMT has been activated it shall provide support to AMSA (as Control Agency for vessels spills) for implementing spill response control measures, interaction with regulatory authorities and support agencies, monitoring, reporting and response termination.

2.4.1. Initial Spill Notification

The spill observer shall take action to stop the spill, if possible and safe to do so. After which the following should occur (as per Section 0, Table 2-1):

- Observer to notify the Vessel Master to activate SOPEP.
- Vessel Master to provide verbal notification to AMSA
- Vessel Master shall alert the ConocoPhillips Australia CSR
- Vessel Master/ ConocoPhillips Australia CSR to deploy satellite tracking buoys (available via AMOSC)
- ConocoPhillips Australia CSR shall alert the GM HSE
- GM HSE shall consult with the Crisis Manager, and jointly determine whether to activate only the IMT or both the IMT and the CMT
- Vessel Master to prepare POLREP and provide to AMSA and ConocoPhillips Australia CSR

Refer to Table 2-1 and ConocoPhillips Australia Emergency Contacts Directory ABU-450-HS-L01-C-00001 for appropriate contact details.

2.5. External Agencies Notification

AMOSC shall provide technical support to assist and shall also provide access to oil spill response equipment and personnel, if required. Details of resource availability are provided in Section 6 of this OPEP

In the event of an MDO spill, the Vessel Master will assume onsite command, will make the initial regulatory notifications to AMSA as defined in Section 2.5.1 and will act as onsite coordinator directed by AMSA. All persons aboard the vessel will be required to act under the direction of the Vessel Master.

The Vessel Master (via the CSR) will notify the ConocoPhillips Australia GM HSE.

The Vessel Master has the responsibility for reporting overboard spills to the AMSA RCC (via POLREP Form contained in the vessel's SOPEP.

The Vessel Master shall immediately notify AMSA, who will be the Control Agency for the MDO release spill in Commonwealth Waters (Level 1 spill will be managed by the Vessel Master).

In consultation with AMSA (as the Control Agency), the Vessel Master, Survey Supervisor and IC (as relevant) shall provide verbal notifications of Level 2 or Level 3 spill events to the organisations listed in Table 2-4. The IC, in consultation with AMSA, should consider additional stakeholder notifications, based on values and sensitivities affected.

Once this initial report has been undertaken, further reports (i.e. SITREP forms) will be issued from the vessel at regular intervals to keep relevant parties (such as AMSA, NOPSEMA, etc.) informed. The ConocoPhillips Australia CSR is responsible for advising the HSE GM of the spill incident via the agreed process. ConocoPhillips Australia is then responsible for notifying NOPSEMA.

Regulatory notification arrangements are provided in Table 2-4. In addition to this, ConocoPhillips Australia will advise potentially affected stakeholders of the spill as per stakeholder process (Section 3 of the EP).

Table 2-4: MDO Spill Regulatory Notifications

Notification timing	Authority	Notification By	Contact Number	Details
Level 1 spill				
Immediately	ConocoPhillips Australia GM HSE	Vessel Master	ConocoPhillips Australia Emergency Contacts ABU-450-HS-L01-C-00001	Vessel to notify ConocoPhillips Australia immediately or ASAP to ensure further notifications can be undertaken within required timeframes.
Within 2 hours	AMSA	Vessel Master	1800 641 792	Verbally notify AMSA RCC of spill. Follow up with written POLREP ASAP. http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf
Within 2 hours	NOPSEMA	ConocoPhillips Australia GM HSE	08 6461 7090	ConocoPhillips Australia to verbally notify NOPSEMA of spill >80 L.
Level 2 or 3 (in addition to Level 1 notifications)				
ASAP – if spill affects Vic Waters	DJPR (Vic)	AMSA/ ConocoPhillips Australia GM HSE	03 8392 6934	Verbally notify DJPR and follow up with POLREP ASAP.
ASAP- if spill affects Tas Waters	EPA Tasmania (Tas)	AMSA/ ConocoPhillips Australia GM HSE	03 6165 4599	Verbally notify EPA and follow up with POLREP ASAP.
Within 2 hours	Type II Monitoring Service Provider (RPS)	ConocoPhillips Australia Environmental Unit Lead (EUL)	08 9211 1111	Verbally notify service provider to initiate operational and scientific monitoring if triggered (as outlined in initiation criteria in Section **Error! Reference source not found.**, **Error! Reference source not found.**).
Within 1 day	NOPTA	ConocoPhillips Australia GM HSE	08 6424 5317	Provide a verbal or written incident summary.
Within 3 days	NOPSEMA	C ConocoPhillips Australia GM HSE	08 6461 7090	Provide a written incident report form.
If within the AMP, KEFs other MNES regardless of spill size				
ASAP	Director of National Parks	ConocoPhillips Australia GM HSE	0419 293 465	Spill with potential to impact AMPs. KEF or other MNES, including potential for oiled wildlife.

A marine pollution report (POLREP) is required to be sent to AMSA for any vessel-based spill. The POLREP should also be sent to the IMT, as it contains the relevant information necessary for the IMT to gain initial situational awareness.

See Table 2-4 for further information regarding POLREP template and submission timeframes.

2.5.1. Immediate (First Strike) Response Measures

The immediate response has been predetermined by the Operational NEBA (see Appendix 2 for template) and must be implemented as soon as practicable, before the development of IAPs. The immediate response for all Level 2 and Level 3 spill events is Hydrocarbon spill trajectory prediction and Operational monitoring of hydrocarbon properties, behaviour and weathering at sea (OM01 and OM03), as detailed in Section 7 of this OPEP.

3. Incident Action Plan Development

The process for identifying appropriate IAPs is illustrated in Figure 3-1.

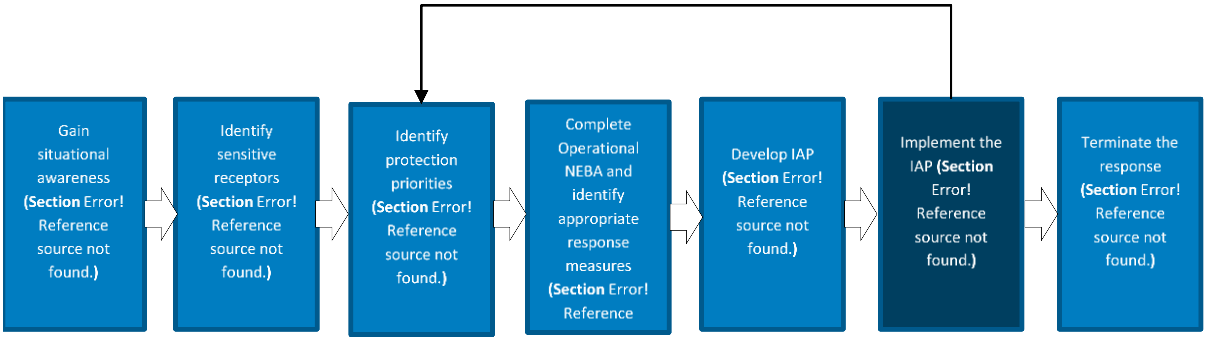


Figure 3-1: Incident Action Plan Development Process

3.1. Situational Awareness

The IMT will gain situational awareness from all available sources including:

- Operational Monitoring and Evaluation data
- vessel or Facility POLREP
- ongoing updates from the vessel (via SITREP forms)
- long-term weather forecast
- other vessels or Facilities in the vicinity
- other operators' activities.

3.2. Sensitive Receptors

Particular values and sensitivities with the potential to be exposed to a spill event have been identified within Section 4 and Appendix H of the EP. The ConocoPhillips Australia IMT room is equipped with maps and tools to identify actual/real-time exposure risks.

Where there is a seasonal component associated with a particular value or sensitivity, this is described in Temporal Presence and Absence section of Appendix A in the EP.

3.3. Protection Priorities

In the event of a spill, the primary aims of the response will be aligned with the NatPlan (AMSA, 2020) and the People, Environment, Assets, Reputation and Sustainability (PEARS) model and include protection of the following, in descending order of priority:

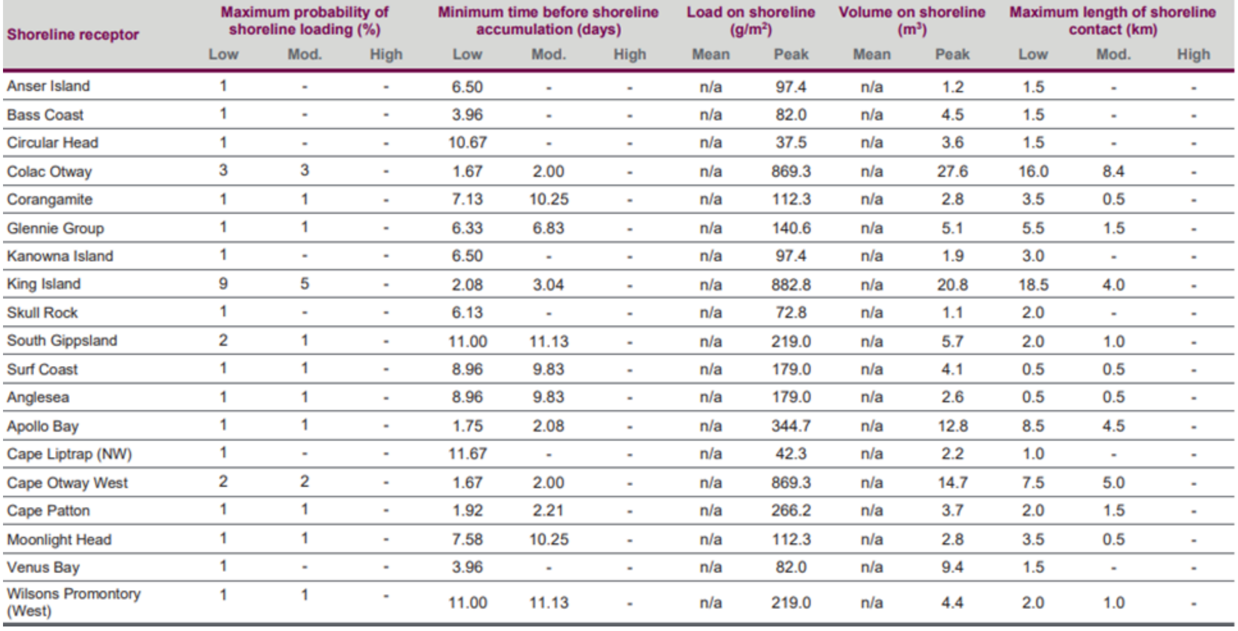
- Human health and safety
- Habitat and cultural resources (environmental sensitivities)
- Rare and/or endangered flora and fauna (environmental sensitivities)
- Commercial resources
- Amenities.

Each shoreline location is evaluated based on predicted time to contact and consequence of contact. The level of consequence associated with identified values and sensitivities of the spill are defined in the ConocoPhillips Australia Risk Matrix (Section 1.x (Exec Sum). Time to contact during a spill event will be based on the location and trajectory (model outputs) and visual observations of the spill.

Table 3-1 shows the shoreline receptors, minimum time before shoreline accumulation in days, Load, Volume and Max length on shoreline.

Figure 3-2 shows where the moderate concentration of 100 g/m2 shoreline loading occurs at King Island, Cape Otway West, Apollo Bay Colac Otway. No high thresholds occurred.

Table 3-1: Summary of oil contact to individual shorelines. Results are based on a 373 m3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area



Shoreline receptor	Maximum probability of shoreline loading (%)			Minimum time before shoreline accumulation (days)			Load on shoreline (g/m²)		Volume on shoreline (m³)		Maximum length of shoreline contact (km)		
	Low	Mod.	High	Low	Mod.	High	Mean	Peak	Mean	Peak	Low	Mod.	High
Anser Island	1	-	-	6.50	-	-	n/a	97.4	n/a	1.2	1.5	-	-
Bass Coast	1	-	-	3.96	-	-	n/a	82.0	n/a	4.5	1.5	-	-
Circular Head	1	-	-	10.67	-	-	n/a	37.5	n/a	3.6	1.5	-	-
Colac Otway	3	3	-	1.67	2.00	-	n/a	869.3	n/a	27.6	16.0	8.4	-
Corangamite	1	1	-	7.13	10.25	-	n/a	112.3	n/a	2.8	3.5	0.5	-
Glennie Group	1	1	-	6.33	6.83	-	n/a	140.6	n/a	5.1	5.5	1.5	-
Kanowna Island	1	-	-	6.50	-	-	n/a	97.4	n/a	1.9	3.0	-	-
King Island	9	5	-	2.08	3.04	-	n/a	882.8	n/a	20.8	18.5	4.0	-
Skull Rock	1	-	-	6.13	-	-	n/a	72.8	n/a	1.1	2.0	-	-
South Gippsland	2	1	-	11.00	11.13	-	n/a	219.0	n/a	5.7	2.0	1.0	-
Surf Coast	1	1	-	8.96	9.83	-	n/a	179.0	n/a	4.1	0.5	0.5	-
Anglesea	1	1	-	8.96	9.83	-	n/a	179.0	n/a	2.6	0.5	0.5	-
Apollo Bay	1	1	-	1.75	2.08	-	n/a	344.7	n/a	12.8	8.5	4.5	-
Cape Liptrap (NW)	1	-	-	11.67	-	-	n/a	42.3	n/a	2.2	1.0	-	-
Cape Otway West	2	2	-	1.67	2.00	-	n/a	869.3	n/a	14.7	7.5	5.0	-
Cape Patton	1	1	-	1.92	2.21	-	n/a	266.2	n/a	3.7	2.0	1.5	-
Moonlight Head	1	1	-	7.58	10.25	-	n/a	112.3	n/a	2.8	3.5	0.5	-
Venus Bay	1	-	-	3.96	-	-	n/a	82.0	n/a	9.4	1.5	-	-
Wilsons Promontory (West)	1	1	-	11.00	11.13	-	n/a	219.0	n/a	4.4	2.0	1.0	-

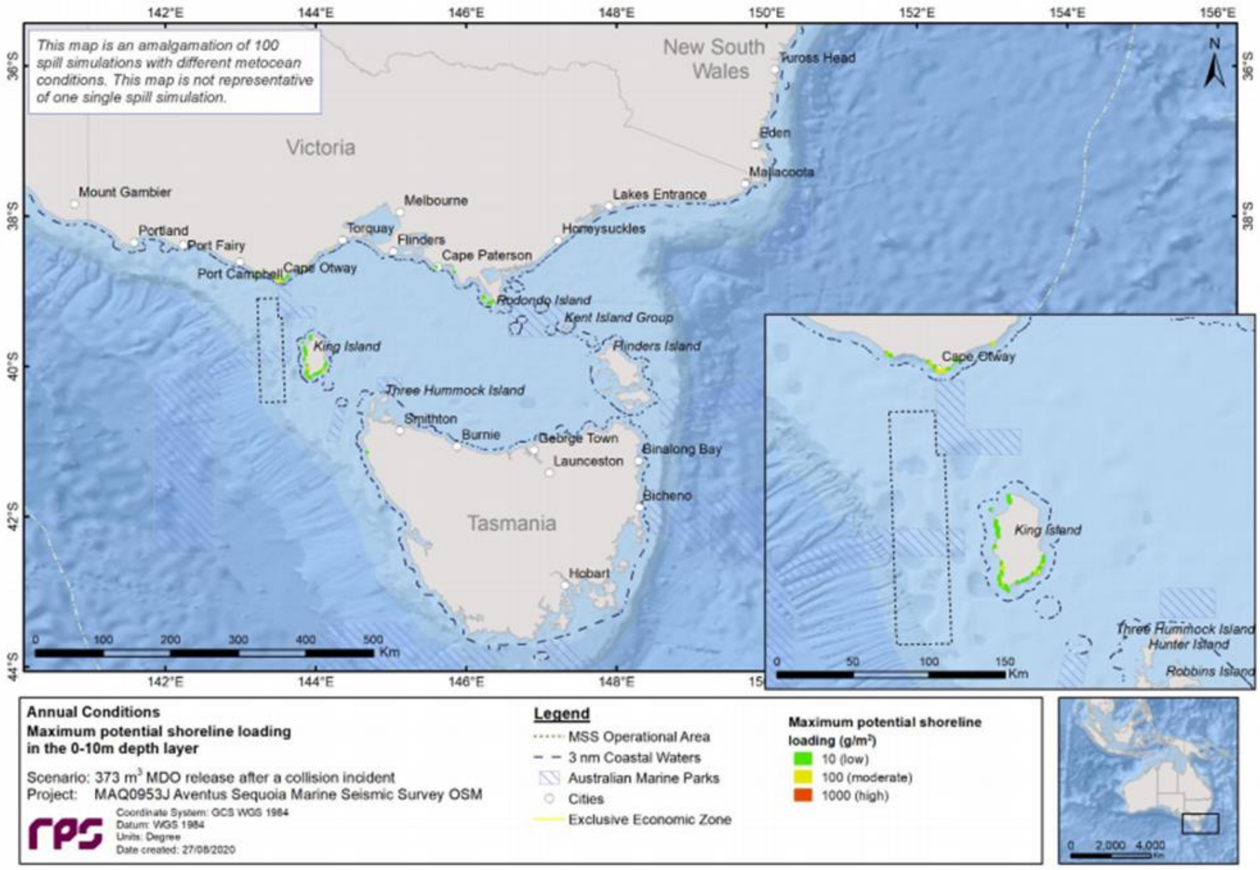


Figure 3-2: Predicted maximum shoreline loading resulting from a 373 m3 surface release of MDO over 6 hours calculated from 100 spill trajectories randomly spaced within the operational area

3.4. Incident Action Plan

The IMT will prepare an IAP once it has gained accurate and reliable situational awareness, reviewed protection priorities and completed the Operational NEBA.

Note that this section should be read in conjunction with the ConocoPhillips Australia Crisis and Incident Management Plan which contains descriptions of IMT roles, and the emergency management competency training associated with these roles. An IAP is typically prepared for response activities beyond the immediate response measures (first strike) timeframe.

