FINAL REPORT

Compilation of information for the US Marine Mammal Protection Act comparability finding process

Alice I. Mackay

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Abbreviations

AFMA – Australian Fisheries Management Authority
AFZ - Australian Fishing Zone
AIMTF – Western Australia Abrolhos Island and Mid-west Trawl Fishery
AT Act - *Antarctic Treaty (Environment Protection) Act 1980*
BCF – South Australian Blue Crab Fishery
BRD – Bycatch Reduction Device
BGTS – Blue Grenadier Trawl Sector of the Commonwealth Southern and Eastern Scalefish and Shark Fishery
CTSF Act - Commonwealth *Torres Strait Fisheries Act 1984*
CCAMLR - *Convention on the Conservation of Antarctic Marine Living Resources*
CCAS - *Convention for the Conservation of Antarctic Seals 1972.*
CSF – Commonwealth Coral Sea Fishery
CTS - Commonwealth Trawl Sector of the Commonwealth Southern and Eastern Scalefish and Shark Fishery
DAWE – Commonwealth Department of Agriculture Water and the Environment
DELWP - Victorian Department of Environment, Land, Water and Planning
DF - Northern Territory Demersal Fishery
DPI - New South Wales Department of Primary Industries
DPIPWE – Tasmanian Department of Primary Industries, Parks, Water and Environment
DPIR – Northern Territory Department of Primary Industries and Resources
DPRID – Western Australian Department of Primary Industries and Regional Development
EBFM - Ecosystem-Based Fisheries Management
ECDTS - East Coast Deepwater Trawl Sector of the Commonwealth Southern and Eastern Scalefish and Shark Fishery
ECOTF – Queensland East Coast Trawl Fishery
EEZ – Exclusive Economic Zone
EGF - New South Wales Estuary General Fishery
EGPMF – Western Australian Exmouth Gulf Prawn Managed Fishery
EIS - Environmental Impact Statement
EM – electronic monitoring
EPTF - Estuary Prawn Trawl Fishery
ERAEF - Ecological Risk Assessment for the Effects of Fishing
ESD - Ecologically Sustainable Development
ETBF- Commonwealth Eastern Billfish and Tuna Fishery
FFG Act - Victorian *Flora and Fauna Guarantee Act 1988*
FM Act – Commonwealth *Fisheries Management Act 1991*
FRM Act – Western Australian *Fish Resources Management Act 1994*
GABTS - Great Australian Bight Trawl Sector of the Commonwealth Southern and Eastern Scalefish and Shark Fishery
GHAT - Gillnet, Hook and Trap Sectors of the Commonwealth Southern and Eastern Scalefish and Shark Fishery
GSVPF – South Australian Gulf Saint Vincent Prawn Fishery
HIMI - Commonwealth Heard Island and McDonald Islands Fishery
LCF – South Australian Lakes and Coorong Fishery
LMFM Act – Tasmanian *Living Marine Resources Management Act 1995*
MITF - Commonwealth Macquarie Island Toothfish Fishery
MNES - Matters of National Environmental Significance
MMPA – U.S. *Marine Mammal Protection Act 1972*
MSC – Marine Stewardship Council
MSF – South Australian Marine Scalefish Fishery
NT Act - Commonwealth *Native Title Act* 1993 (NT Act)
NTF Act – *Northern Territory Fishery Act 1998*
NTFR - *Fisheries Regulations 1992*
NTFJA - Northern Territory Fisheries Joint Authority
NOAA - U.S. National Oceanographic Atmospheric Association
NPW Act – New South Wales *National Parks and Wildlife Act 1974*

NSWBC Act - *New South Wales Biodiversity Conservation Act 2016*
NSWFM Act – New South Wales *Fisheries Management Act 1994*
OHF – New South Wales Ocean Hauling Fishery
OIMF – Western Australian Octopus Interim Managed Fishery
ONLF – Northern Territory Offshore Net and Line Fishery
OTF – New South Wales Ocean Trawl Fishery
OTLF – New South Wales Ocean Trap and Line Fishery
PFTIMF - Pilbara Fish Trawl (Interim) Managed Fishery
PIRSA - Department of Primary Industries and Regions South Australia
PSA - Productivity Susceptibility Analysis
PVA - Population Viability Analysis
QFA – Queensland *Fisheries Act 1994*
QFJA - Queensland Fisheries Joint Authority
QNC Act - *Queensland Nature Conservation Act 1992*
QTSF Act - Queensland *Torres Strait Fisheries Act 1984*
RIBTF – Queensland River and Inshore Beam Trawl Fishery
SANPW Act – South Australian *National Parks and Wildlife Act*
SAFM Act - South Australian *Fisheries Management Act 2007*
SARDI - South Australian Research and Development Institute
SASF – South Australian Sardine Fishery
SBCMF – Western Australian Shark Bay Crab Managed Fishery
SBPMF – Western Australian Shark Bay Prawn Managed Fishery
SBSMF – Western Australian Shark Bay Scallop Managed Fishery
SCCMF – Western Australian South Coast Crustacean Managed Fishery
SESSF - Commonwealth Southern and Eastern Shark and Scalefish Fishery
SETFIA - The South-East Trawl Fishery Industry Association
SGPF – South Australian Spencer Gulf Prawn Fishery
SLED – Sea Lion Exclusion Device
SOCI - species of conservation interest
SPF - Commonwealth Small Pelagic Fishery
TARA - Threat and Risk Assessment Report
TGCF – Tasmanian Giant Crab Fishery
TED – Turtle Excluder Device
TEP – Threatened, endangered, protected
TPCW Act – Northern *Territory Parks and Wildlife Conservation Act 2001*
TTSP Act – Tasmanian *Threatened Species Protection Act 1995*
TRF- Northern Territory Timor Reef Fishery
TUMRA - Traditional Use of Marine Resources Agreements
VF Act – Victorian *Fisheries Act 1995*
VFA – Victorian Fisheries Authority
VGCF – Victorian Giant Crab Fishery
VSRLF – Victorian Southern Rock Lobster Fishery
VW Act – Victorian Wildlife Act 1975
WARLF – Western Australian Rock Lobster Fishery
WBTF - Commonwealth Western Billfish and Tuna Fishery
WC Act - Western Australian *Wildlife Conservation Act 1950*
WCDSCMF – Western Australian West Coast Deep Crustacean Managed Fishery
WCPF – South Australian West Coast Prawn Fishery

Summary

Recent changes to legislation in the United States (US) requires that nations importing seafood must demonstrate that they have a regulatory program for reducing marine mammal bycatch that is comparable in effectiveness to the US standards under the 'Fish and Fish Product Import Provisions' of the *Marine Mammal Protection Act 1972* (MMPA). A comparability finding means the marine mammal protection provisions in the relevant fishery are recognised to be equivalent to that of the United States.