The IAP will:

- Establish the overall incident response objectives and strategies – determine what is to be achieved, where, when and by whom.
- Ensure continuity of incident control – decisions are made and agreed at one location and cascaded down.
- Provide for effective use of resources – usage is coordinated from one central location, facilitating more accurate planning and resource allocation.

The IAP will be the mechanism for oil spill management from the moment it comes into force through to the termination of the response. The intent is that it is used to direct response operations while ensuring that everyone involved in the response is mitigating identified risks and working towards the same objectives and priorities.

The IAP will be the document referred to when dealing with post-incident analysis on issues such as cost and legal requirements, as well as the overall effectiveness of the response and its personnel. The IAP shall be documented and given a period of operational validity (from–to date and time). The IAP shall be revisited and updated prior to the next operational period.

The basic steps for IAP development are provided in Table 5-2.

Table 3-2: IAP Development

Item	Description of Action
1	Set Incident Objectives and IC to Approve
2	IMT Tactics Meeting
3	Planning Meeting Preparation Preparation should include identifying and review of following: • Resources and availability • Safety requirements • Environmental impacts • Situation reports • Maps and supporting docs
4	Planning Meeting Plan Development including concept, work assignments, resources, incident projections and an estimated impact of strategies in containing/controlling the incident. After review, any amendments should be captured and incorporated into an overall plan.
5	IAP Development The IAP is developed by IMT members who are responsible for providing information for inclusion in the IAP. The IAP is approved by the IC.
6	Operations Briefing A briefing is given to inform all members of the IMT and those implementing the Plan, so they are aware of the planned actions and any specific task allocations they are required to complete. This shall include any safety and environmental considerations and need to provide status updates and briefings on incident progress. In early stages of an incident this may be an oral briefing only. In later stages, it is anticipated this will involve written material to support the oral briefing
7	IAP Dissemination and Execution The IAP is circulated and planned actions and tasks to meet plan objectives are completed as per plan requirements
8	Assess Progress Against Incident Objectives Situation reports and status briefings provide progress against the objectives and identify any obstacles to achieving objectives. This information is the commencement point for the development of the IAP for the next operational period.
9	Return to item 1 and develop Plan for next operational period as defined by the IC

4. Response Option Selection

Not all response options and tactics are appropriate for every spill scenario. The response options available were evaluated in Section 5.5 (OSR) of the EP for whether they are expected to be viable for the spill scenario and location; and whether net environmental benefit would be likely. This is known as a strategic, or pre-spill NEBA.

The preliminary screened response options that may be implemented for the spill scenario are summarised in Table 4-1.

A site-specific operational NEBA is required prior to undertaking response options (Section 4.1).

Natural recovery refers to leaving the hydrocarbon in place, rather than actively removing or treating them, allowing for natural biodegradation. As there are no actions associated with this strategy, it is not detailed further in this section. If natural recovery is considered an appropriate response strategy, monitoring, evaluation and surveillance (MES) and an operational NEBA will still be undertaken.

Note: The tasks and responsibilities described in this section are presented to guide response teams. Depending on the nature and scale of the spill and the specific spill parameters, the IC may determine that some tasks be varied or not undertaken, and/or that responsibilities be reassigned.

Table 4-1: Preliminary Screening of Spill Response Options

Spill Response Strategy	Feasibility / Effectiveness	Implement	Comment
Source Control	Feasible and effective	Yes	Primary response strategy. Minimises volume of hydrocarbon lost to environment.
Monitoring, Evaluation and Surveillance (MES)	Feasible and effective	Yes	MDO will largely evaporate and disperse rapidly, a residual fraction of the hydrocarbon may spread to sensitive receptors. Monitoring and evaluation of the spill trajectory will provide information to inform other response strategies and monitoring requirements.
Assisted Natural Dispersion	Feasible and partially effective	Pending Operational NEBA	MDO evaporates and disperses rapidly. Depending on weather conditions, thickness of surface slick proximity to sensitive receptors, this response may present a net environmental benefit.
Dispersant Application	Feasible, but not effective	No	Although dispersant is categorised as 'conditional' for Group II oil, the size of potential spill volume and the natural tendency of spreading into very thin films is evidence that dispersant application will be an ineffective response.
Containment and Recovery	Not feasible, not effective	No	Low viscosity properties of MDO allow for efficient containment by boom and recovery by oleophilic skimmers with ~90% hydrocarbon to water recovery rate. However, to be of value, contain and recover techniques are dependent on adequate oil thickness (generally in excess of 10 g/m^2) (i.e. actionable threshold). The normal sea state of the Otway basin does not provide significant opportunities to utilise this strategy.
Shoreline Protection and Deflection	Potentially feasible and partially effective	Pending Operational NEBA	Low viscosity properties of MDO allow for efficient protection and deflection with boom such as absorbent, zoom boom and beach guardian. The normal sea state of the Otway basin does not provide significant opportunities to utilise this equipment efficiently.
Shoreline Clean-up	Potentially feasible and partially effective	Pending Operational NEBA	The normal sea state of the Otway basin encourages natural processes with high energy wave action, wind and regular storm events. Net environmental benefit may not be achieved by clean-up activities and equipment on the shoreline, depending on the shoreline type and sensitivities present. Shoreline assessment activities would occur if shoreline impact was predicted.
Oiled Wildlife Response	Potentially feasible and partially effective	Pending Operational NEBA	If oiling occurs in areas above the actionable threshold of 10 g/m^2 for surface & >100 g/m^2 for shoreline, oiled wildlife response may be effective. At the direction of State Control Agency, OWR would be implemented to affected wildlife as appropriate. Effectiveness of response option depends on affected species and habitat type.

4.1. Net Environmental Benefit Analysis

NEBA is a methodology for comparing the net environmental benefits associated with multiple management alternatives. With specific reference to oil spills it is 'the process of considering advantages and disadvantages of different spill response options (including no response) to arrive at a spill response decision resulting in the lowest overall environmental and social impacts.

NEBA is undertaken throughout the emergency response and involves four key steps (Table 4-2), to complete an Operational NEBA.

Table 4-2: Key Steps in NEBA Process

NEBA Step	Description
Evaluate Data	Consideration of where the spilled oil may/has occur/ed and where it is likely to drift under the influence of currents and wind; oil spill trajectory modelling support this, as will an understanding of how an oil will 'weather' as it drifts. Within the predicted impact area, identify the key characteristics of the habitats. During the NEBA, specific consideration must be given to formally managed receptors and relevant formal management advice (identified in Receptor Tab in Appendix A of the EP).
Predict Outcomes	Assessment of what is likely to be affected by the spilled oil if no response is undertaken. This may include both ecological and socio-economic resources, and areas with cultural or historical value. Seasonal variations may need to be taken into account.
Balance Trade-offs	The efficiency and feasibility of the OSR option should be reviewed in the context of representative scenarios. This covers the response techniques, the practicalities of their utilisation and how much oil can realistically be recovered or treated (pending on hydrocarbon characteristics, location and sea state). If areas under threat include oil-sensitive coastal habitats, the role of oil spill response at sea is to either prevent or limit the spilled oil from reaching these habitats. Pragmatic considerations (i.e. net benefit) should form an important part of the NEBA process as applied to all feasible response techniques.
Select Best Options	The NEBA process output is the selection of response technique(s) that minimise the overall impacts of a potential spill on the environment and promote the most rapid recovery and restoration of the affected area. Tiered capability is then established based on the identified needs.

Source: IPIECA, 2015

5. Response Options

5.1. Source Control

Source control is the primary response option in an oil spill to limit the loss of hydrocarbon to the environment and involves physical or mechanical controls.

The implementation tasks to guide source control for a vessel are shown in Table 5-1. Further information is detailed in:

- Vessel emergency management plans/SOPEP (as required by AMSA Marine Orders Part 21 and 91)
- National Plan for Maritime Environmental Emergencies (NatPlan; AMSA, 2017).

AMSA's Marine Order Part 21 [Safety and emergency arrangements] requires vessels to have an emergency management plan which includes recommended actions for dealing with emergencies, including damage to the vessel and pollution from the vessel. The emergency management plan/s must include:

- Damage control procedures;
- A decision support system for emergency management;

Marine Order Part 21 [Safety and emergency arrangements] also requires that the Vessel Master must:

- Assign the crew duties relating to emergencies that may occur on the vessel; and provide instructions on those duties.
- Ensure each crew member is trained in the operation and application of all emergency appliances and equipment of the vessel.

In accordance with MARPOL Annex I and AMSA's Marine Order Part 37, Marine Pollution Prevention – oil, a SOPEP is required to be developed based upon the Guidelines for the Development of Shipboard Oil Pollution Emergency Plans (adopted by IMO as Resolution MEPC.54(32) and approved by AMSA). In the event of a spill, the SOPEP details:

- Reporting requirements and a list of authorities to be contacted
- Activities to be undertaken to control the discharge of oil
- Procedures for coordinating with local officials.

Table 5-1: Source Control Implementation Guide

Who	Actions (if relevant)	Complete
Vessel Master / Vessel ERT	Implement source control options aboard the vessel, including: • Single-point control: o isolate source / penetrated tanks o patch installation / salvage • Transfer equipment control: o stripping pumps o shutoff valves o divert to other tanks o closing water tight doors o checking bulkheads o tank lightening. Refer to instructions in vessel emergency management plan/ SOPEP.	
IMT	Mobilise external support agencies (if not already done) and specialised equipment. Check availability of suitable vessels, helicopters, personnel and so on.	

5.2. Monitoring, Evaluation and Surveillance (MES)

MES is important for anticipating resources at risk of exposure, directing response resources, and evaluating the effectiveness of response techniques. MES should be conducted throughout the response duration, potentially along with other response options.

MES assists in determining whether further action is required, helps inform the decision-making for prioritisation of protection of sensitive receptors, and provides valuable information for conducting NEBA, coordinating other response options, and continually assessing the effectiveness of spill response options being implemented.

This OPEP includes MES tactics that may be used to evaluate the parameters and potential trajectory of the spill and may include one or more of the following:

- Trajectory Modelling – uses computer models and computational techniques to estimate the speed and direction of movement, weathering spread patterns, and impacts of an oil spill
- Fate and Weathering Modelling – uses computer modelling and computational techniques to estimate the weathering of an oil spill (via ADIOS model and/or trajectory modelling)

- Visual Observation (from aircraft and/or vessels) – observers on aircraft or vessels use standard references to characterise oil slicks. Visual observation is the most common surveillance and reconnaissance tactic. Observers onboard the survey vessel (i.e. the source of potential spill) would be best placed to provide information.
- Remote Sensing – uses remote sensing technologies to identify oil slicks.

The Operational and Scientific Monitoring Plan (OSMP) is triggered when initiation criteria for the various assessment components are met. Those MES tactics that are associated with protecting environmental receptors are addressed in the OSMP and are not discussed further in this OPEP.

An overview of the OSMP is provided in Section 7, including the monitoring programs and initiation and termination triggers.

Table 5-2 shows an implementation guide for MES (noting this is guidance only and the vessel ERT may vary tasks).

Response techniques will be terminated in accordance with the process detailed in Section 5.4.

Table 5-2: Monitor, Evaluation and Surveillance Implementation Guide

Role	Actions (if Relevant)	Complete
Vessel ERT	Continue surveillance from vessel, if safe to do so.	
	Record relevant data e.g. equipment mobilised, times, locations, Job Hazard Analysis (JHA) is used, etc.	
	Provide regular reports to the IMT IC (as required) regarding the appearance and behaviour of surface spill and weather (surface wind speed, direction, sea state, current speed and direction) and tidal conditions.	
	Confirm estimated spill volume (if possible) and communicate to the IMT.	
IMT	Collate weather and tidal information from Bureau of Meteorology	
	Review OSMP to determine which initiation criteria are triggered, and direct personnel to undertake required assessments.	
	Where required, mobilise aircraft to location to conduct surveillance as per MES.	
	Where required, mobilise vessel and/or aircraft and observers to the scene to carry out/assist with spill monitoring and surveillance activities as per MES.	
	Determine the spill volume and estimate the size of the spill to water via approximate surface calculations, based on: • Vessel Master/ERT spill volume estimates; and/or • Aerial and marine surveillance data where available.	
	If necessary, conduct hydrocarbon distribution, fate and weathering assessment to further develop response strategies. This may include: • Spill fates, weathering and trajectory (for marine spills) modelling – conduct through subcontractor (RPS); or conduct through AMSA National Plan arrangements. • Automated Data Inquiry for Oil Spills (ADIOS) fate and weathering modelling (if required) • Satellite/remote sensing imagery (conduct through AMSA or OSRL) Note: If using AMSA, complete then email the AMSA Oil Spill Trajectory Modelling (OSTM) request form, available here : http://www.amsa.gov.au/environment/maritime-environmental-emergencies/national-plan/General-Information/SPILLREQUEST/index.asp	
	Activate Geographic Information Systems (GIS) support to assist with development of mapping, including analysis of resources at risk sensitivity maps.	
	Review fate weathering and trajectory modelling and validate with field reports to predict spill trajectory.	
	Use available MES data to confirm sensitive environmental and social receptors and protection prioritisation. Use this information to conduct operational NEBA (Appendix 3) to confirm pre-identified response options and tactics are appropriate.	

	Use the MES information collected to periodically reassess spill level, effectiveness of response and NEBA, and modify the response strategy as required.	
	Arrange for additional support, if required, through the following: • ConocoPhillips Global incident Management Assurance Team • AMOSC • OSRL • AMSA Refer to Section **Error! Reference source not found.** for further information.	

Note: The tasks and responsibilities described in Table 5-2 are presented to guide response teams. Depending on the nature and scale of the spill and the specific spill parameters, the Incident Commander may determine that some tasks be varied, should not be undertaken, or that responsibilities be reassigned.

5.3. Secondary Response Options

ConocoPhillips Australia has identified that the following response options are only potentially feasible and partially effective; and may not achieve a net environmental benefit. They would only be undertaken pending an operational NEBA on the day, and in consultation with control agencies.

5.3.1. Assisted Natural Dispersion

The objective of assisted natural dispersion (AND) is to allow hydrocarbons to naturally dissipate and break down through natural physical processes (e.g. wave and wind energy) and biodegradation. Mechanical mixing energy (e.g. vessel propellers) may be applied to increase dissipation.

AND is of most benefit in very calm sea and wind conditions (noting these conditions are not that common in the Otway region). In high wind and wave conditions, additional mixing is not required.

A vessel can use the following tactics to increase mixing energy:

- Propeller wash: manoeuvring a vessel through the slick and using the agitation caused by the propeller to break up surface hydrocarbons
- High-pressure spraying: using a fire hose or other spraying systems to enhance surface break-up.

5.3.2. Shoreline Protection and Deflection

Shoreline protection and deflection (SPD) involves using physical barriers to protect sensitive receptors from hydrocarbons, or to deflect hydrocarbons to other strategic areas where they may be more easily captured.

All protection and deflection operations within State waters (such as King Island) are under the direction of the state control agency.

Deflection equipment such as booms can be deployed to deflect slicks from encroaching on environmentally sensitive areas. Absorbent type booms are a suitable secondary protection measures at environmental sensitive sites. The feasibility and effectiveness of these measures is largely dependent on calm sea conditions allowing for the deployment of booms, and this response option is only warranted where shoreline resources or offshore infrastructure are at risk.

Selection of the appropriate technique depends on the type of shoreline and its sensitivity, time until shoreline contact and weathered state of oil, metocean conditions and shoreline accessibility.

SPD would only be partially effective and would only be selected based on the outcomes of an operational NEBA and/or under direction from State control agencies.

5.3.3. Shoreline Clean-up and Assessment

The IMT shall consider all operational monitoring data to determine the potential for, or to confirm actual, shoreline contact and potential impacts. The IMT will need to consider, in consultation with the relevant state, the practicalities, likely success and risks associated with a shoreline clean-up operation, compared with allowing stranded oil to naturally weather. In any case, shorelines expected to be contacted by moderate thresholds of weathered hydrocarbon should be assessed to confirm the need for further response, including clean-up, where practicable.

The coastline of the Otway Basin is dominated by sheer sandstone cliffs with small and remote beaches which experience frequent heavy surf and swell. These locations rarely have vehicle access that would allow for the deployment of clean-up equipment and teams. Any hydrocarbons on these shorelines will likely weather rapidly and be broken down by natural processes.

A shoreline clean-up would most likely involve the mobilisation of personnel and manual cleaning equipment such as rakes and shovels, to remove the oil from the shoreline. Oily contaminated waste would be stored in impermeable bags or other similar small impermeable waste collection containers.

Oily waste containers would then most likely be transferred to licenced hazardous waste contractors. The waste would then be securely transported for appropriate disposal. Large mechanical equipment such as graders can be used however the sensitives would have to be taken in to account and it may be more appropriate for smaller machines such as rubber tracked bob-cats to be used to help transport collected oily waste and other response equipment around the shoreline.

A decontamination staging post may be established at the clean-up location to enable decontamination of equipment and personnel before demobilisation at the end of each day. Ultimately, all contaminated equipment and personal protective equipment (PPE) would be back-loaded from the location to the mainland for cleaning or appropriate disposal.

Shoreline clean-up operations are often considered in three stages:

- **Stage 1** – bulk oil is removed from the shore to prevent remobilisation;
- **Stage 2** – removal of stranded oil and oiled shoreline material which is often the most protracted part of shoreline clean-up, and;
- **Stage 3** – final clean-up of light contamination and removal of stains, if required.

Depending upon the nature of the contamination, progression through each of these stages may not be required, depending on the termination criteria set by the IMT.

AMSA present guidelines for agreed environmental values and acceptable levels of clean which are useful in guiding the IMT. AMSA (2020) note that the response for shorelines should be terminated when remaining residues are not going to inhibit potential recovery through toxic or smothering effects.

Also, ITOPF (2002) suggest the use of three questions to determine when termination of the response should occur:

- Is the remaining oil likely to damage environmentally sensitive resources?
- Does it interfere with the aesthetic appeal and amenity use of the shoreline?
- Is this oil detrimental to economic resources or disrupting economic activities?

If the answers to the questions are no, then there is (generally) no rationale to undertake or continue shoreline clean up. Ecosystem Management and Associates (2008) suggest that activities can conclude on exposed rocky shores when the shoreline no longer generates sheens that affect sensitive wildlife. The final decision on whether to activate and terminate a shoreline clean-up response will remain with the State, as the Control Agency for the shoreline.

5.3.4. Oiled Wildlife Response

Oiled Wildlife Response (OWR) includes hazing, pre-emptive capture, and capturing, cleaning, treating and rehabilitating fauna that have been oiled.

Observations for oiled wildlife would occur during aerial/vessel surveillance and monitoring (OM02 and OM03). A decision would be made to activate OWR based on observations as well as advice from the relevant departments and stakeholders.

The responsibility for OWR depends on the location and origin of the spill.

Victoria

DELWP is the agency responsible for responding to wildlife affected by a marine pollution emergency in Victorian State waters. If an incident which affects or could potentially affect wildlife occurs in Commonwealth waters close to Victorian State waters, AMSA will request support from DELWP to assess and lead a response if required. DELWP's response to oiled wildlife is undertaken in accordance with the Wildlife Response Plan for Marine Pollution Emergencies (draft).

Tasmania

The Tasmanian Oiled Wildlife Response Plan (WildPlan) is administered by the Resource Management and Conservation Division of the DPIPWE and outlines priorities and procedures for the rescue and rehabilitation of oiled wildlife. Wildlife rescue kits are held at the Hobart and Launceston DPIPWE offices.

Commonwealth waters

The IMT shall consult AMOSC for advice regarding any wildlife response activities, as well as consult the DAWE (as the Jurisdictional Authority for wildlife in Commonwealth waters), for any risks from the spill to MNES (including oiled wildlife).

ConocoPhillips Australia will activate AMOSC and AMSA in the event of a Level 2 / 3 spill. Part of this activation will be the standby of OWR teams. AMOSC and AMSA both have on call personnel and equipment who can be activated if necessary. The Oil Spill Trajectory Modelling (undertaken by RPS) will determine the direction of the spill and the potential interaction of any wildlife.

The IMT shall also consult, via DELWP, DPIPWE, AMOSC personnel and/or Phillip Island Nature Park wildlife clinic oiled wildlife responders to provide support to for any wildlife response activities, including obtaining permits to conduct an OWR in State waters and/or Commonwealth waters, as stated above.

ConocoPhillips Australia will provide support for the response through provision of resources as requested by the relevant agency utilising existing contracts such as AMOSC.

Both DELWP and AMSA have local and regional oiled wildlife response capability that may be activated under the direction of DELWP. Personnel may also be deployed under the direction of the relevant agency to undertake wildlife response activities in State jurisdiction.

AMOSC maintains an ‘oiled wildlife response capability registers’ on behalf of industry to support OWRs. The AMOSC register maintains currency of potential resources, such as:

- Equipment and the locations of stockpiles
- Response personnel (including global OWR specialists such as Sea Alarm)
- Training/exercise materials
- Aid (national and international).

AMOSC have collaboratively developed an OWR model that is based on a small number of OWR adviser(s) who receive specific training at an IMT level to manage an OWR. At a site-management level this is further broken into ‘OWR Field Management’ who are moderately trained to supervise field response, such as the State oiled wildlife support teams and the AMOSC OWR team. Philip Island Nature Park (Victoria) have over 100 personnel also trained in OWR. These personnel are available, under a ‘best endeavours’ MoU agreement with AMOSC.

‘General Field Responders’ are personnel who receive basic ‘just-in-time training’ to carry out tasks as directed by personnel with higher levels of OWR training. ConocoPhillips Australia maintain service agreements with various environmental service providers and general labour hire companies who can provide personnel to assist as general field responders, who would receive on-the-job training to assist with wildlife response activities. The OWR Division Coordinator (within the IMT) may engage with qualified veterinarian specialists to provide in-field expertise and technical support.

With regard to fauna protection priorities the following is a guide:

- **Priority 1:** birds endangered, threatened or protected by treaty
- **Priority 2:** common birds
- **Priority 3:** pinniped pups and penguin chicks
- **Priority 4:** adult pinnipeds and penguins.

Response priorities at the time will be finalised in consultation with the State oiled wildlife advisers. Under specific circumstances, pre-contact wildlife response could potentially be used to prevent or reduce the impacts of a spill on populations of seabirds, aquatic birds (penguins) and pinnipeds. It is most suitable when used on wildlife affected by persistent oily slicks; however, it may also be considered for residuals from a Level 2 spills. Operational Monitoring of the spill would provide data regarding spill trajectory and potential wildlife that may be affected by the spill.

Wildlife hazing can be an effective control measure when deployed across limited geographical areas and against specific populations, where the surface oil resulting from a spill is largely contained. Hazing could potentially be used to deter marine fauna, seabirds, aquatic birds and shorebirds from entering a spill area. It is not an effective measure against volatile spills which rapidly evaporate, nor does it have particular application against dissolved or dispersed oils.

Techniques include:

- Vessel traffic that generates underwater noise and motion
- Vessel air horns (where available) to create above-water noise
- Vessel fire hoses that direct streams of water in front of whales and other fauna.

Oiled wildlife capture at sea is also theoretically possible; however, it would present significant challenges.

The final decision on whether to terminate a shoreline wildlife response will remain with State, as the Control Agency for the shorelines.

If the IMT make a decision on response termination it will include an agreed threshold for ceasing operations, as well as thresholds for scaling back rescue operations. Termination of response will be determined by the IMT in collaboration with relevant stakeholders and will consider factors including the following: the safety of responders; the current effectiveness of the response; deteriorating weather conditions (including wind, visibility and sea conditions); habitats deemed clear from risk of oiling - lack of presence of oiled wildlife remaining in the affected area or a decrease in the numbers of affected wildlife being captured towards the agreed threshold for ceasing operations; completion of stabilisation and transportation of all captured wildlife; and completion of collection and removal of carcasses.

5.3.5. Waste Management

Waste management is considered a support function to the overall response effort, and is needed to manage collection, storage, transportation and disposal of hydrocarbon contaminated solid and liquid waste. The overall objective is to ensure the safe and appropriate handling, segregation and disposal of wastes generated by spill response.

If Shoreline clean-up and OWR are activated, there is potential for waste generation. Shoreline clean-up generates significant increase in the volume of waste (ratio of 1:20-20).

Wastes generated will be managed and disposed of at appropriately licenced facilities.

5.4. Response Termination

The termination of a response to a Level 2 or Level 3 spill within Commonwealth waters shall occur only when the following conditions have been fulfilled, as determined by the IC, in consultation with AMSA, DAWE and AMOSC:

- When the source of the spill has been stopped
- When the objectives of the IAP have been met
- When there are no further practicable steps that can be taken to respond to a spill.

The termination of a response to a spill which has entered State waters will be the responsibility of the State. Termination criteria for the Operational and Scientific Monitoring Programs (OSMP) are detailed in Section 7.

6. Spill Response Resources

Table 6-1: Summary of Spill Response Resources Immediately Available

Resource	Description	Purpose	Timeframe
Support Vessels	ConocoPhillips Australia maintains a range of vessel support call-off contracts. Where spill surveillance can be carried out from vessels, noting its practicality is limited by the number of available vessels and the scale of the spill. For smaller spills, their dimensions, direction of travel, colour and state of weathering can be reasonably well estimated and reported. For large spills, it would be difficult to accurately estimate the size of a slick from the	Vessel surveillance Support vessels used on the Sequoia MSS and Vessels of opportunity (VoO) based in ports nearest to the survey area would be engaged as required. VoO from ports slightly further afield, such as Geelong and Barry Beach would also be considered.	Commence mobilisation in within 24 hours. (via IMT)

	bridge of a vessel because sight is limited to the horizon. However, it would be possible to determine what is happening to the oil, such as its colour, thickness, weathering and the slick's direction of travel		
Aviation support	ConocoPhillips Australia will activate its contract with AMOSC to access helicopter and/or fixed aircraft to assist in spill monitoring. ConocoPhillips Australia can request the assistance of AMOSC's Core Group personnel (>120 oil and gas industry personnel nation-wide) who are available 24/7 to respond to marine oil spills.	Access to Emergency Management Victoria's (EMV's) State Aircraft Unit. Additionally, NatPlan resources can be activated. EMV's State Response Team (SRT) or AMSA Search and Rescue resources can be called upon but is unlikely to be required given the AMOSC resources available. These resources are available within 4 hours of request. The SRT has 10 State Emergency Service (SES) volunteers and one DEDJTR staff member that are trained in oil on water observation. A MoU between the Tasmanian Fire Service (TFS) and EPA Tasmania details the agreement between parties and the response arrangements. Briefly, in addition to Control Agency roles, TFS will provide aircraft and aerial tactical response requirements including air attack supervisors for aerial dispersant application, air observers and aircraft staging areas in support of a marine incident.	Air support can be mobilised within 4 hours of request, depending on aircraft availability.
Satellite Tracker buoys	Electronic surface tracking buoy(s) to be deployed from supply vessel at first strike to start tracking the movement of the spill. Can be hired from AMOSC.	Maintain situational awareness of spill to support ongoing spill response planning and validate IAPs.	Immediately where available on the vessels supporting the seismic acquisition.
Satellite imagery analysis	Satellite imagery can be used to track the spill via OSRL or AMSA.	Satellite-based remote sensors can be used to detect oil on water and, because such images cover extensive sea areas, they can provide a comprehensive picture of the overall extent of pollution from a spill. The sensors used include those operating in the visible and infrared regions of the spectrum, and synthetic aperture radar (SAR). Optical observations of oil require clear, daylight skies, thereby severely limiting the application of such systems. SAR, on the other hand, is not limited by the presence of cloud and, since it does not rely on reflected light, remains operational at night. However, radar imagery often includes a number of anomalous features, or false positives, such as algal blooms, wind shadows and rain squalls, which can be mistaken for oil. Consequently, the imagery requires expert interpretation. The minimum time for satellite imagery in the permit area from commercial suppliers is anticipated to be between 24 and 48 hours.	Images within 48 hours (if required).

Oil Spill Trajectory Modelling	Oil spill modelling can be used to forecast the trajectory and fate of oil plumes resulting from surface or subsurface releases. It can be initiated almost immediately and provides rapid results. However, its accuracy depends on the spill estimates and the predicted metocean data, as well as the reliability of forecasts of wind speed and direction.	ConocoPhillips Australia will activate its contract with AMOSC to access 24/7 emergency OSTM. Also available via AMSA upon request, who are likely to contract RPS.	OSTM results can be provided within 5 hours of request.

6.1. Health and Safety

Health and safety considerations will be incorporated into the spill response. ConocoPhillips Australia health and safety objectives are to:

- Adhere to the PEARS philosophy
- Provide a safe working environment and prevent workplace incidents by managing risks to ALARP
- Eliminate, or minimise all environment and community risks to ALARP and ensure any impacts are neither serious nor long-lasting
- Ensure the security of personnel, assets and information.

The IMT should develop a Safety Management Plan utilising the National Plan Guidance on Marine Oil Spill Response Health and Safety document (AMSA, 2018). Contractors are responsible for the development of site-specific risk assessments before undertaking any activities. The safety of personnel is the primary concern in a spill incident. An individual risk assessment, such as a job hazard analysis (JHA), will always be conducted by a response contactor or other appointed or responsible personnel, such as the HSE manager or supervisor. If the response is conducted by a Control Agency other than ConocoPhillips Australia (i.e. AMSA), that agency is expected to adhere to stringent safety procedures as outlined in their respective oil spill response plans (i.e. the NatPlan).

6.2. Cost Recovery

In the event of a hydrocarbon spill, Part 6.1A of the OPGGS Act states that titleholders are required to eliminate or control the spill, clean up the spill and remediate any environmental damage and undertake environmental monitoring of the impact of the spill. The Act also states that any costs incurred by NOPSEMA and Commonwealth and state/Territory government agencies must be reimbursed by the titleholder.

Part 1B of the OPGGS(E) specifies that titleholders are required to maintain sufficient financial assurance to meet the costs, expenses and liabilities that may result from a worst-case event associated with its offshore activities. In the case of the Sequoia MSS, this most credible such event would be a large scale MDO spill. Financial assurance must be demonstrated to NOPSEMA before the EP can be accepted.

The joint title holders, ConocoPhillips Australia and 3D Oil, have processes in place to support cost recovery associated with spill response and operational and scientific monitoring.

7. Operational Scientific Monitoring Program Overview

This section provides an overview of the OSMP arrangements for the Sequoia MSS.

ConocoPhillips Australia has an ABU OSMP (i.e. for ConocoPhillips Australia operations within Australia). Procedural-level information to implement the Sequoia OSMP is contained within the Sequoia MSS OSMP Implementation Plan (ABU2-000-EN-V01-D-00003), which includes Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs). The OSMP can be rapidly activated in the event of a level 2 or 3 MDO spill. The Control Agency also has the authority to direct COP Australia to undertake an OSMP response in line with the Sequoia MSS OSMP Implementation Plan.

Monitoring appropriate to the nature and scale of the spill will be determined based on the hydrocarbon characteristics, the nature and scale of the release (e.g. slow continuous release or instantaneous short duration release), weathering characteristics (dispersion and dilution rates), the location of the spill and the modelled trajectory of the spill.

There are two types of monitoring – Type I (Operational Monitoring) and Type II (Scientific Monitoring), which are discussed in the following sections.

7.1. Type I Operational Monitoring

The objectives of operational (Type I) monitoring are to:

- Obtain situational awareness information
- Support adaptive management of spill response
- Identify potential impacts from the spill
- Identify potential benefits/impacts of spill response activities.

Information obtained from operational monitoring may also be used to support the design of Scientific (Type II) monitoring.

The Type I monitoring may comprise some or all of the monitoring studies described in Table 7-1, depending on the nature and scale of the release and resources at risk. These studies are presented separately in Table 7-1, however, in practice they may be undertaken simultaneously.

Five operational monitoring studies have been identified:

- OM01 Hydrocarbon and other chemical spill trajectory prediction
- OM02 Hydrocarbon and other chemical spill surveillance and reconnaissance
- OM03 Operational monitoring of hydrocarbon and other chemical properties, behaviour and weathering
- OM04 Pre-emptive assessment of sensitive receptors at risk
- OM05 Operational monitoring to identify contaminated sensitive receptors

As the Control Agency, AMSA is responsible for initiating an appropriate level of Type I Operational Monitoring using NatPlan resources to monitor the spill and any response effort, if required.

The Vessel Master of operational in-field vessels associated with the Sequoia MSS activities or vessels of opportunity (VoO) mobilised by ConocoPhillips Australia will provide information routinely to the relevant Control Agency (AMSA) and the ConocoPhillips Australia IMT, via a POLREP/SITREP form, to allow for determination and planning of appropriate response actions under the NatPlan and relevant state plan(s), if required.

Operational monitoring and observation in the event of a spill will inform adaptive management of the spill response and, if required, will support the identification of appropriate scientific monitoring of relevant key sensitive receptors.

Specific monitoring/data requirements for Type I monitoring are expected to include:

- Estimation of sea state;
- Estimation of wind direction and speed;
- Locating and characterising surface slicks (thickness and areal extent);
- GPS tracking using drifter buoys, if available;
- Manual or computer predictions of oil trajectory and weathering for Level 2 and 3 spills; and
- GIS mapping.

Determining the location, extent and characterisation of surface slicks will likely be restricted to daylight hours only, when surface slicks will be visible. Vessel based evaluations of sea state and weather conditions will continue until this function is taken over by the Control Agency.

ConocoPhillips Australia will implement, assist with, or contribute to (including funding if required) any other Type I monitoring as directed by the Control Agency.

7.2. Type II Scientific Monitoring

In consultation with the Control Agency, ConocoPhillips Australia will undertake scientific monitoring relevant to the circumstances of the spill and the sensitivities at risk. The Sequoia OSMP Implementation Plan describes the detailed arrangements and studies that will be activated in the event of a Level 2 or 3 MDO spill (Table 7-1), in response to initiation criteria being met. COP may decide to implement scientific monitoring even when initiation criteria are not triggered.

The OSMP Implementation Plan ensures COP has a capability to undertake Type II scientific monitoring and also enables the chosen service provider (RPS) to act to either assist the Control Agency or to undertake key Type II monitoring activities on ConocoPhillips Australia’s behalf.

ConocoPhillips Australia will work with AMSA and relevant stakeholders to implement appropriate Type II Scientific Monitoring. The aim of the Type II monitoring is to understand the environmental impacts of the spill and response activities on the environment and monitor recovery, with a focus on relevant environmental, socio- economic and cultural values and sensitive receptors.

The scientific monitoring program outlined in the OSMP has been developed to ensure that it is consistent with monitoring guidelines and methodologies such as CSIRO (2016) and Przeslawski and Foster (2020).

Type II monitoring is expected to comprise some, or all of the monitoring studies described in Table 7-1, depending on the nature and scale of the release and resources at risk:

- SM01 Monitoring of hydrocarbons and other chemicals in marine waters
- SM02 Monitoring of hydrocarbons in benthic sediments
- SM03 Survey of intertidal sediments and biological communities to determine impacts of hydrocarbon spill and other chemicals and recovery
- SM04 Monitoring of subtidal benthos to determine impacts of hydrocarbon spill/other chemicals and recovery
- SM05 Wildlife surveys to determine impact of hydrocarbon/chemical spill on shorebirds and seabirds
- SM06 Wildlife surveys to determine impact of hydrocarbon/chemical spill on marine megafauna
- SM07 Determination of impact of hydrocarbon/chemical spill on commercial, traditional and recreational fisheries and aquaculture

- SM08 Determination of impact of hydrocarbon/chemical spill on recreational, commercial, Listed protected areas and Heritage place and/or industrial users

As described previously, ConocoPhillips Australia will engage with AMSA to coordinate and review operational monitoring data, such as surveillance and modelling outputs to confirm the predicted extent and degree of MDO exposure and any identified impacts. Scientific monitoring plans having been based on desktop/technical studies and/or field investigations, in order to ensure they are feasible and will obtain relevant information.