Several Australian commercial fisheries have received an 'exempt' classification under the MMPA import provisions which means they have been determined to have a remote likelihood, or no known incidental mortality of marine mammals. The remaining fisheries that are seeking a comparability finding have been classified as 'export' fisheries as they were determined to have more than a likelihood of incidental mortality to marine mammals. For each of these fisheries, the US requires information on monitoring programs in the fishery, levels of marine mammal bycatch, the species and 'stocks' (populations) involved, and the management strategies in place to mitigate bycatch.

This report synthesises the required information for 15 Australian Commonwealth managed commercial fisheries or fishery subsectors, and 29 Australian State and Territory commercial fisheries that are seeking a comparability finding under the US MMPA. Reports and / or observations of marine mammal interactions in Australian commercial fisheries that are not seeking export approval are also synthesised as this information is also required as part of the comparability finding process.

Marine mammal interactions have been independently observed and / or fishery-reported in nine of the Commonwealth managed and 18 of the State or Northern Territory managed fisheries that are seeking export approval. Marine mammal interactions have also been recorded in four Commonwealth managed fishery sectors that are not looking for export approval, and a number of State or Territory managed fisheries that are not seeking export approval. Fishery logbook data of marine mammal interactions are publicly available for all Commonwealth managed fisheries, but vary in availability for other jurisdictions.

Six species of seal have been observed or reported to interact with the fisheries considered by the project. Four are recorded to interact in waters off the Australian continent, with the southern elephant and crab eater seal interactions only recorded in Antarctic fisheries. Between 2010 and 2020, 177 interactions with pinnipeds, resulting in 121 mortalities, were reported in Commonwealth managed fisheries seeking export approval. Of these, 44% were reported to be Australian fur seals, 25% were southern elephant seals, 13% were New Zealand fur seals, and 16% were reported as 'seals' not identified to species. The majority of interactions with Australian fur seals were with the Blue Grenadier Trawl Sector (BGTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF), which reported 61 interactions resulting in 51 mortalities over this period. All interactions with southern elephant seals (45 interactions, 40 mortalities) were recorded in the demersal longline sector of the HIMI, which has 100% observer coverage. Australian and New Zealand fur seals or 'seal' mortalities have also been reported in the Tasmanian and Victorian Rock Lobster Fisheries, with the Tasmanian salmon aquaculture industry and with the New South Wales Ocean Trawl fishery.

Between 2010 and 2020, 125 interactions with cetaceans, resulting in 15 mortalities were reported in six Commonwealth managed fisheries that are seeking export approval. The majority of interactions (90%) and mortalities (87%) were reported in the Eastern Tuna and Billfish Fishery (ETBF). The ETBF has had mandatory Electronic Monitoring (EM) since 2015. To verify logbook accuracy, EM footage is reviewed for at least 10% of all fishing effort, and all logbook reports of protected species interactions are audited. Most interactions with cetaceans in the fishery involved short-finned pilot

whales (27%), 'dolphins' not identified to species (24%) and common dolphins (10%). The majority of cetaceans (88%) that interacted with the fishery were released alive. Interactions with 'dolphins' were also reported in eight State or Territory fisheries. Annual numbers of observed or reported interactions with dolphins, except for the Western Australian Pilbara Fish Trawl Interim Managed Fishery (PFTIMF) were generally of one or two individuals over the last five year and did not always result in a mortality. Reported mortalities in the Western Australian PFTIMF were between 11 and 26 common bottlenose dolphins per year between 2015 and 2020. Entanglements of an additional three species, the Australian humpback dolphin, Australian snubfin dolphin and the spinner dolphin have been recorded in nets deployed as part of the Queensland Shark Control Program.

The vast majority of marine mammal interactions with Commonwealth managed fisheries between 2010 and 2010 were reported in sectors not seeking export approval under the US MMPA. Between 2010 and 2020, 1,636 pinniped interactions and 33 cetacean interactions were reported with otter-board trawl gear, and 221 pinniped interactions and one cetacean interaction were reported with Danish-seine gear in the Commonwealth Trawl Sector (CTS) of the Southern and Eastern Shark and Scalefish Fishery (SESSF). Over the same period 296 pinniped interactions and 372 cetacean interactions were reported in the gillnet sector of the SESSF, and 130 pinniped interactions and 42 cetacean interactions were reported in the mid-water trawl sector of the Small Pelagic Fishery. Australian fur seals were reported as the species involved in 53% of interactions with pinnipeds in these four sectors, with a further 39% of interactions being reported as 'seals' not identified to species. Common dolphins were reported as the species involved in 39% of cetacean interactions in these four sectors, with 54% of interactions reported as being with 'dolphins' not identified to species. Marine mammal interactions in the gillnet sector of the SESSF and mid-water trawl sector of the Small Pelagic Fishery are managed using mandatory EM or observer coverage, permanent spatial closures, and further temporal or spatial closures if bycatch trigger limits are met.

Entanglement of large whales were reported in all six of the State managed crustacean fisheries for which information was synthesised. Such entanglement events are likely to increase as whale populations continue to recover since the cessation of commercial whaling. Between 2015 and 2019 entanglements of 319 humpback whale, ten southern right whale, one sei whale and two unidentified large baleen whales were reported in Australian waters to the International Whaling Commission. While these interactions are unlikely to impact the recovery of either the western or eastern Australian stocks of humpback whales which are estimated as 17,810-26,100 and 24,545 individuals respectively, there are clear ethical issues regarding the welfare of entangled individuals, the risk to disentanglement teams when removing gear from whales, as well as an increasing issue of social licence in fisheries. For southern right whales from the southeast population, an increase in mortalities due to entanglements could impact the recovery of that subpopulation.

The amount of quantitative information with which to assess commercial fisheries interactions with marine mammal species varied greatly between jurisdictions. For those Commonwealth fisheries where marine mammal interactions are known to occur observer coverage, or audit level of Electronic Monitoring (EM) is set at between 10-100%. EM is used as tool to improve the accuracy of fishery logbooks and has led to significant changes in the reporting of interactions with protected species in those fisheries where it has been implemented (Emery et al., 2019a). For fisheries with EM, when a fisher reports an interaction with a protected species in their logbook, the video footage from the fishing operation when in the interaction occurred is also audited, and species identification is confirmed or updated where possible. Of the State and Northern Territory fisheries considered, there was high variability in the level of observer coverage, and only one fishery, the Western Australian PFTIMF has an observer program specifically to monitor interactions with threatened, endangered and protected (TEP) species. Management strategies including mandatory use of excluder devices, gear modifications and bycatch trigger limits are used in several fisheries to mitigate marine mammal interactions.

In Australia, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) all interactions between commercial fisheries and TEP species must be reported to the Commonwealth Department of Water and Environment (DAWE). However, the way in which interactions are reported are not standardised. Where reports are made publicly available by jurisdictions, many do not contain relevant information such as the species involved, fishing effort, or the level of independent monitoring in the fishery. Without this information it is not possible to assess interaction rates or determine whether these rates may have population consequences to the species involved.