ConocoPhillips Australia will activate its contract with its OSMP provider (RPS) immediately (where reasonably practicable) following a level 2 or 3 spill to design and initiate implementation of the appropriate monitoring studies as outlined in the OSMP. This is required to allow as much preparation time as possible to be able to mobilise a response in optimal timeframes. The actual SMPs to be mobilised will be determined following consultation with the Control Agency and stakeholders.

Initiation criteria for operational and scientific monitoring plans are outlined below in Table 7-1 with additional detail provided in the OSMP Implementation Plan. Following ConocoPhillips Australia's notification to RPS that a spill has occurred, RPS will make the necessary preparations to conduct the triggered studies.

Table 7-1: Operational Monitoring (OM) and Scientific Monitoring (SM) program summary

Monitoring plan	Aim and objectives	Initiation criteria	Termination criteria	Approximate mobilisation time	Resources required	Suppliers/ support party
Operational monitoring (OM)						
OM01 Hydrocarbon and other chemical spill trajectory prediction	Used to predict the trajectory and concentration of spilled hydrocarbon, to guide the management and execution of spill response operations.	Level 2 or 3 hydrocarbon spills; Or Level 1 hydrocarbon spill in the event that the spill extends beyond 500 m from the source and the source has not been contained.	Confirmation hydrocarbon release has ceased; And Trajectory assessment indicates that sensitive receptors are no longer at risk of hydrocarbon contact at or above moderate thresholds.	< 2 hours	Spill modelling software Personnel with appropriate training and expertise in oil spill modelling. Current, wind, temperature (air and sea), precipitation and tide data Bathymetric data for the spill EMBA.	RPS/AMOSC/OSRL
OM02 Hydrocarbon and other chemical spill surveillance and reconnaissance	To provide regular daily ongoing surveillance in the event of a spill; and to assess the colour, consistency, distribution and location of surface slicks and/or shallow subsurface plumes (if visible).	Level 2 or 3 hydrocarbon spills; Or Level 1 spill in the event that the spill extends beyond 500 m from the source and the source has not been contained.	Confirmation hydrocarbon release has ceased; And surface sheen (as per Bonn Agreement Oil Appearance Code) and subsurface plumes are no longer visible.	< 2 days	Outputs from OM01. Satellite tracker buoy(s). Crew for deployment of buoy(s). Personnel with aerial, satellite and vessel surveillance experience. Suitable aircraft/vessels.	Vessel/aerial contractors RPS/AMOSC/OSRL
OM03 Operational monitoring of hydrocarbon and other chemical properties, behaviour and weathering	To detect and monitor for the presence, quantity, properties, behaviour and weathering of surface, entrained and dissolved hydrocarbons, to inform decision making for spill response activities.	Level 2 or 3 hydrocarbon spills	Response activities have ceased, And Concentrations of hydrocarbon in water are equal to or below relevant environmental guidelines (ANZECC/ARMCANZ 2000, ANZG 2018) species protection levels.	Preparation to deploy field personnel and equipment will commence on notification from ConocoPhillips Australia IMT that this OM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification	Outputs from OM01- 02. Personnel with appropriate training and experience in field sampling Suitable vessels Sampling and sample storage equipment Accredited National Association of Testing Authorities (NATA) Laboratory.	RPS under contract for duration of activities Subject Matter Experts (SMEs) Vessel contractor AMSA
OM04 Pre-emptive assessment of	To assess the presence and extent of sensitive receptors based on a desktop review of	Level 2 or 3 hydrocarbon spills	Spill response operations have been completed; Or	< 2 days	Outputs from OM01–03. Environmental Unit Leader (to support or delegate) to	ConocoPhillips and RPS under

sensitive receptors at risk	existing data, where available; to undertake a		the assessment of sensitive receptors that were identified as being potentially impacted/contacted by the hydrocarbon spill is completed.		review report, identify key information gaps in baseline data Key outcomes to be incorporated into COP's IAP spill response framework.	contract for duration of activities SMEs
OM05 Operational monitoring to identify contaminated sensitive receptors	To identify which sensitive receptors (habitats and organisms) are likely to be at risk from the hydrocarbon spill based on exposure (identified from OM01-OM04) and geographical location; to inform suitable response activities to minimise potential impacts to sensitive receptors from the spill and response activities; to assess and document actual/anticipated impacts to wildlife during the spill and response activities; and to identify areas of potential impact for scientific monitoring survey designs.	Level 2 or 3 hydrocarbon spills	Confirmation hydrocarbon release has ceased; And spill response operations have been completed.	Preparation to deploy field personnel and equipment will commence on notification from IMT that the OM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification	Outputs from OM01–04. Personnel with appropriate training and experience in field survey and wildlife identification. Suitable vessels. Sampling and sample storage equipment. Accredited NATA Laboratory.	RPS/OSRL/AMOSC Vessel/aerial contractor SMEs
Scientific monitoring (SM)						
SM01 Monitoring of hydrocarbons and other chemicals in marine waters	To measure concentrations of hydrocarbons in marine waters, via the implementation of vessel-based water quality surveys; to quantify the presence, concentrations and persistence of hydrocarbons; to apply resulting data into identification of zones of likely exposure relative to key habitats and sensitive receptors for other SMs; to obtain post-release pre-	Level 2 or 3 hydrocarbon spills	Monitoring has established the temporal and spatial distribution and nature of the spill and it is considered there is no further risk of receptors being contacted; Or concentrations of hydrocarbons in water are below relevant environmental guidelines (ANZECC/ARMCANZ 2000, ANZG 2018 species protection levels) or United States	Preparation to deploy field personnel and equipment will commence on notification from ConocoPhillips Australia IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification	Outputs from OM01–03. Personnel with aerial, satellite and vessel surveillance experience. Personnel with appropriate training and expertise in field sampling and in the use of specialised imagery software, image enhancement, feature extraction, geo-referencing, and interpretation of satellite imagery.	Vessel/aerial contractor RPS under contract for duration of activities

	exposure baseline data where feasible; to assess hydrocarbon content of water samples against accepted environmental guidelines and/or benchmarks (where relevant), where available i.e. ANZECC/ ARMCANZ (2000), ANZG (2018).		Environmental Protection Authority (US EPA) Water Quality Benchmarks for Aquatic Life reference levels).			
SM02 Monitoring of hydrocarbons in benthic sediments	To understand composition, persistence and fate of hydrocarbons in sediments to provide data to assist in quantifying exposure levels of environmental values, sensitivities or receptors; to obtain post-release pre-exposure baseline data where feasible; to assess hydrocarbon concentrations and type in sediments at sites that were exposed to the spill against concentrations at reference sites and sediment quality guidelines; to conduct fingerprinting where feasible and appropriate at selected locations to characterise hydrocarbons and other chemicals in marine sediments to determine the likely source.	Level 2 or 3 hydrocarbon spills where spill trajectory modelling, surveillance or monitoring (OM01–05) predicts or indicates hydrocarbon exposure to sediments; Or Other SMs are triggered that require information on the presence, extent and persistence of hydrocarbons in benthic sediments (e.g. SM03, SM04and SM07).	Monitoring has established temporal and spatial distributions and nature of hydrocarbons and show no further natural receptors or sediments will be contacted; Scientific monitoring of sensitive receptors at sediment sampling sites have identified impact and recovery; Or Monitoring results indicate that the concentrations of petrogenic hydrocarbons are below ANZECC/ARMCANZ 2000, ANZG 2018 guidelines at all sampling sites, where parameter values exist.	Preparation to deploy field personnel and equipment will commence on notification from ConocoPhillips Australia IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Outputs from OM01–04. Personnel with appropriate training and expertise in field sampling (water collection and processing). Suitable vessels. Sample collection and sample storage equipment (including multiparameter logger with fluorometer). Accredited NATA Laboratory.	Vessel contractor RPS under contract for duration of activities SMEs
SM03 Survey of intertidal sediments and biological communities to determine impacts of hydrocarbon spill and	To monitor and determine the impact and subsequent recovery of intertidal sediments and biological communities from a hydrocarbon spill and/or response activities.	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts or indicates hydrocarbon contact with a sensitive resource (shoreline,	Impacts and recovery to shoreline and intertidal sediments and biological communities have been determined and monitoring results indicate no further habitats are at risk from, or	Preparation to deploy field personnel and equipment will commence on notification from ConocoPhillips Australia IMT that the SM has been triggered.	Output from OM01–04 and SM01–02. Personnel with appropriate training and expertise in field sampling (intertidal habitat / communities and sediments)	Vessel contractor RPS under contract for duration of activities SMEs

other chemicals and recovery		intertidal benthic habitat/ community); Or other scientific monitoring programs are triggered that require information on the presence, extent and persistence of hydrocarbons in intertidal habitats or sensitive receptors (SM04 and SM05).	have been exposed to, hydrocarbons; And affected shoreline and intertidal biological communities have reached a stable, climax community where inter-survey variability in assemblages is more similar to relevant controls sites; And sediment samples indicate that levels of hydrocarbons are below reference/pre-impact levels.	Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Suitable vessels (i.e., low draft) and vehicles Sample collection and sample storage equipment Accredited NATA Laboratory Underwater video / photographic equipment (i.e., towed video, drop camera, BRUVs)	
SM04 Monitoring of subtidal benthos to determine impacts of hydrocarbon spill/other chemicals and recovery	To determine the extent, severity, and likely level of impacts to subtidal benthic habitats and associated biological communities arising from a hydrocarbon spill and response activities and subsequent recovery	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts or indicates likely hydrocarbon contact with subtidal benthic habitats/ communities .	Impacts to subtidal habitats have been determined and monitoring results indicate no further habitats are at risk from, or have been exposed to hydrocarbons; And Affected subtidal benthic habitats have returned to stable climax community conditions And Monitoring shows restoration or resumption of key biological processes (e.g., reproduction and recruitment) necessary for post impact recovery is demonstrated by affected marine benthos; And Sediment samples indicate that levels of hydrocarbons are equal to or below	Preparation to deploy field personnel and equipment will commence on notification from IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Output from OM01–05 and SM01–03). Personnel with appropriate training and expertise in field sampling (sponge reef, seagrass, macroalgae, fish communities). Suitable vessels Sample collection and sample storage equipment Accredited NATA Laboratory Underwater video/ photographic equipment (i.e. towed video, drop camera, BRUVs)	Vessel contractor RPS under contract for duration of activities SMEs

			guideline or reference/pre-impact levels.			
SM05 Wildlife surveys to determine impact of hydrocarbon/chemical spill on shorebirds and seabirds	To assess any short term or longer-term environmental effects on seabird and migratory shorebird populations within the study area that may have resulted from a hydrocarbon spill.	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts contact is possible to seabirds or shorebird populations or any of their habitats of importance for breeding, nesting or foraging; Or Monitoring (OM05) has identified contact or an impact to seabirds or shorebird populations as a result of the hydrocarbon spill; Or Reports or scientific evidence of oiled seabirds or shorebird populations.	There has been no demonstrable evidence of an impact on seabirds and/or shorebirds from the hydrocarbon/ chemical spill; Or Impacts to key seabird and shorebird behaviour and breeding activities have been quantified in the zone of exposure; And Measured parameters have returned to baseline conditions or are comparable to reference sites (taking into account natural variability) in terms of breeding population (for seabirds) or counts (for shorebirds) and impacts on species and taxa are no longer detectable.	Preparation to deploy field personnel and equipment will commence on notification from IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Output from OM01–05. Personnel with appropriate training and expertise in field sampling (avian ecologists). Photographic equipment. Binoculars. Tissue sample collection and sample storage equipment. Accredited NATA laboratory.	Vessel/aerial contractor RPS under contract for duration of activities SMEs
SM06 Wildlife surveys to determine impact of hydrocarbon/chemical spill on marine megafauna	To assess any short term or longer-term environmental effects of spill hydrocarbons/ chemicals on marine megafauna which may have resulted from a hydrocarbon spill.	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts contact is possible to marine megafauna populations or any of their habitats of importance for breeding or foraging; Or Monitoring (e.g. OM05) has identified potential contact or impact to marine megafauna populations as a result	There has been no demonstrable evidence of an impact on marine megafauna from the hydrocarbon/chemical spill; Or Impacts to key biological processes (e.g. abundance, distribution, breeding) have been quantified and have returned to levels similar to pre-spill or reference sites.	Preparation to deploy field personnel and equipment will commence on notification from IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Output from OM01–05 and SM04. Personnel with appropriate training and expertise in field sampling (marine megafauna ecologists). Photographic equipment Binoculars. Tissue sample collection and sample storage equipment. Accredited NATA laboratory.	Vessel/aerial contractor RPS under contract for duration of activities SMEs

		of the hydrocarbon spill; Or Reports or scientific evidence of oiled marine megafauna.				
SM07 Determination of impact of hydrocarbon/chemical spill on commercial, traditional and recreational fisheries and aquaculture	To identify, report, and monitor potential impacts on fish and shellfish fisheries resulting from the hydrocarbon spill and/or associated spill response activities; and to determine the spatial and temporal extent of sublethal impacts on indicator species, which may impact commercial, traditional and recreational fish and shellfish species, including health effects attributable to the spill and/or response activities and tainting of the flesh and/or bioaccumulation of toxins in fish.	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts contact is possible to commercial, traditional or recreational species or aquaculture species; Or Advice has been provided to government or directives from government have been issued to restrict, ban or close a fishery (SM07 will provide data for government to enable decisions to be made on when a fishery/aquaculture facility should be closed or can be reopened); Or Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.	Contamination in the edible portion or in the stomach / intestinal contents attributable to the spill is no longer detected; Or The physiological and biochemical parameters of commercial, traditional, recreational or aquaculture species are comparable between reference and impact sites; Or Evidence that catch rates, species composition, community abundance, distribution and age structure of commercial fisheries and by-catches have returned to baseline levels (taking into account natural variability).	Preparation to deploy field personnel and equipment will commence on notification from IMT that the SM has been triggered. Deployment of field personnel and equipment into the field within 7 days of receipt of notification.	Output from OM01–05. Personnel with appropriate training and expertise in field sampling (i.e. ecotoxicology, fisheries sampling). Photographic equipment. Binoculars. Fish traps. Tissue sample collection and sample storage equipment. NATA accredited laboratory.	Vessel contractor RPS under contract for duration of activities SMEs
SM08 Determination of impact of hydrocarbon/chemica	To determine the extent, severity and likely persistence of direct and indirect impacts on commercial, recreational	Spill trajectory modelling, surveillance or monitoring (OM01–05) predicts	Monitoring results have quantified the extent and level of impact to selected	Preparation to deploy personnel will commence on notification from	Output from OM01–05. Baseline data on relevant users. Personnel with appropriate training and expertise in	RPS under contract for duration of activities

l spill on recreational, commercial and/or industrial users	and/or industrial users from a hydrocarbon spill and associated response activities.	hydrocarbon spill contact, or impacts from associated response activities with commercial, recreational and/or industrial users.	recreational, commercial and/or industrial users; And Monitoring indicates there are no new or additional impacts likely to affect recreational, commercial and/or industrial users; And Monitoring identifies that the activities of recreational, commercial and/or industrial users have returned to baseline levels (taking into account natural variability).	ConocoPhillips Australia IMT that the SM has been triggered. Deployment of personnel within 7 days of receipt of notification.	socio-economic receptors and economic impact analysis and/or ecosystem-based valuation methods.	SMEs

Sequoia MSS Environment Plan PMST Reports – Appendix J

ABU2-000-EN-V01-D-00001

Rev 2 31 May 2021

Appendix J - Sequoia MSS PMST Report Order

PMST Reports	Definition
Operational Area	Operational Area
Plankton Seismic Sound EMBA	Operational Area +0.17 km
Invertebrate Seismic Sound EMBA	Operational Area +0.414 km
Cephalopod Seismic Sound EMBA	Operational Area + 3.56 km
Vessel Sound EMBA	Operational Area + 1 km
Fish Seismic Sound EMBA	Operational Area + 2.55 km
Bird and Marine Reptile Light EMBA	Operational Area + 20 km
Marine Reptiles Seismic Sound EMBA	Operational Area + 5.43 km
Marine Mammal Seismic Sound Behaviour EMBA	Operational Area + 11.11 km
LF Cetacean Seismic Sound EMBA	Operational Area + 56.9 km
Safe Diving EMBA	Operational Area + 45 km
Spill EMBA	Low threshold entrained oil

Australian Government
Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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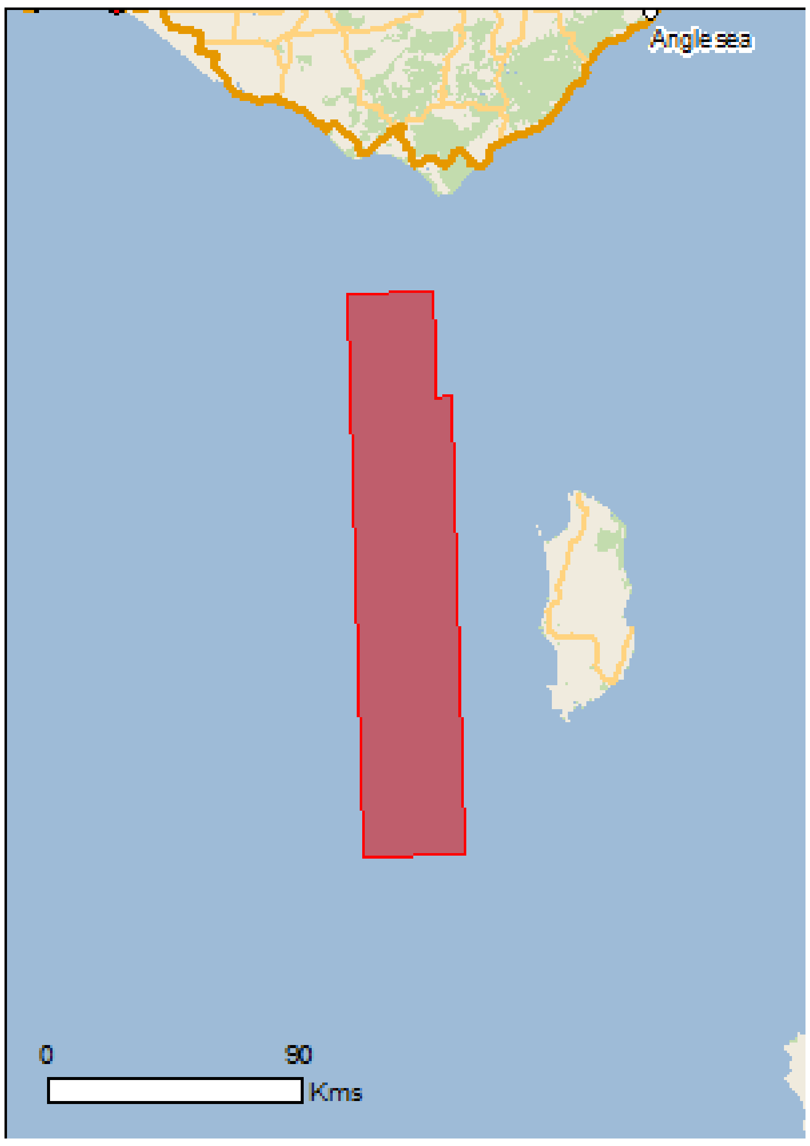

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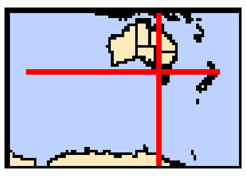

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	34
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Thalassarche bulleri		
Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis		
Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata		
Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus		
Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Australian Government
Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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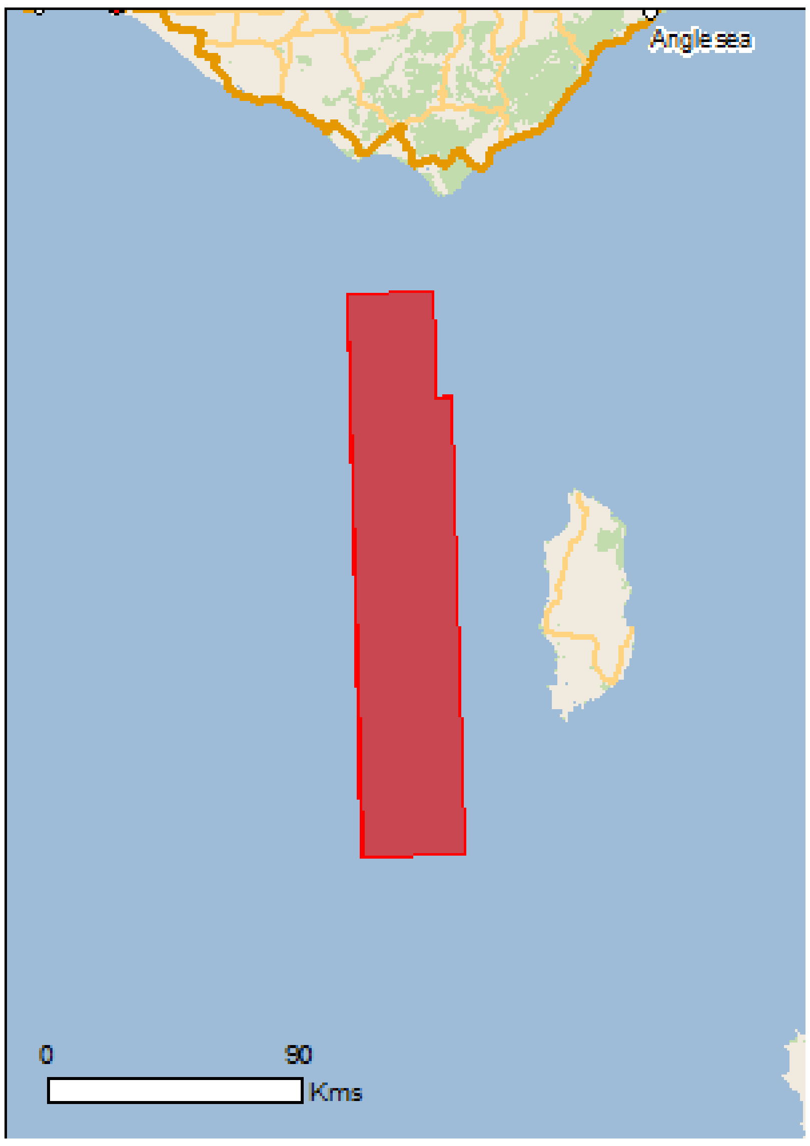

Coordinates
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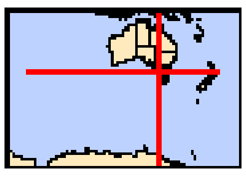

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	34
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov.		
Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna		
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis		
Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps		
Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii		
Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus		
Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus		
Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus		
Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius		
Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis		
Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa		
Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata		
Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus		
Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri		
Tucker's Pipefish [66262]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Notiocampus ruber		
Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques		
Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus		
Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris		
Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus		
Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus		
Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus		
Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra		
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus		
Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris		
Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer		
Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi		
Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus		
Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri		
Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus		
Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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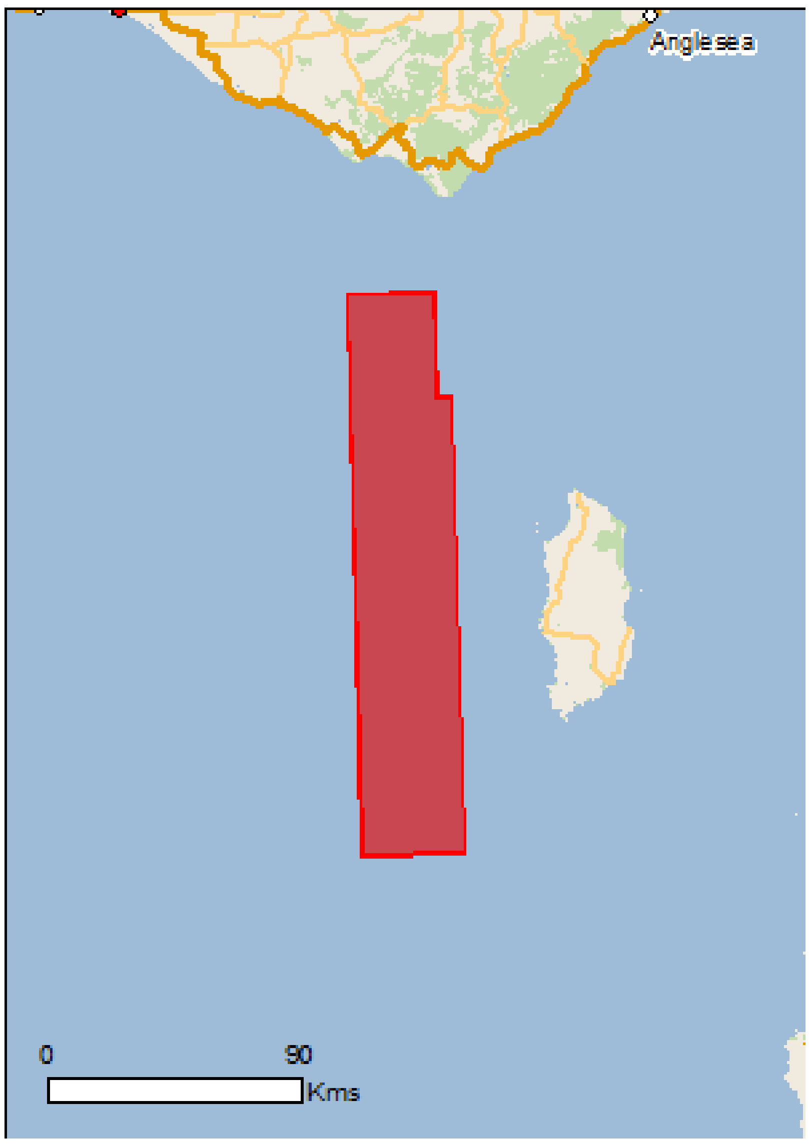

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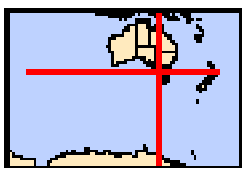
Coordinates
Buffer: 0.414Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	34
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of Agriculture, Water and the Environment

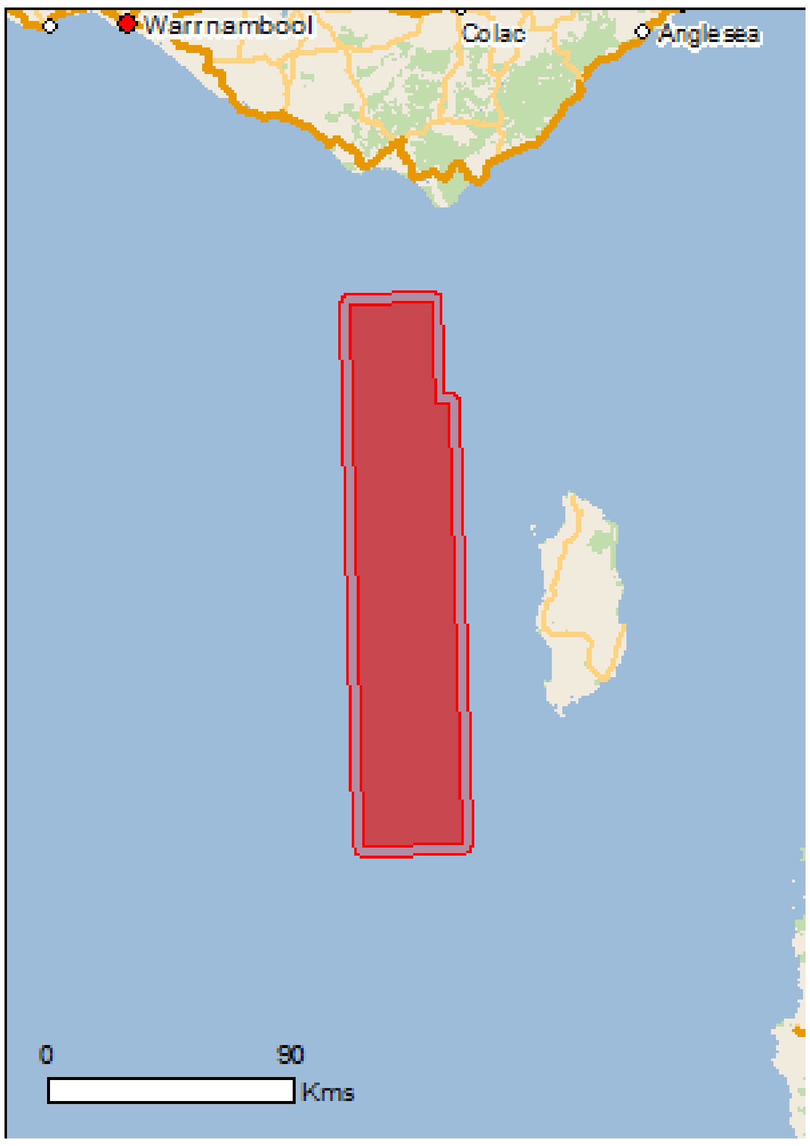
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

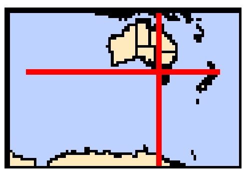
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:33:58



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 3.56Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	35
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	60
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal		Species or species

Name	Threatened	Type of Presence
[21]		habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Australian Government
Department of Agriculture,
Water and the Environment

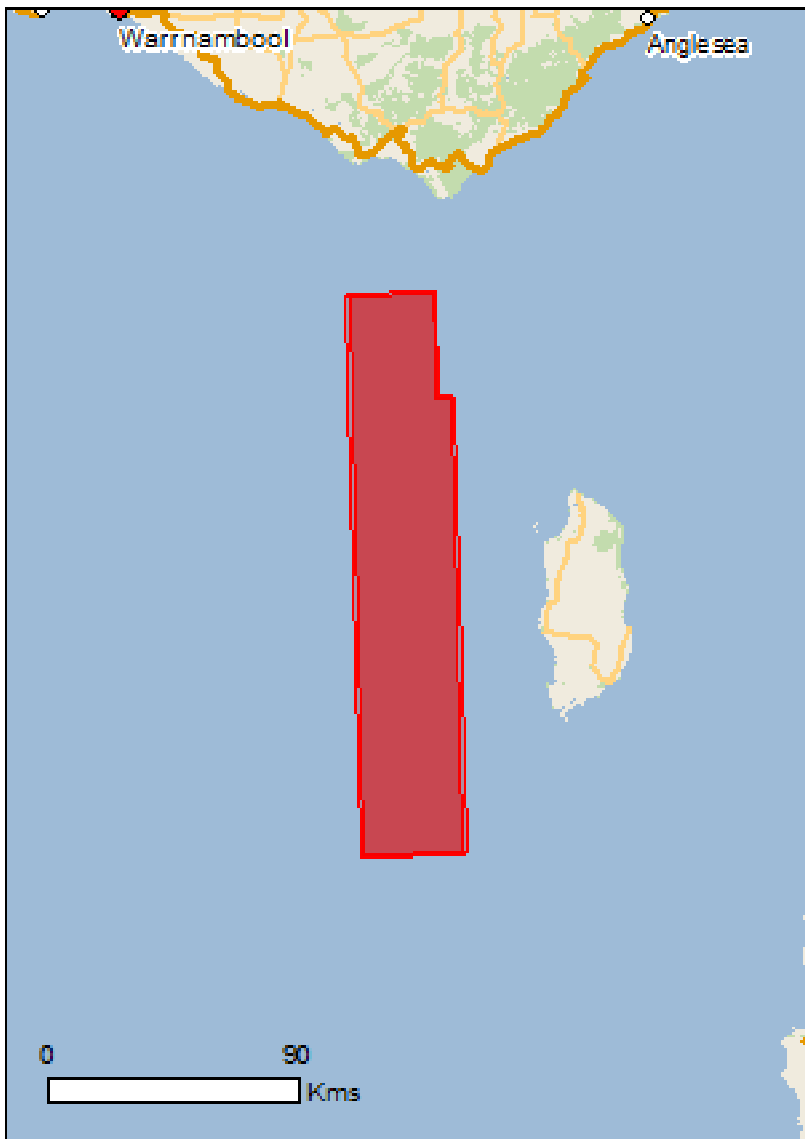
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

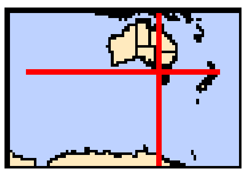
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:31:43



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	34
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea		
Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov.		
Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna		
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis		
Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps		
Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii		
Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus		
Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus		
Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus		
Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius		
Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis		
Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa		
Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata		
Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus		
Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri		
Tucker's Pipefish [66262]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government
Department of Agriculture, Water and the Environment

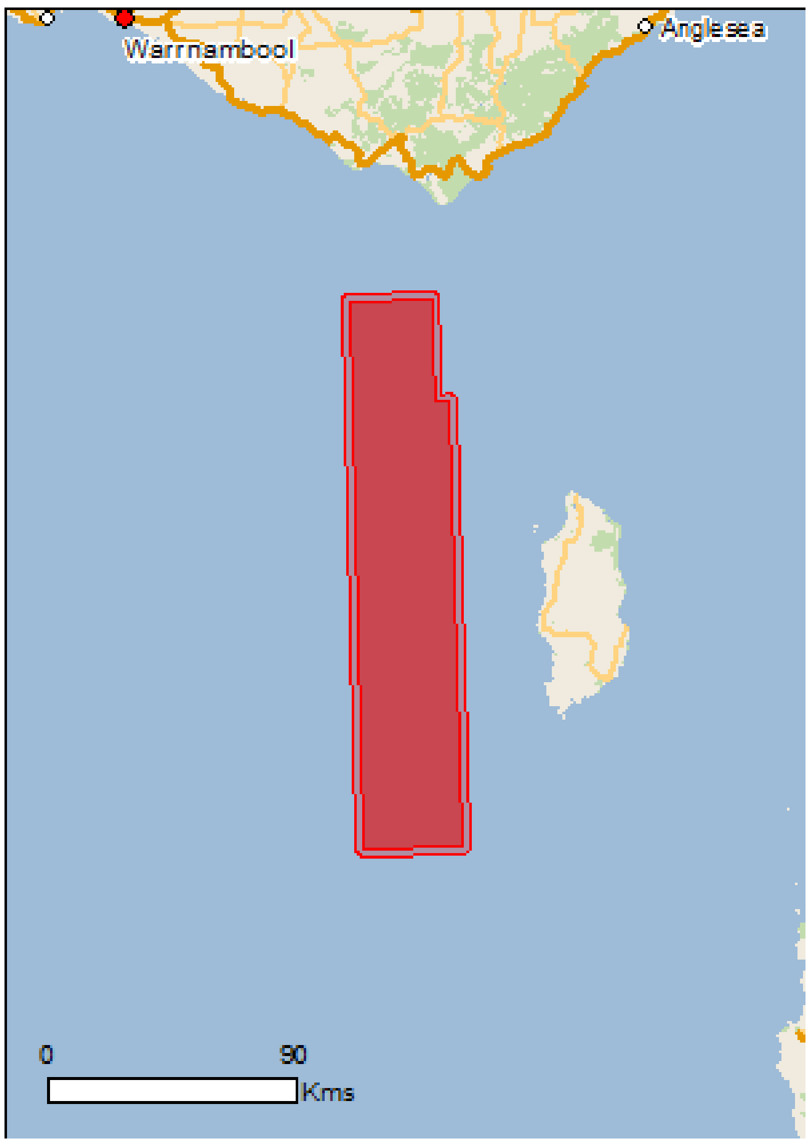
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