A simple first step that would allow cross jurisdictional comparisons of marine mammal (and other TEP species) in Australian fisheries, is to introduce a mandatory form for reporting TEP interactions in commercial fisheries. For each fishery, the annual report to DAWE should contain the following information: total fishing effort, number of operators, and the level of fishery-independent monitoring. Fishery-independent-monitoring could include periods when fishery scientists or observers are aboard collecting data in the fishery under normal fishing practices. This would greatly improve the utility of these reports, and would provide managers, fishers, and stakeholders a means of better assessing the level of TEP fishery interactions occurring in Australia.

1 Introduction

Under the 'Fish and Fish Product Import Provisions' of the United States *Marine Mammal Protection Act 1972* (MMPA), all nations exporting seafood to the United States are now required to demonstrate that they have a regulatory program for reducing marine mammal bycatch, in the exporting commercial fishery, that is comparable in effectiveness to United States standards. The exporting fishery must obtain a 'comparability finding', which means the provisions to protect and manage marine mammal interactions in the fishery are recognised to be equivalent to those of the United States. The 'Fish and Fish Product Import Provisions' came into effect on the 1st of January 2022.

To date, the United States National Oceanographic Atmospheric Association (NOAA) has classified those Australian fisheries looking to export product as either 'exempt' or 'export'. 'Exempt' fisheries are those which NOAA have determined have a remote likelihood, or no known incidental mortality of marine mammals. 'Export' fisheries are those determined to have more than a likelihood of causing incidental mortality to marine mammals, and NOAA require further information to determine if a comparability finding under the US MMPA can be obtained. The criteria to receive a comparability finding include:

- Conditions related to the prohibition of intentional killing or injury of marine mammals, and
- The requirement to develop and maintain regulatory programs comparable in effectiveness to the U.S. regulatory program for reducing incidental marine mammal bycatch

The scope of this project was to synthesise available information on the occurrence, nature, and extent of marine mammal interactions for 15 Australian Commonwealth managed commercial wild capture fisheries or sub-fisheries, and 29 State or Northern Territory managed commercial wild capture fisheries.

1.1 Structure of the report

Each chapter presents a synthesis of available information, by jurisdiction, for each commercial fishery that is seeking a comparability finding under the US MMPA. These were:

- Relevant legislation relating to fishery and marine mammal management
- A summary of the marine mammal species known to, or likely to, occur in area of the fishery
- Information on the distribution and abundance of these species
- Results of risk assessments undertaken in the fishery
- Information on monitoring in the fishery
- Data on observed or fishery reported marine mammal interactions for the last (most recent) five years
- Management strategies to mitigate interactions
- An assessment of the potential for interactions to occur based on gear type and marine mammal ecology

A synthesis of marine mammal abundance data for 22 species in Australian waters is provided in Appendix B. For all Commonwealth commercial fisheries seeking a comparability finding, fishing effort, observer data and fishery logbook data were provided by the Australian Fisheries Management Authority (AFMA). For the State and Northern Territory commercial fisheries, information was collated, where available, from publicly accessible reports.

1.2 Fisheries management in Australia

Australian territorial waters are the world's third largest jurisdiction, covering a geographic area of approximately 13,800,000 km^2. These waters include the following Australian external territories. Ashmore Reef, Cartier Island, Christmas Island and Cocos (Keeling) islands in the Indian Ocean, the Coral Sea Islands in the Coral Sea, Norfolk Island in the Pacific Ocean, Heard Island, McDonald Island and Macquarie Islands in the Southern Ocean, and the Australian Antarctic Territory. The Australian Antarctic Territory consists of all islands and territories south of 60°S, and between 45°E and 160°E (excluding the French territory Terre Adélie).

Australian fisheries are managed under eight different jurisdictions. Generally, commercial fisheries that operate in coastal waters within three nautical miles (nm) of the coastline are managed under State or Territory laws, whilst those operating between three and 200 nm from the coast are managed, by the AFMA, under Commonwealth laws. For a small number of species (such as tuna and tuna like species), the Commonwealth jurisdiction extends to the coast of some states. There are also 59 Offshore Constitutional Settlement agreements between the Commonwealth and State and Territory governments to manage commercial fishery resources that move between State and Commonwealth jurisdictions. The distribution of commercial fishing effort and catch (by weight) varies greatly between jurisdictions. In 2017-18 the total landed commercial catch of wild caught species was 173,699 tonnes, of which 30% was caught in South Australian fisheries, 29% was caught in Commonwealth fisheries, and 13% was caught in Western Australian fisheries (Steven et al., 2020). The majority (82%) of landed catch by weight in South Australia was sardines (*Sardinops sagax*), which are predominantly used as feed in southern blue fin tuna (*Thunnus maccoyii*) aquaculture.

While each jurisdiction has its own specific fisheries legislation, the environmental performance of all commercial fisheries that export product and / or operate in Commonwealth waters must be assessed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These assessments are conducted against the Guidelines for the Ecologically Sustainable Management of Fisheries, that outline specific principles and objectives to evaluate the ecological sustainability of the fishery's management arrangements (DEWR, 2007). For listed species, which are commonly referred to as threatened, endangered or protected (TEP) species, the fishery being assessed must provide reliable information on the extent and likely impacts of interactions with TEP species, and what management measures are in place to avoid the capture and / or mortality of these species. All marine mammal species are listed protected species under the EPBC Act.

The EPBC Act also requires that all interactions between Australian commercial fisheries and TEP species are reported to the Commonwealth Department of Agriculture, Water, and the Environment (DAWE). The public availability of these interaction reports varies between jurisdictions. Fishery logbook reports of TEP interactions with Commonwealth and Queensland managed commercial fisheries are published quarterly online. South Australia produces an annual report summarising all logbook reported TEP interactions in its commercial fisheries, while Western Australia and the Northern Territory provide summaries of logbook reported interactions as part of annual fishery status. The amount of information provided with the summaries of TEP interactions also varies greatly between jurisdictions. Some reports group interactions by taxa not species (e.g., dolphins), and by gear type instead of fishery. There can also be limited information provided on the nature, or outcome of the interaction. For some jurisdictions the definition of an 'interaction' includes reporting when a TEP species is sighted in the vicinity of fishing operations.

Most jurisdictions use a qualitative risk assessment approach to judge the potential impact that a given fishery many have on marine mammals and other TEP. Under the Commonwealth *Fisheries Management Act 1991* (FM Act), Commonwealth fisheries are managed in accordance with the ecologically sustainable development principles (ESD) which follow an Ecosystem-Based Fisheries

Management (EBFM) approach. A key component of this approach is the use of an Ecological Risk Assessment for the Effects of Fishing (ERAEF) framework to identify potential ecological risks from the fishery (Hobday et al., 2011). Under the ERAEF process, any TEP species that is identified as being at risk from the fishery during a first level assessment are further evaluated using Productivity Susceptibility Analysis (PSA). This analysis scores the likely risk to a species, from the fishery, in relation to the species productivity (e.g., age at maturity, fecundity), and their susceptibility to the fishing activity (e.g., availability, selectivity, post-capture mortality) (Hobday et al. 2011). The identification of TEP species assessed as being of high, or medium residual risk is then used to prioritise management actions under fishery-specific bycatch and discarding workplans.

The Queensland government has recently adopted a modified ERAEF approach to assess its fisheries, while in New South Wales, the risk to TEP species from each commercial fishery is assessed through an Environmental Impact Statement (EIS). The Northern Territory, Western Australian, Southern Australian and Victorian governments undertake risk assessments following the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Fisheries' (Fletcher, 2015; Fletcher et al., 2002). Further information on the management of commercial fisheries in each jurisdiction is presented in the relevant sections below.

The information required to inform these risk assessment approaches is very limited for most marine mammal species in Australian waters, and it is common that data on the occurrence or abundance of these species, or their spatial or temporal overlap with the fishery being assessed is unavailable. Limited observer coverage in many fisheries also means that information on interactions with TEP is reliant on accurate self-reporting by fishers. In addition, as these risk assessments are fishery specific, the cumulative impacts of fishery interactions on TEP species cannot be assessed by this method.

1.3 Overview of marine mammals in Australia

A total of 56 marine mammal species have been recorded in Australian waters, including the external territories of the subantarctic islands and the Australian Antarctic Territory. All marine mammals are listed under the EPBC Act, and it is an offence to kill, injure, take, trade, keep, or move any member of a listed marine species without a permit. All pinnipeds found south of 60°S are protected under the *Antarctic Treaty (Environment Protection) Act 1980* (AT Act) through the *Convention for the Conservation of Antarctic Seals 1972* (CCAS). A total of 45 cetacean species, 10 pinniped species, and one sirenian, the dugong (*Dugong dugong*) have been recorded.

The EPBC Act is the primary environmental legislation in Australia. The key objectives of the act are to provide protection for the environment, conserve Australian biodiversity, and promote ecologically sustainable development, through the conservation and ecologically sustainable use of natural resources. It provides a legal framework for the protection and management of nationally and internationally important listed flora, fauna and ecological communities which are defined in the Act as Matters of National Environmental Significance (MNES). Once a species is listed under the EPBC Act it becomes a MNES, and conservation advice, recovery plans and assessments and approval provisions under the Act can be used to promote its recovery. Each state and Northern Territory government is responsible for managing marine mammals within their jurisdictions (i.e., coastal waters out to 3 nautical miles), and each government has its own legislation for listing and managing protected species. As a result, the threat listing for a marine mammal species (e.g., Endangered) can vary between jurisdictions. Information on species listing by jurisdiction is presented in the relevant sections below.

There are more than 150 indigenous Traditional Owner groups in Australia who have connection to Sea Country and have managed and used marine resources for millennia (Evans et al., 2017). In Northern Australia, the dugong is a cultural keystone species for many Traditional Owners who have the right to hunt dugongs in their sea country under the *Native Title Act 1993* (NT Act). This right is

not affected by the EPBC Act or State legislation. Within the Torres Strait, the harvest of dugongs is classified as a traditional fishery and within Australian waters is regulated by the Commonwealth *Torres Strait Fisheries Act 1984* (CTSF Act) and the Queensland *Torres Strait Fisheries Act 1984* (QTSF Act).

The Commonwealth waters off Australia have been divided into six marine regions, and Marine Regional Plans have been developed for four of these regions (Fig. 1). The aim of these plans is to improve understanding of the marine environment, including the conservation values within each region. These conservation values include lists of marine mammals that are known to occur in each region. Table 1 provides a list of marine mammals for each marine regions collated from published marine bioregional plans and the profile for the south-east marine region (COA, 2015a; DSEWPaC, 2012a, 2012b, 2012c, 2012d). For the Coral Sea marine region, the list of marine mammals is those known to occur in the Great Barrier Reef region (Lawler et al., 2007). Information on additional marine mammal species that have been recorded in State or Territory waters but are not included in Marine Regional Plans are presented in the relevant sections below.

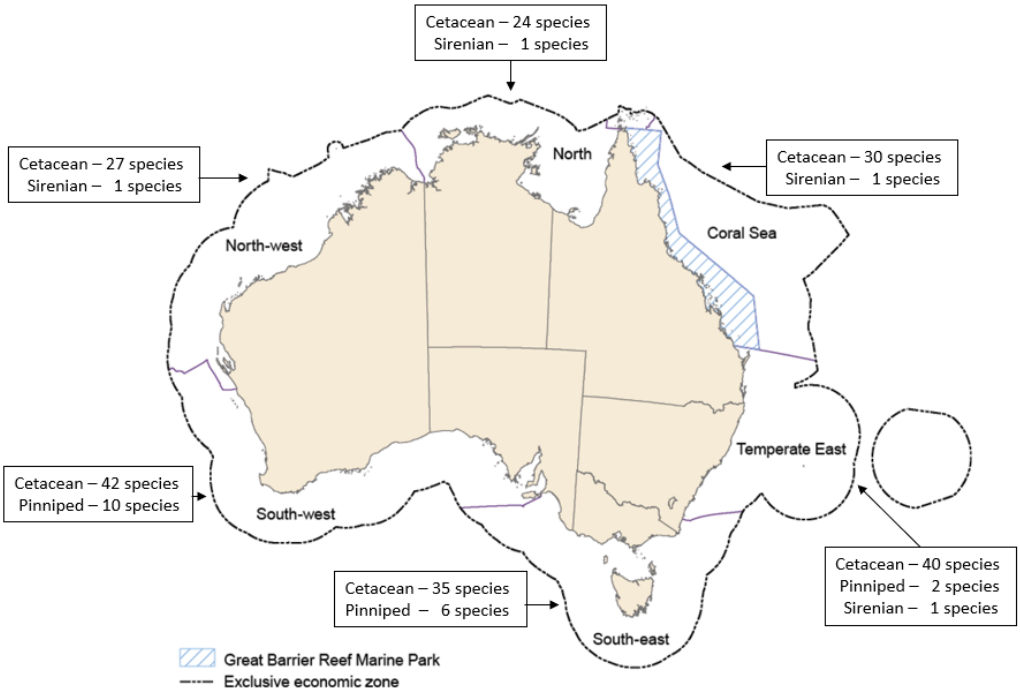


Figure 1: Map showing the Marine Bioregions of Australia and the number of marine mammal species of each order that is listed to occur in each region.