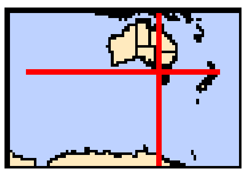
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:31:58



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 2.55Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	35
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	60
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria		
White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea		
Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal		Species or species

Name	Threatened	Type of Presence
[21]		habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans

[Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Australian Government

Department of Agriculture,
Water and the Environment

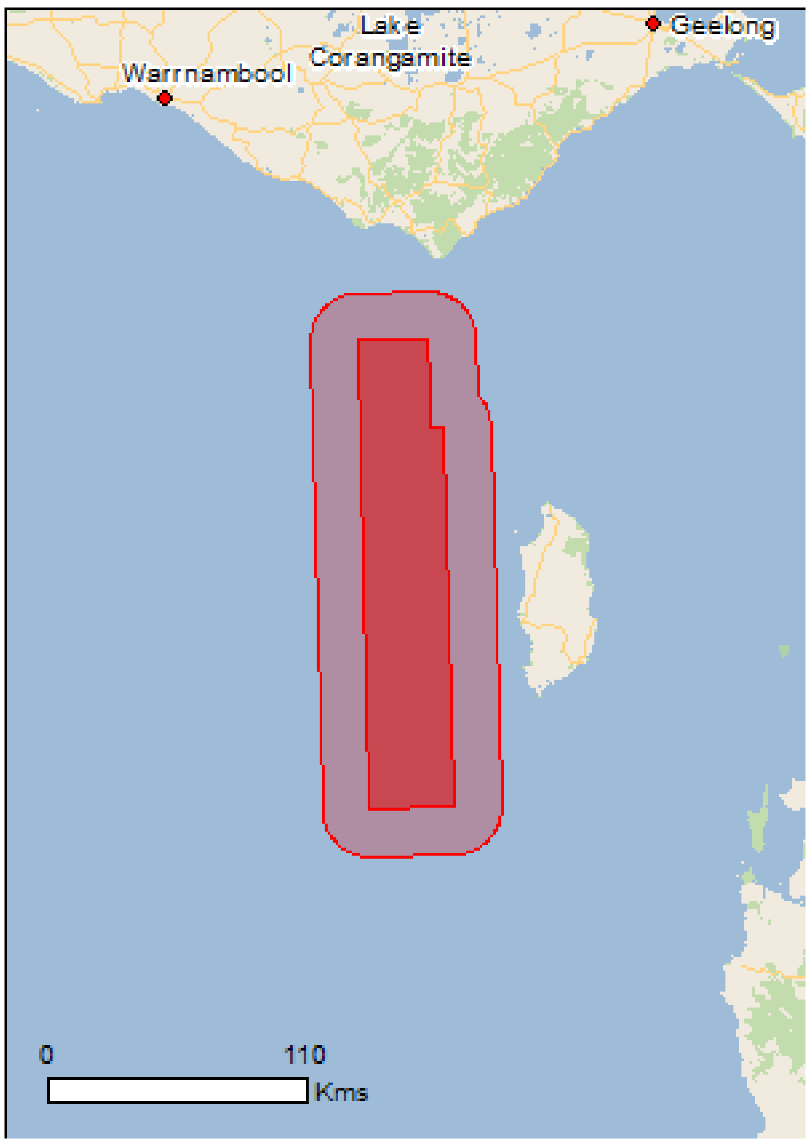
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

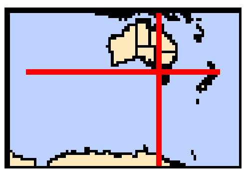
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:34:28



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 20.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	36
Listed Migratory Species:	40

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pachyptila turtur		
Fairy Prion [1066]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus		
Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov.		
Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Fish		
Heraldia nocturna		
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis		
Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps		
Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known

Name	Status	Type of Presence
		to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area

Name	Status	Type of Presence
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)
Zeehan	Special Purpose Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government

Department of Agriculture,
Water and the Environment

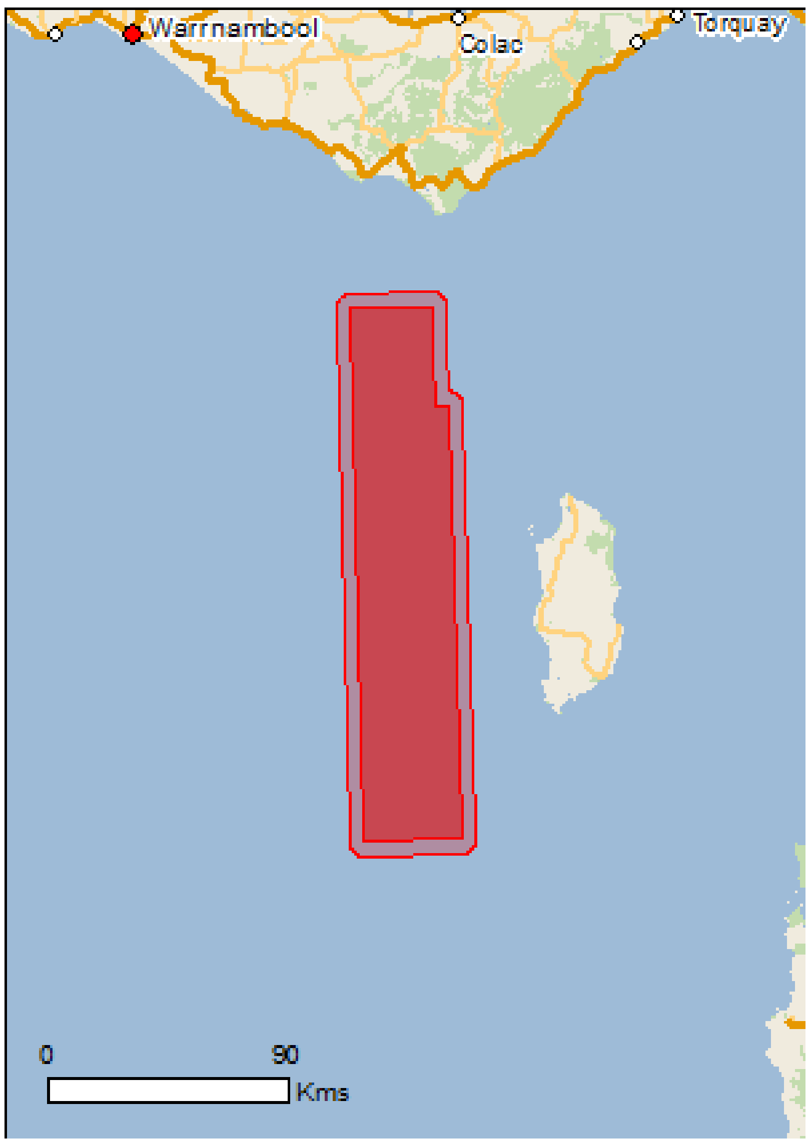
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

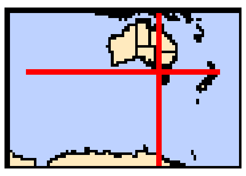
Report created: 27/05/21 23:33:58



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 5.43Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	36
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	61
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat may occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Australian Government

Department of Agriculture,
Water and the Environment

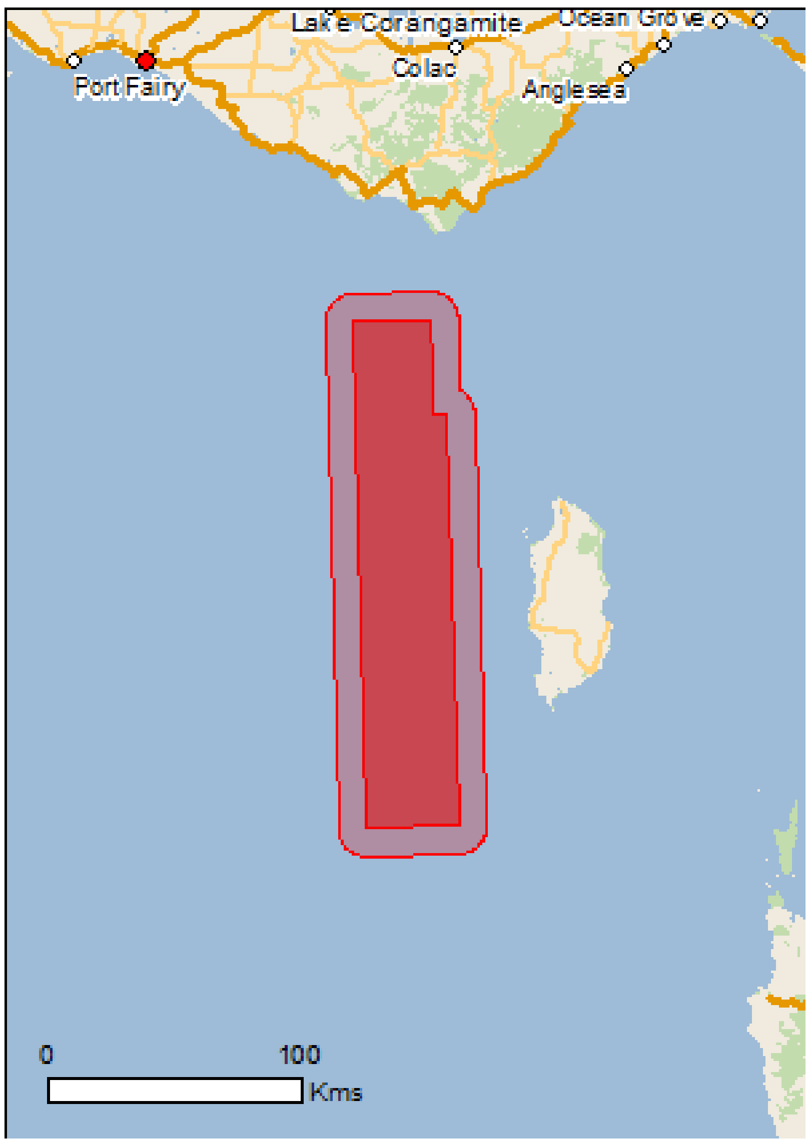
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

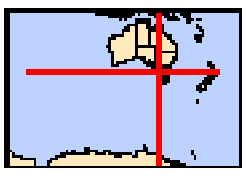
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:34:28



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 11.1Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	36
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	61
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
Fish		
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat may occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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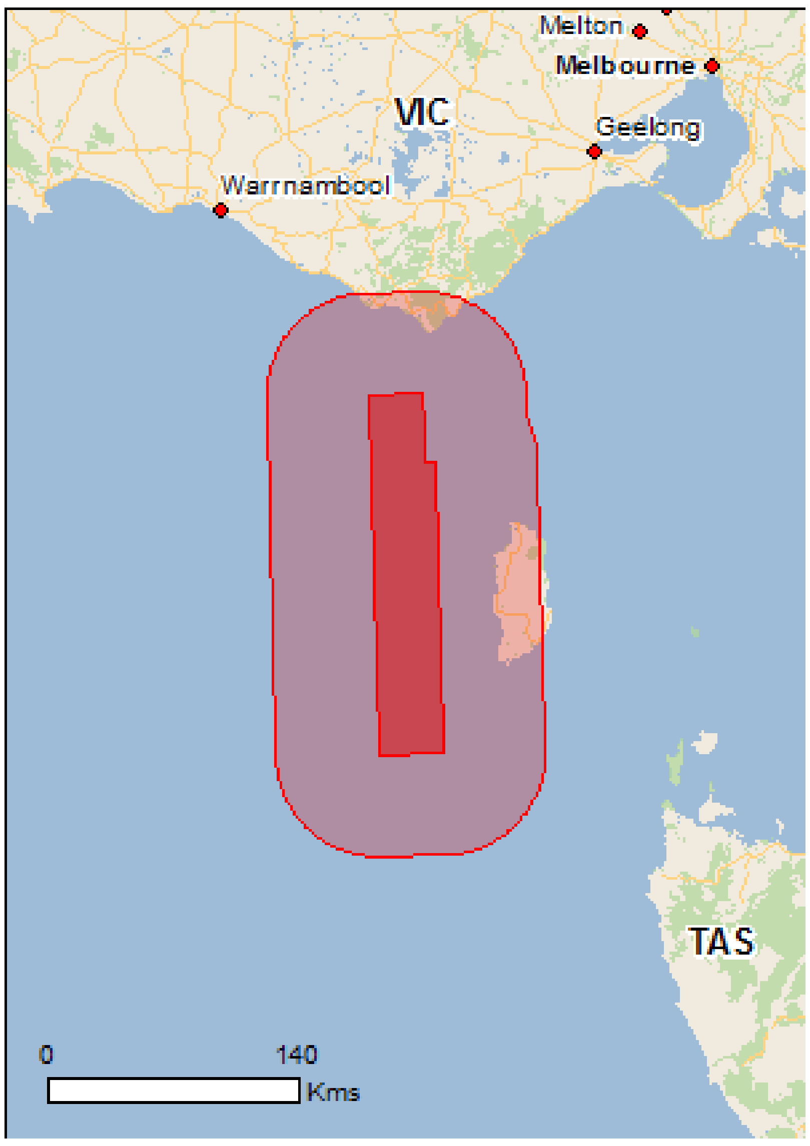
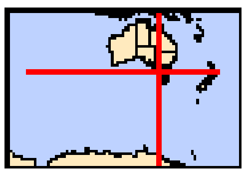


This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 56.9Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	77
Listed Migratory Species:	57

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	1
Listed Marine Species:	92
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	61
Regional Forest Agreements:	2
Invasive Species:	34
Nationally Important Wetlands:	10
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Great Ocean Road and Scenic Environs	VIC	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Lavinia	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Acanthiza pusilla archibaldi		
King Island Brown Thornbill, Brown Thornbill (King Island) [59430]	Endangered	Species or species habitat known to occur within area
Acanthornis magna greeniana		
King Island Scrubtit, Scrubtit (King Island) [82329]	Critically Endangered	Species or species habitat known to occur within area
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Platycercus caledonicus brownii Green Rosella (King Island) [67041]	Vulnerable	Species or species habitat known to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Strepera fuliginosa colei Black Currawong (King Island) [67113]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Fish		
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Antechinus minimus maritimus Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Miniopterus orianae bassanii Southern Bent-wing Bat [87645]	Critically Endangered	Roosting known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Astelia australiana Tall Astelia [10851]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus strzeleckii Strzelecki Gum [55400]	Vulnerable	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat known to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat likely to occur within area
Hypolepis distans Scrambling Ground-fern [2148]	Endangered	Species or species habitat known to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat may occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat known to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat known to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Cape Wickham Lighthouse	TAS	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel	Endangered	Foraging, feeding or

Name	Threatened	Type of Presence
[1060]		related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area

Name	Status	Type of Presence
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area

Name	Status	Type of Presence
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)
Zeehan	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Aire River	VIC
Aire River W.R.	VIC
Badger Box Creek	TAS
Barham Paradise S.R.	VIC
Calder River	VIC
Cape Wickham	TAS
Cape Wickham	TAS
Cataraqui Point	TAS
Christmas Island	TAS
City of Melbourne Bay	TAS
Colliers Forest Reserve	TAS
Colliers Swamp	TAS
Counsel Hill	TAS
Crinoline Creek	VIC
Currie Lightkeepers Residence	TAS
Deep Lagoons	TAS
Disappointment Bay	TAS
Eldorado	TAS
Gentle Annie	TAS
Great Otway	VIC
Johanna Falls S.R.	VIC
Kentford Forest	TAS
Kentford Forest	TAS
Kentford Road	TAS
Lake Flannigan	TAS
Latrobe B.R.	VIC
Lavinia	TAS
Lily Lagoon	TAS
Loorana	TAS
Lymwood	TAS
Marengo N.C.R.	VIC
Muddy Lagoon	TAS
New Year Island	TAS
Nugara	TAS
Olangolah Creek	VIC
Parker River	VIC
Pegarah Forest	TAS

Name	State
Porky Beach	TAS
Port Campbell	VIC
Princetown W.R	VIC
Red Hut Point	TAS
Red Hut Road #1	TAS
Reekara	TAS
Reekara Road #1	TAS
Reekara Road #2	TAS
Sandfly Beach	TAS
Sea Elephant	TAS
Sea Elephant Bootlace	TAS
Sea Elephant River	TAS
Seal Rocks	TAS
Seal Rocks	TAS
Stokes Point	TAS
Stony Creek (Otways)	VIC
Tambar	TAS
Tathams Lagoon	TAS
Unnamed P0176	VIC
Wicks Road Nugara	TAS
Wild Dog B.R.	VIC
Wild Dog Creek SS.R.	VIC
Wongarra B.R.	VIC
Yambacoona	TAS

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Tasmania RFA	Tasmania
West Victoria RFA	Victoria

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Callipepla californica California Quail [59451]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Aire River	VIC
Bungaree Lagoon	TAS
Lake Flannigan	TAS
Lavinia Nature Reserve	TAS
Lower Aire River Wetlands	VIC
Pearshape Lagoon 1	TAS
Pearshape Lagoon 2	TAS
Pearshape Lagoon 3	TAS
Pearshape Lagoon 4	TAS
Princetown Wetlands	VIC

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

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-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government