For most marine mammal species that have been recorded in Australian waters, there is limited data on their distribution. This is particularly the case for species that occur in offshore waters. Several marine mammal species are year-round residents in Australian continental waters. These are the endemic Australian sea lion (*Neophoca cinerea*), Australian fur seal (*Arctocephalus pusillus doriferus),* New Zealand fur seal (*Arctocephalus forsteri*), Australian snubfin dolphin (*Orcaella heinsohni*), Australian humpback dolphin (*Sousa sahulensis*), Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) common bottlenose dolphins (*T. truncatus*), and dugong. Populations of southern elephant seals (*Mirounga leonina*), Antarctic fur seals (*Arctocephalus gazella*) and sub- Antarctic fur seals (*Arctocephalus tropicalis*) breed in the Australian sub-Antarctic at Macquarie Island and Heard and McDonald Islands. Humpback whales (*Megaptera novaeangliae*), southern right whales (*Eubalaena australis*) and blue whales (*Balaenoptera musculus*) all undertake seasonal migrations to forage and /

or breed in Australian waters. Two subspecies of blue whales are seasonally present, the pygmy blue whale (*B. m. brevicauda*) and the Antarctic blue whale (*B. m. intermedia*), and are covered by

Four cetacean species and three pinniped species are currently listed as nationally threatened under the EPBC Ac. The blue whale, southern right whale, Australian sea lion and the sub-Antarctic fur seal are listed as Endangered, and the sei whale (*B. borealis*), fin whale (*B. physalus*) and southern elephant seal are listed as Vulnerable. There are currently four recovery plans or conservation management plans for marine mammal species under the EPBC Act. These are the 'Recovery Plan for the Australian sea lion', 'The sub-Antarctic fur seal and southern elephant seal recovery plan', 'Conservation Management Plan for the Southern Right Whale' and the 'Conservation Management Plan for the Blue Whale' and (COA, 2015b; DSEWPaC, 2013, 2012e). The 'Conservation Management Plan for the Blue Whale, Commonwealth of Australia 2015' (COA, 2015b), proposes the occurrence of three overlapping 'populations'; the Antarctic blue whale Indo-Australian pygmy blue whale and the Tasman-Pacific pygmy blue whale.

Table 1: Marine mammal species listed in the Marine Bioregional Plans or Profiles for the six marine bioregions off the Australian continent.

Common name	Species name	EPBC Act status	NW	N	SW	SE	TE	CS
Dwarf minke whale	*Balaenoptera acutorostrata subsp.*	Cetacean						
Antarctic minke whale	*Balaenoptera bonaerensis*	Migratory, cetacean						
Sei whale	*Balaenoptera borealis*	Vulnerable, migratory, cetacean						
Bryde's whale	*Balaenoptera edeni*	Migratory, cetacean						
Blue whale and pygmy blue whale	*Balaenoptera musculus and B. m. brevicauda*	Endangered, migratory, cetacean						
Omura's whale	*Balaenoptera omurai*	Cetacean						
Fin whale	*Balaenoptera physalus*	Vulnerable, migratory, cetacean						
Pygmy right whale	*Caperea marginata*	Migratory, cetacean						
Southern right whale	*Eubalaena australis*	Endangered, migratory, cetacean						
Humpback whale	*Megaptera novaeangliae*	Migratory, cetacean						
Common dolphin	*Delphinus delphis*	Cetacean						
Pygmy killer whale	*Feresa attenuata*	Cetacean						
Short-finned pilot whale	*Globicephala macrorhynchus*	Cetacean						
Long-finned pilot whale	*Globicephala melas*	Cetacean						
Risso's dolphin	*Grampus griseus*	Cetacean						
Southern bottlenose whale	*Hyperoodon planifrons*	Cetacean						
Pygmy sperm whale	*Kogia breviceps*	Cetacean						
Dwarf sperm whale	*Kogia simus*	Cetacean						
Fraser's dolphin	*Lagenodelphis hosei*	Migratory, cetacean						
Hourglass Dolphin	*Lagenorhynchus cruciger*	Cetacean						
Dusky dolphin	*Lagenorhynchus obscurus*	Migratory, cetacean						
Southern right whale dolphin	*Lissodelphis peronii*	Cetacean						
Australian snubfin dolphin	*Orcaella heinsohni*	Migratory, cetacean						
Killer whale, orca	*Orcinus orca*	Migratory, cetacean						
Melon-headed whale	*Peponocephala electra*	Cetacean						
Spectacled porpoise	*Phocoena dioptrica*	Migratory, cetacean						
Sperm whale	*Physeter macrocephalus*	Migratory, cetacean						
False killer whale	*Pseudorca crassidens*	Cetacean						
Indo-Pacific humpback dolphin	*Sousa sahulensis*	Migratory, cetacean						

Common name	Species name	EPBC Act status	NW	N	SW	SE	TE	CS
Pantropical spotted dolphin	*Stenella attenuata*	Migratory, cetacean						

Striped dolphin	*Stenella coeruleoalba*	Cetacean							
Long-snouted spinner dolphin	*Stenella longirostris*	Cetacean							
Rough-toothed dolphin	*Steno bredanensis*	Cetacean							
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	Cetacean							
Bottlenose dolphin	*Tursiops truncatus*	Cetacean							
Arnoux's beaked whale	*Berardius arnuxii*	Cetacean							
Andrew's beaked whale	*Mesoplodon bowdoini*	Cetacean							
Blainville's beaked whale	*Mesoplodon densirostris*	Cetacean							
Gingko-toothed beaked whale,	*Mesoplodon ginkgodens*	Cetacean							
Gray's beaked whale	*Mesoplodon grayi*	Cetacean							
Hector's beaked whale	*Mesoplodon hectori*	Cetacean							
Strap-toothed beaked whale	*Mesoplodon layardii*	Cetacean							
True's beaked whale	*Mesoplodon mirus*	Cetacean							
Longman's beaked whale	*Mesoplodon pacificus*	Cetacean							
Shepherd's beaked whale, Tasman beaked whale	*Tasmacetus shepherdi*	Cetacean							
Cuvier's beaked whale	*Ziphius cavirostris*	Cetacean							
New Zealand fur seal	*Arctocephalus forsteri*	Marine							
Antarctic fur seal	*Arctocephalus gazella*	Marine							
Australian fur seal	*Arctocephalus pusillus*	Marine							
Sub-Antarctic fur seal	*Arctocephalus tropicalis*	Endangered, marine							
Leopard seal	*Hydrurga leptonyx*	Marine							
Weddell seal	*Leptonychotes weddelli*	Marine							
Crab-eater seal	*Lobodon carcinophagus*	Marine							
Southern elephant seal	*Mirounga leonina*	Vulnerable, marine							
Australian sea lion	*Neophoca cinerea*	Endangered, marine							
Ross seal	*Ommatophoca rossi*	Marine							
Dugong	*Dugong dugon*	Marine, migratory							

2 Summary of marine mammal interactions with Commonwealth fisheries

The following section summarises available information on marine mammal interactions with each of the 15 Commonwealth managed fisheries, or fishery sectors, that are seeking export approval under the import provisions of the US MMPA. This information includes observer data and fishery-dependent logbook data provided by the AFMA, and published fishery reports. Reports and / or observations of marine mammal interactions in Australian commercial fisheries that are not seeking export approval are also synthesised as this information is required as part of the comparability finding process.

The AFMA definition of an interaction is 'any physical contact a person, boat or gear has with a protected species including catching and colliding with any of these species'. Records of interactions in fishery logbooks include information on the species involved, the time, location and nature of the interaction, and the 'fate' of the individual(s). Additional information recorded by onboard observers include, where possible, the age and sex of the individual. To synthesise these data, all 'fates' recorded as injured, unknown, or dead were grouped together. For all fishery logbook reports where an observer was present, if the species had not been recorded, e.g., the fisher had written 'seal', this species was updated to match the observer record. Where observer data were provided, observed and fishery logbook reported interaction rates were calculated. To make interaction rates more readily comparable between different gear types, the unit of effort for all fisheries is a single fishing operation, hereafter referred to as a shot. More detailed information on each fishery, or fishing sector, including effort, observer coverage and a summary of all marine mammal interactions by fishery subsector, are provided in the relevant sections below. To meet the information requirements of the MMPA import provisions, a data table summarising marine mammal interactions for the last five years in Commonwealth managed fisheries (2016-2020) is provided in Appendix A.

No marine mammal interactions were reported between 2010 and 2020 six of the 15 Commonwealth managed fisheries, or fishery sectors, seeking export approval under the MMPA: the Torres Strait Prawn Fishery (TSPF), Southern Bluefin Tuna Fishery (BTF), the purse seine sector of the Small Pelagic Fishery (SPF), and the East Coast Deepwater Trawl Sector (ECDTS) and Great Australian Bight Trawl Sector (GABTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF) between 2010 and 2020. These fisheries had varying levels of observer coverage over this period. No marine mammal interactions were recorded in the Macquarie Island Toothfish Fishery (MITF) or the demersal trawl sector of the Heard Island or McDonald Island Fishery (HIMI), between 2012 and 2020, the period for which logbook data were provided. Both fisheries had 100% observer coverage during this period.

Nine Commonwealth managed fisheries or fishery sectors that are seeking export approval reported interactions with marine mammals between 2010 and (Table 2). Over this period 303 marine mammal interactions, resulting in 136 mortalities, were recorded (Table 2). Detailed summaries of these interactions are provided in each fishery sub-section below. More than half (58%) of the interactions were with pinnipeds. Of these, 44% of individuals were reported as Australian fur seals, 33% were reported as southern elephant seals, and 16% were reported as 'seals' not identified to species. The majority of reported interactions with Australian fur seals were with the BGTS of the SESSF (61 interactions resulting in 51 mortalities), which has 100% observer coverage and mandatory use of seal excluder devices (SEDs). Australian fur seal interactions were also recorded in

the orange roughy and Autolongline sectors of the SESSF and the Eastern Tuna and Billfish Fishery (ETBF) and the Western Tuna and Billfish Fishery (WTBF). All interactions with southern elephant seals (45 interactions resulting in 40 mortalities) were recorded in the demersal longline sector of the HIMI, which has 100% observer coverage. Where the species was identified, New Zealand fur seals were the next most frequently recorded pinniped, with most interactions (11 interactions and 7 mortalities) reported in the BGTS of the SESSF. A total of 28 interactions and 12 mortalities with 'seals' not identified to species were reported from six fisheries or fishery subsector. Half of these mortalities were reported in the demersal longline sector of the HIMI, with three mortalities reported in both the BGTS and Autolongline sectors of the SESSF.

Between 2010 and 2020, 125 interactions with cetaceans resulting in 15 mortalities were reported in six Commonwealth managed fisheries seeking export approval (Table 2). The majority of interactions (90%) and mortalities (87%) were reported in the ETBF. The ETBF has had mandatory Electronic Monitoring (EM) since 2015, with at least 10% of all shots reviewed to verify logbook accuracy, and all logbook reports of protected species interactions audited. Of the 113 individual cetaceans reported to interact with the fishery, most were short-finned pilot whales (27%), 'dolphins' not identified to species (24%) and common dolphins (10%). The majority of cetaceans (88%) that interacted with the fishery were released alive. The ETBF also reported the only interaction with a dugong recorded in any of the Commonwealth fisheries or fishery sectors seeking export approval. The reported interaction is surprising given it occurred in deep water outside the known distribution of the species. The report was validated by EM. The WTBF reported eight interactions with cetaceans between 2010 and 2020, resulting in one mortality of a long-finned pilot whale. This fishery has had mandatory EM since 2015, with at least 10% of all shots reviewed to verify logbook accuracy, and all logbook reports of protected species interactions audited. The post-release survival rates of marine mammals interacting with longline gear is unknown and will depend on the nature of the interaction.

Four fisheries, or fishery sectors reported non-lethal interactions with cetaceans between 2010 and 2020 (Table 2). These were one 'dolphin' in the Northern Prawn Fishery, one minke whale in the Coral Sea Fishery, and two killer whales in the Manual hook sector of the SESSF. An interaction with a killer whale, resulting in a mortality, was reported in the Autolongline sector of the SESSF in 2016. EM is mandatory for all boats using automatic baited demersal longline gear in the SESSF, and for all boats in the Manual hook sector of the SESSF that fish more than 100 days per fishing season (01 May – 30 April).

Interactions with marine mammals have also been reported in fishery logbooks in four Commonwealth managed fisheries or fishery sectors that are not seeking export approval under the United States Marine Mammal Protection Act. These are the otter-board trawl gear and Danish-seine gear sectors of the Commonwealth Trawl Sector (CTS) of the SESSF, the gillnet sector of the SESSF and the mid-water trawl gear sector of the SPF.

Between 2010 and 2020, 1,636 pinniped interactions, and 33 cetacean interactions were reported with otter-board trawl gear in the CTS, and 221 pinniped interactions and one cetacean interaction were reported in the Danish-seine gear in the CTS. The gillnet sector of the SESSF reported 296 pinniped interactions and 372 cetacean interactions over this period, and 130 pinniped interactions and 42 cetacean interactions were reported in the mid-water trawl sector of the Small Pelagic Fishery. Further details of interactions, observer coverage and strategies to mitigate marine mammal bycatch in these sectors are provided in the relevant sections below.

Table 2: Total number of individual marine mammal interactions of marine mammal species that were observed and / or reported in fishery logbooks between 2010 and 2020 in Commonwealth Managed Fisheries seeking a comparability finding under the import provisions of the United States Marine Mammal Protection Act.

Common Name or logbook recorded ID (in quotation marks)	Total individuals (Reported)	Northern Prawn Fishery	Coral Sea Fishery	Eastern Tuna and Billfish Fishery	Western Tuna and Billfish Fishery	SESSF Blue Grenadier Trawl Sector	SESSF - orange roughy trawl	SESSF – Automatic longline sector	SESSF – manually baited hook sector	Heard Island and McDonald Islands Fishery
Australian sea lion	7				LB				LB	
Antarctic fur seal	1 (1)									LB, O
Australian fur seal	71 (53)			O, LB	O, LB	O, LB	O, LB	LB		
New Zealand fur seal	23 (13)			LB	LB	O, LB		LB	LB	
Crabeater seal	2 (2)									LB, O
Southern elephant seal	45 (40)									LB, O
Bottlenose dolphin sp.	3 (1)			LB						
Common dolphin	11 (2)			O, LB						
Killer whale	3 (1)							LB	LB	
False killer whale	9 (0)			LB	LB					
Melon-headed whale	8 (2)			LB						
Long-finned pilot whale	8 (1)			O, LB	LB					
Short-finned pilot whale	34 (3)			O, LB	LB					
Cuvier's beaked whale	1 (0)				LB					
Humpback whale	2 (0)			LB						
Minke whale	1 (0)		LB, O							
Dugong	1 (0)			LB						
"Seals"	28 (12)			LB	LB	LB		LB	LB	
"Dolphins"	28 (3)	LB		LB						
"Toothed whales"	2 (0)			LB						
"Whales (mixed)"	14 (2)			LB	LB					
"Baleen whales"	1 (0)			LB						