**Department of Agriculture,
Water and the Environment**

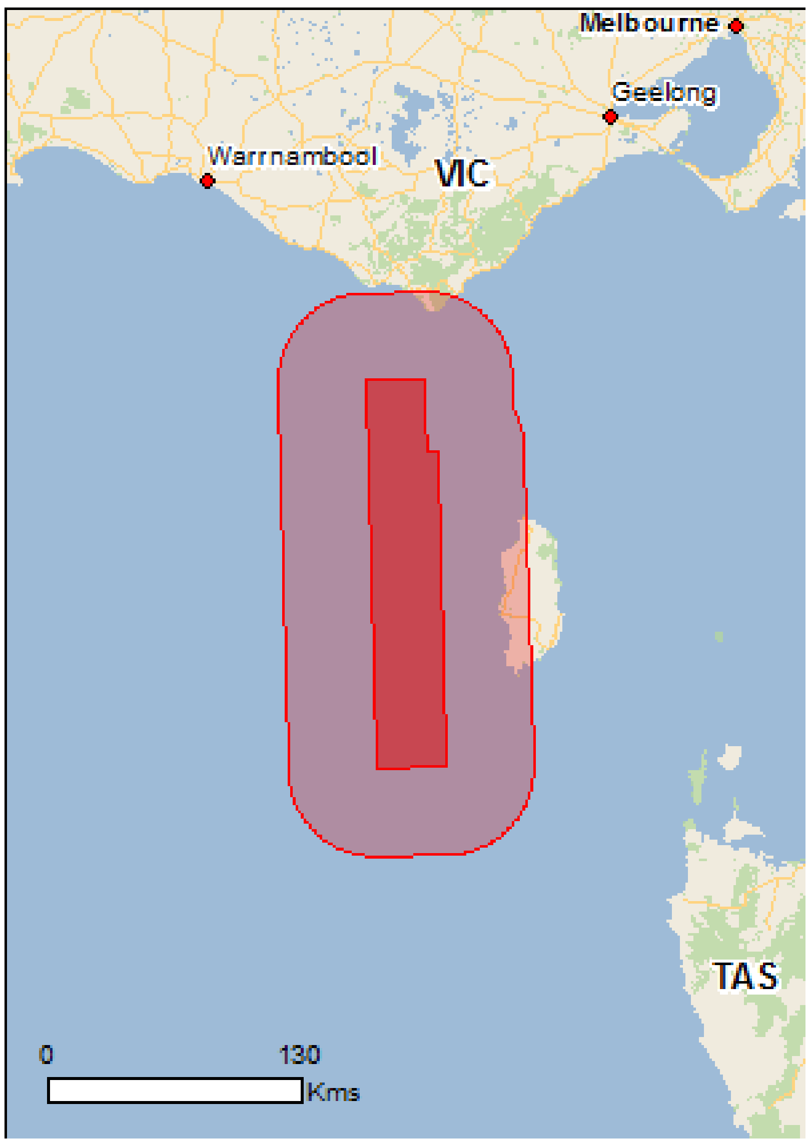
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 27/05/21 23:37:13



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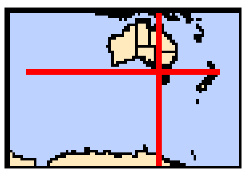
Coordinates
Buffer: 45.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	75
Listed Migratory Species:	56

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	1
Listed Marine Species:	90
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	41
Regional Forest Agreements:	2
Invasive Species:	34
Nationally Important Wetlands:	9
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Great Ocean Road and Scenic Environs	VIC	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Lavinia	Within 10km of Ramsar

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Acanthiza pusilla archibaldi		
King Island Brown Thornbill, Brown Thornbill (King Island) [59430]	Endangered	Species or species habitat known to occur within area
Acanthornis magna greeniana		
King Island Scrubtit, Scrubtit (King Island) [82329]	Critically Endangered	Species or species habitat known to occur within area
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Platycercus caledonicus brownii Green Rosella (King Island) [67041]	Vulnerable	Species or species habitat known to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Strepera fuliginosa colei Black Currawong (King Island) [67113]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thinornis cucullatus cucullatus		
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Fish		
Galaxiella pusilla		
Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Antechinus minimus maritimus		
Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus		
Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Miniopterus orianae bassanii		
Southern Bent-wing Bat [87645]	Critically Endangered	Roosting known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus		
Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Astelia australiana		
Tall Astelia [10851]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Eucalyptus strzeleckii Strzelecki Gum [55400]	Vulnerable	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat known to occur within area
Hypolepis distans Scrambling Ground-fern [2148]	Endangered	Species or species habitat known to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat may occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat likely to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Cape Wickham Lighthouse	TAS	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Name	Status	Type of Presence
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)
Zeehan	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves

[Resource Information]

Name	State
Aire River	VIC
Aire River W.R.	VIC
Badger Box Creek	TAS
Barham Paradise S.R.	VIC
Calder River	VIC
Cape Wickham	TAS
Cape Wickham	TAS
Cataraqui Point	TAS
Christmas Island	TAS
Colliers Forest Reserve	TAS
Colliers Swamp	TAS
Currie Lightkeepers Residence	TAS
Deep Lagoons	TAS
Great Otway	VIC
Johanna Falls S.R.	VIC
Kentford Forest	TAS
Kentford Forest	TAS
Kentford Road	TAS
Lake Flannigan	TAS
Latrobe B.R.	VIC
Lily Lagoon	TAS
Lymwood	TAS
Marengo N.C.R.	VIC
Muddy Lagoon	TAS
New Year Island	TAS
Nugara	TAS
Parker River	VIC
Porky Beach	TAS
Port Campbell	VIC
Red Hut Point	TAS
Reekara	TAS
Sandfly Beach	TAS
Seal Rocks	TAS
Seal Rocks	TAS
Stokes Point	TAS
Stony Creek (Otways)	VIC
Tathams Lagoon	TAS
Unnamed P0176	VIC
Wicks Road Nugara	TAS
Wild Dog B.R.	VIC
Wild Dog Creek SS.R.	VIC

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Tasmania RFA	Tasmania
West Victoria RFA	Victoria

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Callipepla californica California Quail [59451]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Aire River	VIC
Bungaree Lagoon	TAS
Lake Flannigan	TAS
Lower Aire River Wetlands	VIC
Pearshape Lagoon 1	TAS
Pearshape Lagoon 2	TAS
Pearshape Lagoon 3	TAS
Pearshape Lagoon 4	TAS
Princetown Wetlands	VIC

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
West Tasmania Canyons	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-39.098013 143.220252,-39.092547 143.490619,-39.352719 143.499836,-39.351686 143.547377,-40.468694 143.589119,-40.475505 143.265,-39.098013 143.220252

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Australian Government
Department of Agriculture,
Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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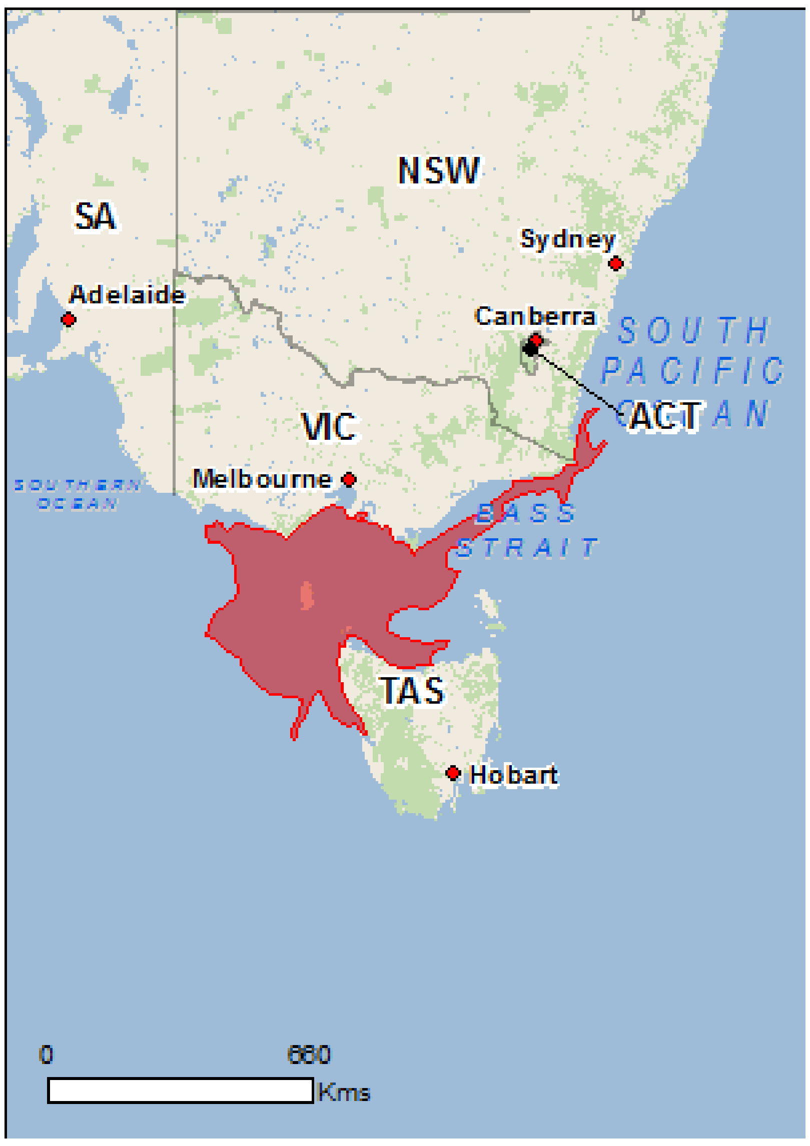

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Coordinates
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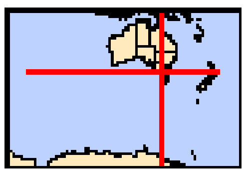


Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	4
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	12
Listed Threatened Species:	128
Listed Migratory Species:	82

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	6
Listed Marine Species:	125
Whales and Other Cetaceans:	32
Critical Habitats:	1
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	6

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	103
Regional Forest Agreements:	5
Invasive Species:	57
Nationally Important Wetlands:	10
Key Ecological Features (Marine)	4

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Indigenous		
Western Tasmania Aboriginal Cultural Landscape	TAS	Listed place
Historic		
Great Ocean Road and Scenic Environs	VIC	Listed place
Point Nepean Defence Sites and Quarantine Station Area	VIC	Listed place
Quarantine Station and Surrounds	VIC	Within listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Corner inlet	Within 10km of Ramsar
Lavinia	Within Ramsar site
Port phillip bay (western shoreline) and bellarine peninsula	Within 10km of Ramsar
Western port	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Community may occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community may occur within area
Lowland Native Grasslands of Tasmania	Critically Endangered	Community likely to occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community likely to occur within area
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to

Name	Status	Type of Presence
		occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		
Acanthiza pusilla archibaldi King Island Brown Thornbill, Brown Thornbill (King Island) [59430]	Endangered	Species or species habitat known to occur within area
Acanthornis magna greeniana King Island Scrubtit, Scrubtit (King Island) [82329]	Critically Endangered	Species or species habitat known to occur within area
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Platycercus caledonicus brownii Green Rosella (King Island) [67041]	Vulnerable	Species or species habitat known to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Strepera fuliginosa colei Black Currawong (King Island) [67113]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Breeding known to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Tyto novaehollandiae castanops (Tasmanian population) Masked Owl (Tasmanian) [67051]	Vulnerable	Breeding known to occur within area
Crustaceans		
Astacopsis gouldi Giant Freshwater Crayfish, Tasmanian Giant Freshwater Lobster [64415]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Insects		
Oreisplanus munionga larana Marrawah Skipper, Alpine Sedge Skipper, Alpine Skipper [77747]	Vulnerable	Species or species habitat known to occur within area
Synemon plana Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Antechinus minimus maritimus Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (Tasmanian population) Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population) [75183]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Miniopterus orianae bassanii Southern Bent-wing Bat [87645]	Critically Endangered	Roosting known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Perameles gunnii gunnii Eastern Barred Bandicoot (Tasmania) [66651]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Sarcophilus harrisii Tasmanian Devil [299]	Endangered	Species or species habitat likely to occur within area
Plants		
Acacia constablei Narrabarba Wattle [10798]	Vulnerable	Species or species habitat known to occur within area
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area
Caladenia caudata Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat may occur within area
Caladenia dienema Windswept Spider-orchid [64858]	Endangered	Species or species habitat known to occur within area
Caladenia insularis French Island Spider-orchid [24372]	Vulnerable	Species or species habitat may occur within area
Caladenia orientalis Eastern Spider Orchid [83410]	Endangered	Species or species habitat known to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Corunastylis brachystachya Short-spiked Midge-orchid [76410]	Endangered	Species or species habitat known to occur within area
Craspedia preminghana Preminghana Billybutton [77046]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat may occur within area
Diuris lanceolata Snake Orchid [10231]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Eucalyptus strzeleckii Strzelecki Gum [55400]	Vulnerable	Species or species habitat known to occur within area
Euphrasia collina subsp. muelleri Purple Eyebright, Mueller's Eyebright [16151]	Endangered	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat known to occur within area
Grevillea infecunda Anglesea Grevillea [22026]	Vulnerable	Species or species habitat likely to occur within area
Hypolepis distans Scrambling Ground-fern [2148]	Endangered	Species or species habitat known to occur within area
Ixodia achillaeoides subsp. arenicola Sand Ixodia, Ixodia [21474]	Vulnerable	Species or species habitat may occur within area
Lachnagrostis adamsonii Adamson's Blown-grass, Adamson's Blowngrass [76211]	Endangered	Species or species habitat may occur within area
Leiocarpa gatesii Wrinkled Buttons [76212]	Vulnerable	Species or species habitat likely to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat likely to occur within area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Pimelea spinescens subsp. spinescens Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980]	Critically Endangered	Species or species habitat may occur within area
Prasophyllum atratum Three Hummock Leek-orchid [82677]	Critically Endangered	Species or species habitat known to occur within area
Prasophyllum favonium Western Leek-orchid [64949]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat likely to occur within area
Prasophyllum pulchellum Pretty Leek-orchid [64953]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum secutum Northern Leek-orchid [64954]	Endangered	Species or species habitat likely to occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area
Pterostylis rubenachii Arthur River Greenhood [64536]	Endangered	Species or species habitat known to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat likely to occur within area
Senecio macrocarpus Large-fruit Fireweed, Large-fruit Groundsel [16333]	Vulnerable	Species or species habitat likely to occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat known to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat likely to occur within area
Thelymitra matthewsii Spiral Sun-orchid [4168]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Zearaja maugeana Maugean Skate, Port Davey Skate [83504]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Breeding known to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur

Name	Threatened	Type of Presence
		within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - HMAS CERBERUS
Defence - TRAINING CENTRE (Norris Barracks) - Portsea
Defence - WEST HEAD GUNNERY RANGE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
HMAS Cerberus Marine and Coastal Area	VIC	Listed place
Historic		
Cape Wickham Lighthouse	TAS	Listed place
Gabo Island Lighthouse	VIC	Listed place
Sorrento Post Office	VIC	Listed place
Table Cape Lighthouse	TAS	Listed place
Wilsons Promontory Lighthouse	VIC	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Larus dominicanus Kelp Gull [809]		Breeding known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Migration route known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Pelecanoides urinatrix Common Diving-Petrel [1018]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area

Name	Threatened	Type of Presence
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Breeding known to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Critical Habitats [Resource Information]

Name	Type of Presence
Thalassarche cauta (Shy Albatross) - Albatross Island, The Mewstone, Pedra Branca	Listed Critical Habitat

Australian Marine Parks [Resource Information]

Name	Label
Apollo	Multiple Use Zone (IUCN VI)
Beagle	Multiple Use Zone (IUCN VI)
Boags	Multiple Use Zone (IUCN VI)
Franklin	Multiple Use Zone (IUCN VI)
Zeehan	Multiple Use Zone (IUCN VI)
Zeehan	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Albatross Island	TAS
Anser Island	VIC
Arthur-Pieman	TAS
Badger Box Creek	TAS
Ben Boyd	NSW
Bird Island	TAS
Black Pyramid Rock	TAS
Calm Bay	TAS
Cape Liptrap Coastal Park	VIC
Cape Patterson N.C.R	VIC
Cape Wickham	TAS
Cape Wickham	TAS
Cataraqui Point	TAS
Christmas Island	TAS
City of Melbourne Bay	TAS
Colliers Forest Reserve	TAS
Colliers Swamp	TAS
Cone Islet	TAS
Councillor Island	TAS
Counsel Hill	TAS
Croajingolong	VIC
Currie Lightkeepers Residence	TAS
Curtis Island	TAS
Deep Lagoons	TAS
Devils Tower	TAS
Disappointment Bay	TAS
East Moncoeur Island	TAS
Eldorado	TAS
Four Mile Beach	TAS
French Island	VIC
Gentle Annie	TAS
Great Otway	VIC
Harbour Islets	TAS
Henderson Islets	TAS
Hogan Group	TAS
Hunter Island	TAS
Kentford Forest	TAS
Kentford Forest	TAS
Kentford Road	TAS
King Island	TAS
Kings Run	TAS
Kings Run #2	TAS
Lake Flannigan	TAS
Latrobe B.R.	VIC
Lavinia	TAS
Lily Lagoon	TAS
Lily Pond B.R.	VIC

Name	State
Little Trefoil	TAS
Loorana	TAS
Lymwood	TAS
Marengo N.C.R.	VIC
Millwood Road	TAS
Mornington Peninsula	VIC
Mount Heemskirk	TAS
Muddy Lagoon	TAS
Nadgee	NSW
Nares Rocks	TAS
New Year Island	TAS
North East Islet	TAS
Nugara	TAS
Ocean Beach	TAS
Pegarah	TAS
Pegarah Forest	TAS
Penguin Islet	TAS
Phillip Island Nature Park	VIC
Point Nepean	VIC
Porky Beach	TAS
Port Campbell	VIC
Preminghana	TAS
Red Hut Point	TAS
Red Hut Road #1	TAS
Reekara	TAS
Reekara Road #1	TAS
Reekara Road #2	TAS
Reid Rocks	TAS
Rodondo Island	TAS
Sandfly Beach	TAS
Sea Elephant	TAS
Sea Elephant Bootlace	TAS
Sea Elephant River	TAS
Seacrow Islet	TAS
Seal Islands W.R.	VIC
Seal Rocks	TAS
Seal Rocks	TAS
Southern Wilsons Promontory	VIC
Stack Island	TAS
Stokes Point	TAS
Stony Creek (Otways)	VIC
Sugarloaf Rock	TAS
Sundown Point	TAS
Table Cape	TAS
Table Cape	TAS
Tambar	TAS
Tathams Lagoon	TAS
The Doughboys	TAS
Three Hummock Island	TAS
Ventnor B.R.	VIC
West Moncoeur Island	TAS
West Point	TAS
Wicks Road Nugara	TAS
Wilsons Promontory	VIC
Wilsons Promontory Islands	VIC
Yambacoona	TAS