2.1 Northern Prawn Fishery

The NPF targets a number of tropical prawn species, including white banana prawn (*Penaeus merguiensis*) and tiger prawn (*P. esculentus*) using twin or quad-rigged bottom otter trawls. The fishery operates between Cape Londonderry in Western Australia to Cape Yorke in Queensland, from the high-water mark out to the limits of the Exclusive Economic Zone (EEZ). Most effort is undertaken along the coast of the Gulf of Carpentaria (Fig. 2). In Western Australian, Northern Territory and Queensland state waters, the fishery is managed by the AFMA under an Offshore Constitutional Settlement. There are currently 52 vessels active in the fishery with an annual total effort of around 8,000 days (Parsa et al., 2020). The banana prawn season runs from 1 April to 15 June and the tiger prawn season runs from 1 August to 30 November. The NPF has export approval under the EPBC Act until January 2024, with a key condition that the AMFA facilitate research to improve information on interactions and develop decision rules to minimise bycatch of sea snakes and sawfish. Interactions with these two species groups has been identified as the main priority to be addressed under the NFP Bycatch Strategy 2020-2024. The NFP was first certified by the Marine Stewardship Council (MSC) in 2012 and recertified in 2018.

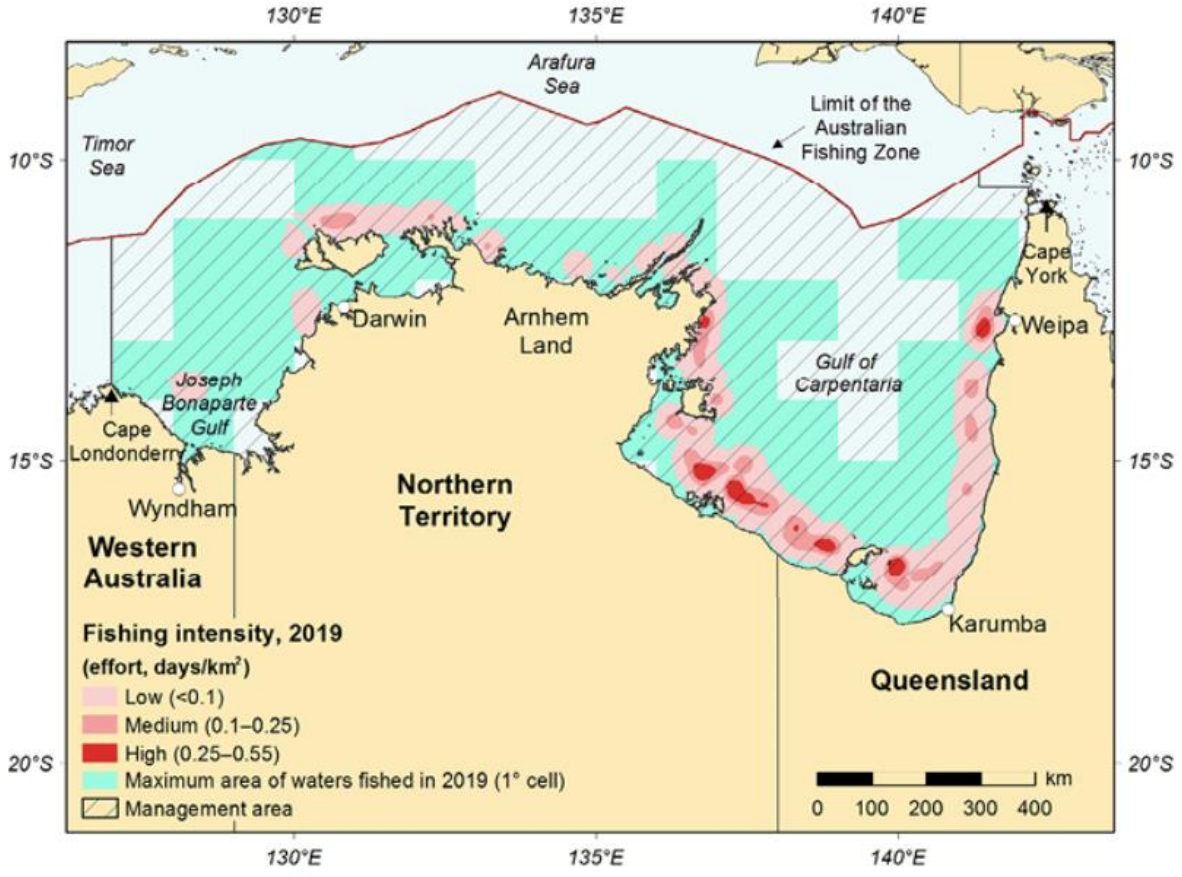


Figure 2: Area of the Northern Prawn Fishery, and fishing effort in in 2019. All trawl nets in the NFP must be fitted with approved Turtle Excluder Devices (TED) and Bycatch Reduction Devices (BRD), and there is an ongoing gear monitoring program in the fishery that collects vessel level information on TED and BRD configurations. A study in the fishery in 2001, found a 99% reduction in turtle bycatch, and a 17.7% and 36.3% in shark and ray bycatch, respectively, in nets where a combination of TED and BRD were used (Brewer et al., 2006). No interactions with marine mammals were recorded in the 3,224 tows observed during the study.

Between 2006 and 2015, six interactions with dolphins, not recorded to species, were reported in fishery logbooks in the NPF (Banks et al., 2017; Tuck et al., 2013). The fate of three dolphins, each a single interaction recorded in 2006, 2007 and 2009, was not available (Tuck et al., 2013). Two mortalities were reported in 2012, and one dolphin was recorded as alive in 2013 (Banks et al., 2017). The interaction with the dolphin that was released alive in 2013 occurred in the Joseph Bonaparte Gulf region, and was the only dolphin interaction recorded by Crew Member Observers (CMO) in the fishery between 2002 and 2016 (Fry et al., 2018). Between 2016 and 2020, one dolphin interaction, not recorded to species was reported in a fishery logbook (Table 3). Over this period, independent observer coverage in the NFP ranged from 1.5% to 3.4% of fishing effort, and CMO coverage ranged from 11.3% to 15.8% of fishing effort (Table 3). A performance indicator of the most recent bycatch strategy for the fishery is that CMO coverage is a minimum of 12% of fishing effort, and that a minimum of 85% of bycaught individuals are photographed to allow species identification (AFMA, 2020a).

Table 3: Independent observer coverage, Crew Member Observer coverage and logbook and observed marine mammal interactions in the Northern Prawn Fishery between 2016 and 2020.