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
East Gippsland RFA	Victoria
Eden RFA	New South Wales
Gippsland RFA	Victoria
Tasmania RFA	Tasmania
West Victoria RFA	Victoria

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Callipepla californica California Quail [59451]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Feral Chicken, Domestic Fowl [917]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Turdus philomelos Song Thrush [597]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Austrocylindropuntia spp. Prickly Pears [85132]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Anderson Inlet	VIC
Bungaree Lagoon	TAS
Lake Flannigan	TAS
Lavinia Nature Reserve	TAS
Pearshape Lagoon 1	TAS
Pearshape Lagoon 2	TAS
Pearshape Lagoon 3	TAS
Pearshape Lagoon 4	TAS
Unnamed Wetland	TAS
Western Port	VIC

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Bonney Coast Upwelling	South-east
Upwelling East of Eden	South-east
West Tasmania Canyons	South-east
Canyons on the eastern continental slope	Temperate east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-38.635466 141.690888,-38.609787 141.855845,-38.541208 141.928748,-38.597847 142.044762,-38.662219 142.105831,-38.705041 142.182006,-38.594814 142.317481,-38.587311 142.449217,-38.68706 142.752187,-38.70659 143.1548,-38.75537 143.36097,-38.85639 143.50972,-38.74213 143.67661,-38.4827 144.0332,-38.27117 144.52453,-38.29224 144.744862,-38.36155 144.831642,-38.49361 144.88449,-38.48396 145.03169,-38.39394 145.12406,-38.38717 145.27048,-38.45031 145.28822,-38.513039 145.12131,-38.56993 145.49826,-38.64933 145.55928,-38.6759 145.65749,-38.63533 145.75934,-38.67276 145.83415,-38.75754 145.85556,-38.90882 145.921989,-38.894764 146.144974,-38.97427 146.26918,-39.12559 146.34911,-39.06978 146.42952,-38.70931 147.083246,-38.37067 147.781144,-37.928799 148.585961,-37.823406 148.588464,-37.77582 149.48738,-37.70371 149.668895,-37.55971 149.77173,-37.53644 150.00124,-37.39483 149.95412,-37.081122 150.055916,-36.745716 150.12924,-36.586315 150.277327,-36.525454 150.449225,-36.534931 150.51317,-36.601004 150.461804,-36.712648 150.298283,-36.871265 150.225802,-37.221827 150.349604,-37.265987 150.422648,-37.086356 150.629091,-37.17086 150.690368,-37.580807 150.297817,-37.69285 149.949943,-38.237222 149.737016,-38.119885 149.580355,-37.99844 149.60526,-37.94902 149.502115,-37.962876 149.35542,-38.060361 149.203204,-38.006511 149.071301,-38.063201 148.801628,-38.188116 148.408543,-38.296356 148.360306,-38.409778 148.405632,-38.478199 148.361288,-38.946971 147.499879,-39.020502 147.214274,-39.114298 147.111946,-39.282792 147.08734,-39.389626 147.118232,-39.44035 147.3724,-39.627663 147.251396,-39.876815 147.015154,-39.99498 146.869332,-40.044398 146.643018,-40.001737 146.323753,-40.159362 145.846334,-40.394197 145.77,-40.478311 145.825657,-40.572694 146.121333,-40.674676 146.696415,-40.636365 146.994598,-40.625339 147.164306,-40.750145 147.010182,-40.792093 146.816457,-40.93308 146.700559,-41.00355 146.783357,-41.041506 146.669787,-41.084926 146.097003,-41.018293 145.841461,-40.718464 145.355066,-40.634478 145.255893,-40.505336 144.959257,-40.514935 144.85372,-40.7101 144.79186,-40.66932 144.691,-40.868499 144.70639,-40.93029 144.617669,-41.42897 144.761,-41.69631 144.91517,-41.997619 145.22307,-42.19815 145.28404,-42.146109 145.164615,-42.034318 145.02696,-42.049152 144.858437,-41.900454 144.530718,-41.491444 144.266907,-41.51246 144.164334,-41.677247 144.035957,-41.931226 143.87753,-42.115049 143.717515,-42.247249 143.703308,-42.286704 143.679686,-42.215584 143.589207,-42.087519 143.590773,-41.869301 143.802354,-41.626717 143.822941,-41.548071 143.701794,-41.504437 143.107402,-41.350902 142.828223,-41.095875 142.518759,-40.911482 142.453801,-40.83254 142.289812,-40.709825 142.029798,-40.58005 141.888761,-40.5064 141.682496,-40.163812 141.845437,-39.96216 142.169911,-39.867106 142.347408,-39.74168 142.410005,-39.456516 142.348899,-39.12675 142.310955,-38.911135 141.986187,-38.901266 141.768968,-38.775979 141.686318,-38.635466 141.690888

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

DAYLIGHT OPERATIONS

MARINE MAMMAL ADAPTIVE MANAGEMENT PROCEDURE – SEQUOIA 3DMSS AUGUST-OCTOBER 2021

AT ALL TIMES

>2 Shutdowns from SRW/BW Adult(s) in preceding 24 Hours

Shutdown for maximum duration, then commence Start-up Procedure in daylight
OR
Shutdown until aerial surveillance can confirm no SRW/BW adult(s) present in or migrating towards TTS effect distances, then commence Start-up Procedure in daylight.
(Refer to effect distance-shutdown duration below)

>2 Shutdowns from SRW CC-Pair(s) in preceding 24 Hours

Shutdown for maximum duration, then commence Start-up Procedure in daylight
OR
Shutdown until aerial surveillance can confirm no SRW CC-Pairs present in or migrating towards TTS or BD effect distances, then commence Start-up Procedure in daylight.
(Refer to effect distance-shutdown duration below)

≥3 Power-downs or Shutdowns from Other Whale(s) in preceding 24 Hours

No Night-time Acquisition and commence Start-up Procedure in daylight.

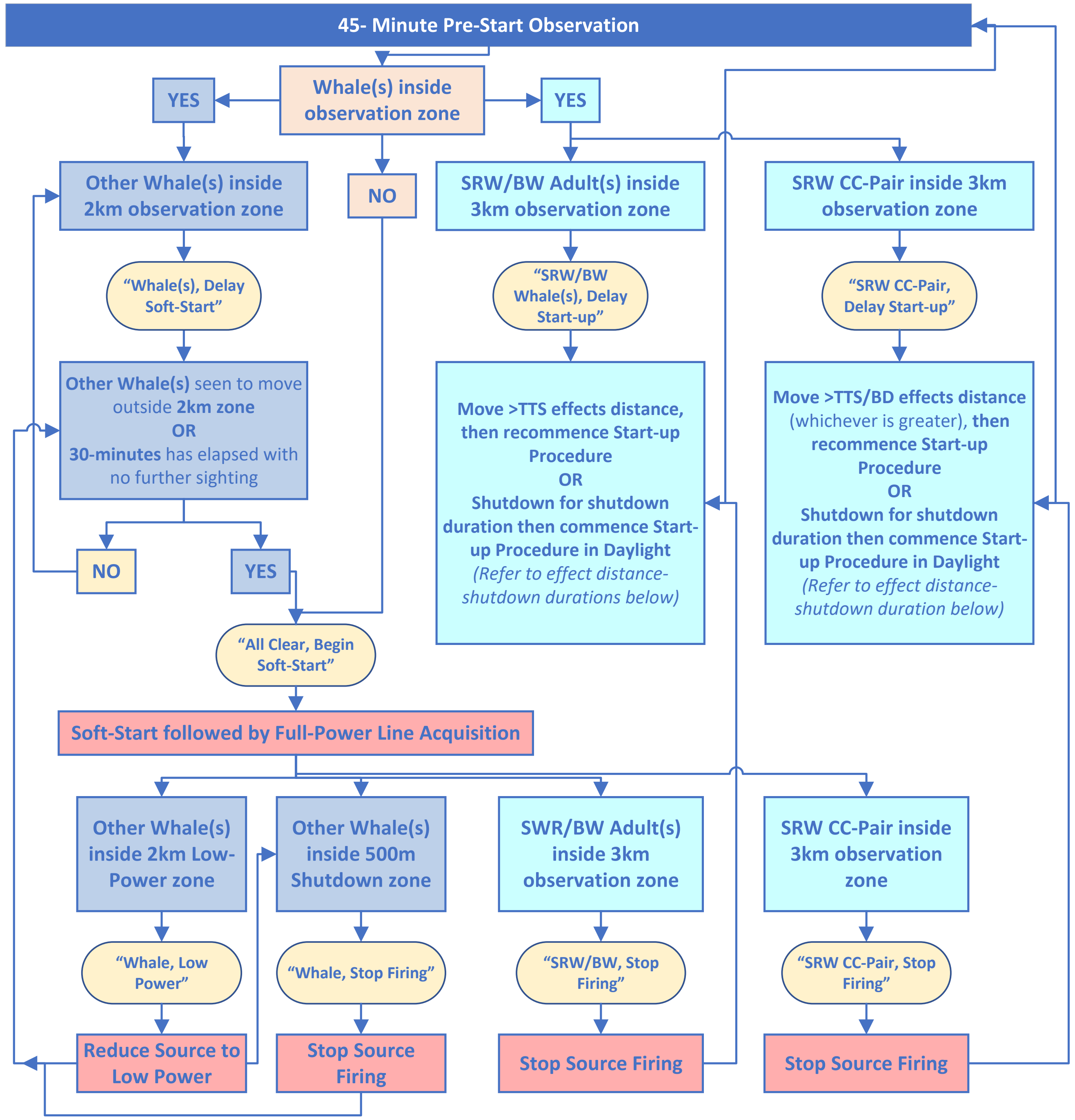
PLANNING PRIORITIES

Where possible, acquisition of eastern seismic lines will occur within 12-24 hours following aerial surveillance that confirms no SRW/BW Whale(s) are present along or moving towards west coast of King Island.

The eastern acquisition lines will not be acquired until SRW/BW whale(s) are not detected inside King Island coastal BIA. A second aerial surveillance flight may be triggered to confirm.

At night, where possible, acquisition will be prioritised for areas where previous aerial surveillance has confirmed no SRW/BW whales are present within or moving into.

DURING ACQUISITION



45- Minute Pre-Start Observation

Whale(s) inside observation zone

YES

Other Whale(s) inside 2km observation zone

"Whale(s), Delay Soft-Start"

Other Whale(s) seen to move outside **2km zone**
OR
30-minutes has elapsed with no further sighting

NO

YES

NO

YES

SRW/BW Adult(s) inside 3km observation zone

"SRW/BW Whale(s), Delay Start-up"

Move >TTS effects distance, then recommence Start-up Procedure
OR
Shutdown for shutdown duration then commence Start-up Procedure in Daylight
(Refer to effect distance-shutdown durations below)

SRW CC-Pair inside 3km observation zone

"SRW CC-Pair, Delay Start-up"

Move >TTS/BD effects distance (whichever is greater), **then recommence Start-up Procedure**
OR
Shutdown for shutdown duration then commence Start-up Procedure in Daylight
(Refer to effect distance-shutdown duration below)

"All Clear, Begin Soft-Start"

Soft-Start followed by Full-Power Line Acquisition

Other Whale(s) inside 2km Low-Power zone

"Whale, Low Power"

Reduce Source to Low Power

Other Whale(s) inside 500m Shutdown zone

"Whale, Stop Firing"

Stop Source Firing

SWR/BW Adult(s) inside 3km observation zone

"SRW/BW, Stop Firing"

Stop Source Firing

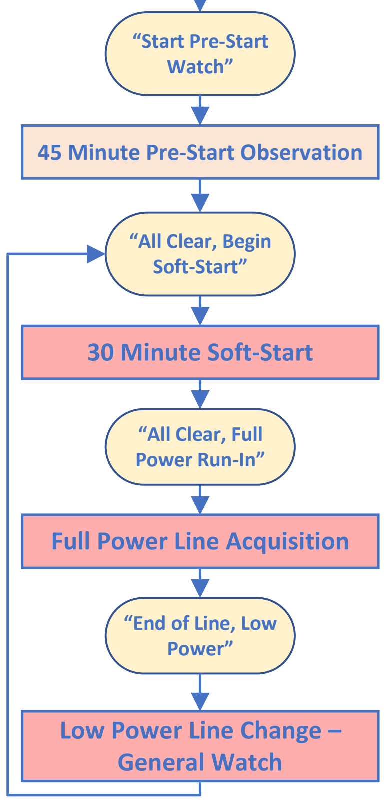
SRW CC-Pair inside 3km observation zone

"SRW CC-Pair, Stop Firing"

Stop Source Firing

STANDARD COMMUNICATIONS

START-UP PROCEDURE



"Start Pre-Start Watch"

45 Minute Pre-Start Observation

"All Clear, Begin Soft-Start"

30 Minute Soft-Start

"All Clear, Full Power Run-In"

Full Power Line Acquisition

"End of Line, Low Power"

Low Power Line Change – General Watch

AERIAL/VESSEL SURVEILLANCE

SRW/BW Adult(s) within or approaching TTS Zone

Shutdown and move >TTS effects distance, then commence Start-up Procedure
OR
Shutdown for shutdown duration then commence Start-up Procedure in Daylight
(Refer to effect distance-shutdown duration below)

SRW CC-Pair(s) within or approaching TTS or BD Zone

Shutdown and move >TTS/BD effect distance (whichever is greater), **then commence Start-up Procedure**
OR
Shutdown for shutdown duration then commence Start-up Procedure in Daylight
(Refer to effect distance-shutdown duration below)

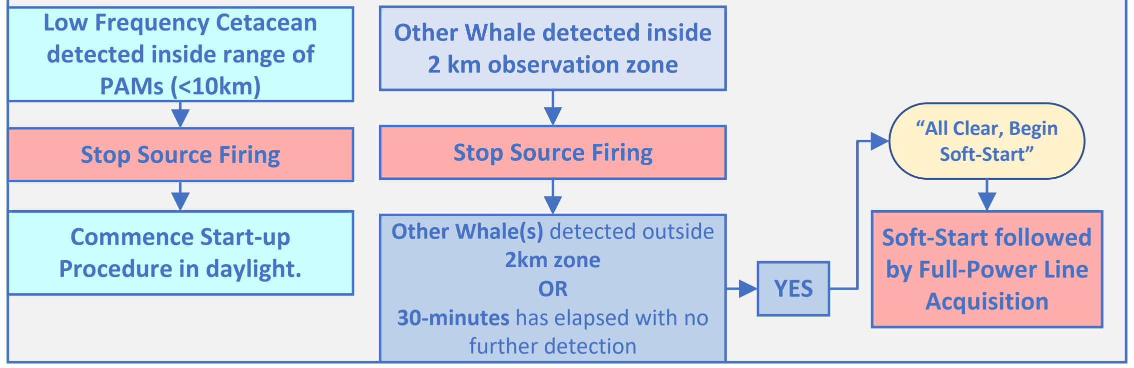
SHORELINE SURVEILLANCE

Resident migration-ready SRW CC-Pair not reported by Land-based Observer Network for 48 hours

Adaptively manage surveillance effort to improve confidence in 48 hour trigger, liaise with nearby MMO programs, undertake second weekly aerial surveillance flight as soon as practicable to confirm no SRW CC-Pairs present in or migrating towards TTS or BD effect distances. *(Refer to effect distance-shutdown duration below)*

ACRONYMS	**BIA**= Biologically Important Area; **BD**= Behavioural Disturbance; **BW**= Blue Whale; **CC-Pair**= Cow-Calf Pair; **MMO**=Marine Mammal Observer; **PAM**= Passive Acoustic Monitoring; **SRW**= Southern Right Whale; **TTS**= Temporary Threshold Shift.

NIGHT-TIME/LOW-VIS OPERATIONS



Low Frequency Cetacean detected inside range of PAMs (<10km)

Stop Source Firing

Commence Start-up Procedure in daylight.

Other Whale detected inside 2 km observation zone

Stop Source Firing

Other Whale(s) detected outside **2km zone**
OR
30-minutes has elapsed with no further detection

YES

"All Clear, Begin Soft-Start"

Soft-Start followed by Full-Power Line Acquisition

NOTES & LEGEND

ASSUMPTIONS
If unable to confirm SWR without calf, assume CC-Pair
If unable to confirm other whale, assume SRW/BW

DAYTIME / GOOD VISIBILITY
MMO is lead for marine mammal/wildlife monitoring, with PAM detections reported to MMO for awareness and calibration of observations

NIGHT-TIME / POOR VISIBILITY
PAM Operator monitors for marine mammals with focus on Low Frequency Cetaceans (Baleen whales)

Vessel to fire source at full-power ONLY within acquisition area. Vessel to fire at low-power on line turns to deter whales from entering area.

"Message"
Other Whales
SRW/BW
Source Firing
Condition

Direction	TTS Distance (km)	BD Distance – Adults (km)	BD Distance – Cow-Calf Pairs (km)	Average Speed of Migration (km/hr)	TTS/BD Zone	TTS Zone Shutdown Duration (hr) - Adults	TTS/BD Zone Shutdown Duration (hr) - Cow-Calf Pairs
Whale(s) is between seismic vessel and Victorian coast (AREA 2)	11.7	11.1 km	15	Adults and Cow-Calf Pairs ~3	Worst-case assumption that whales have to travel past the vessel, therefore the TTS/BD distance is doubled to calculate the 'effect zone' and then divided by the average speed of migration to determine shutdown duration (vessel speed of 4.5 knots away from whale is not accounted for to be conservative).	8	10
Whale(s) is between seismic vessel and west coast of Tasmania (AREA 4)	12.5		25			8	17
Whale is between seismic vessel and west coast of King Island (AREA 1)	25.9		25			17	17
Whale is between seismic vessel and offshore waters (AREA 3)	56.6		28			38	38
Interpolation of mapping (accurate distance pending)	Shutdown duration for observations within shutdown zone to 3km assumes animal takes longest route to exit TTS/BD Zone (56.6km)					19	19