Year	Effort (days)	% Observer coverage	% Crew Member Observer coverage	Logbook reported marine mammal interactions	Observed marine mammal interactions
2016	8,880	1.5%	11.3%	0	0
2017	7,418	2.4%	15.8%	0	0
2018	7,988	1.9%	15.7%	1 dolphin injury	0
2019	8,093	3.4%	12.7%	0	0
2020	7,230	1.8%	14.2%	0	0

A PSA was undertaken for 22 cetacean species and the dugong during an ERA of the fishery in 2007 (Griffiths et al., 2007). After Level 2 PSA, 21 cetacean species were assessed to be at medium risk from the fishery, while the common dolphin (*Delphinus delphis*) was assessed to be at low risk (AFMA, 2008). Although species of the seven dolphin interactions in the NPF were not reported, it is likely that the species involved may have been one, or more, of those that are known to forage in association with prawn trawl gear. Common bottlenose dolphins have been recorded to follow trawlers and feed off discards in the Torres Strait Prawn Fishery (Hill and Wassenberg, 1990), while Indo-Pacific bottlenose dolphins and the Australian humpback dolphin have been observed foraging in association with prawn trawls in other regions of Australia (Cagnazzi, 2010; Chilvers et al., 2003; Parra, 2006).

Abundance estimates for cetaceans in the area of the fishery are restricted to a 10 km coastal strip of Northern Territory state waters. These estimates are 6,058 (± 1,011) Australian snubfin dolphin, 1,753 (± 438) Australian humpback dolphin, and 2,594 (±1,647) bottlenose dolphins (*T. truncatus* and / or *T. aduncus*) (Palmer et al., 2017b). There are no estimates of abundance for cetacean species that occur in Commonwealth waters where the fishery operates. The NPF also overlaps with the distribution of dugongs in the region. The most recent population estimate of dugongs from an aerial survey of over 20,547km^2 of the Gulf of Carpentaria was 5,783 (±767) in 2014 (Groom et al., 2015).

2.2 Torres Strait Prawn Fishery

The TSPF is a multi-species fishery that targets prawns using quad-rigged bottom otter trawl gear. The key species are brown tiger prawn (*P. esculentus*) and blue endeavour prawn (*Metapenaeus endeavouri*). The fishery operates in the eastern region of the Torres Strait Protected Zone (TSPZ) and in Queensland waters between 1 March and 1 December each year (Fig. 3). Fisheries within the TSPZ are shared by Australia and Papua New Guinea (PNG), with the Torres Strait Protected Zone Joint Authority responsible for managing fisheries that operates in Australia's area of the TSPZ. There is a limit of 61 Australian fishing boat licences in the fishery, with 8-20 boats active in the fishery in recent years (AFMA, 2016). The TSPF has export approval under the EPBC Act until October 2026.

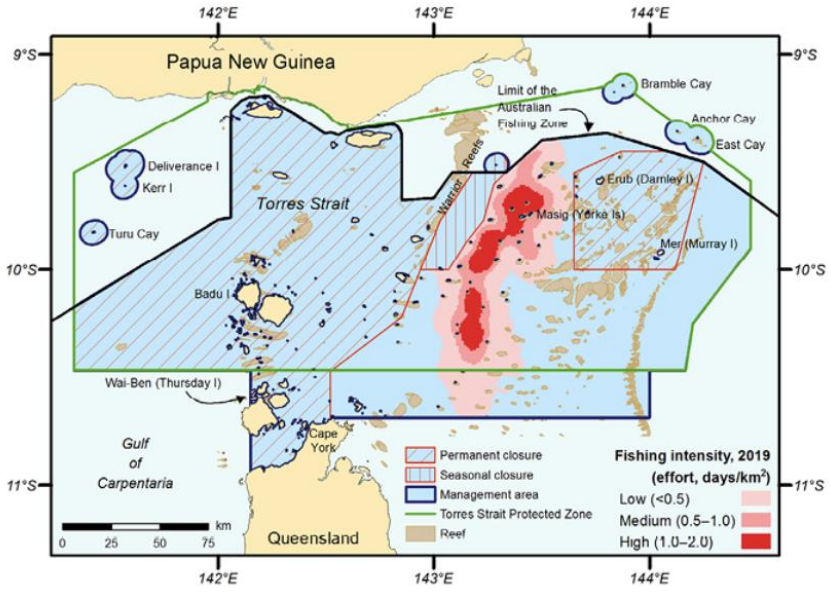


Figure 3: Area of the Torres Strait Prawn Fishery and fishing effort in 2019. The use of TEDs has been mandatory in the fishery since 2002, with BRDs becoming mandatory in 2004. Since 2008, a number of permanent spatial closures have been in place within the TSPZ to protect important green turtle (*Chelonia mydas*) and flatback turtle (*Natator depressus*) nesting areas (Butler and Steven, 2020).

No interactions with dolphins or other marine mammals were reported in fishery logbooks or recorded by observers between 2005 and 2020 (Turnbull and Cocking, 2020). An assessment of the environmental sustainability of the fishery found that the core distribution of dugongs, and the seagrass beds they feed on in the Torres Strait, were not exposed to trawl effort. Table 4 summarises fishing effort, observer coverage and logbook reported and observed interactions with marine mammals and the TSPF between 2016 and 2020.

Common bottlenose dolphins (*Tursiops truncatus*) have been recorded to follow trawlers in the fishery and scavenge discarded catch (Hill and Wassenberg, 1990). However, when scientific trawls were undertaken in an area closed to trawling no dolphins were seen. Feeding associations between bottlenose dolphin species and prawn trawl nets have been shown in a number of fisheries (Broadhurst, 1998; Chilvers and Corkeron, 2001). There are no estimates of abundance for bottlenose dolphins in the area where the fishery operates, or information on the occurrence or abundance of other cetacean species. Estimates of abundance for dugongs are available from the western area of the TSPZ which is permanently closed to trawling.

Table 4: Fishing effort, observer coverage and logbook and observed marine mammal interactions in the Torres Strait Prawn Fishery between 2016 and 2020.

Year	Effort (no. of days)	Observer coverage (% days)	Logbook reported marine mammal interactions	Observed marine mammal interactions
2016	2,327	2.8%	0	0
2017	935	3.7%	0	0
2018	2,078	1.9%	0	0
2019	2,627	1.9%	0	0
2020	1,034	5%	0	0

2.3 Coral Sea Fishery

The CSF is a multi-gear fishery that uses demersal line, dropline, trotline, and hand collection methods to target a wide variety of species. There are four sectors within the fishery: Lobster and Trochus Sector, Line and Trap Sector, Aquarium Sector and Sea Cucumber Sector. The fishery extends along the coast of Queensland from Sandy Cape to Cape York, and out to the extent of the Australian Fishing Zone (Fig. 4) (Emery et al., 2020). The use of trawl and trap gear ceased in the fishery in mid-2019 (AFMA, 2020b). The Coral Sea Marine Park occurs within the area of the fishery, and gear restrictions are in place in different zones of the park. The CSF has export approval under the EPBC Act until January 2024.

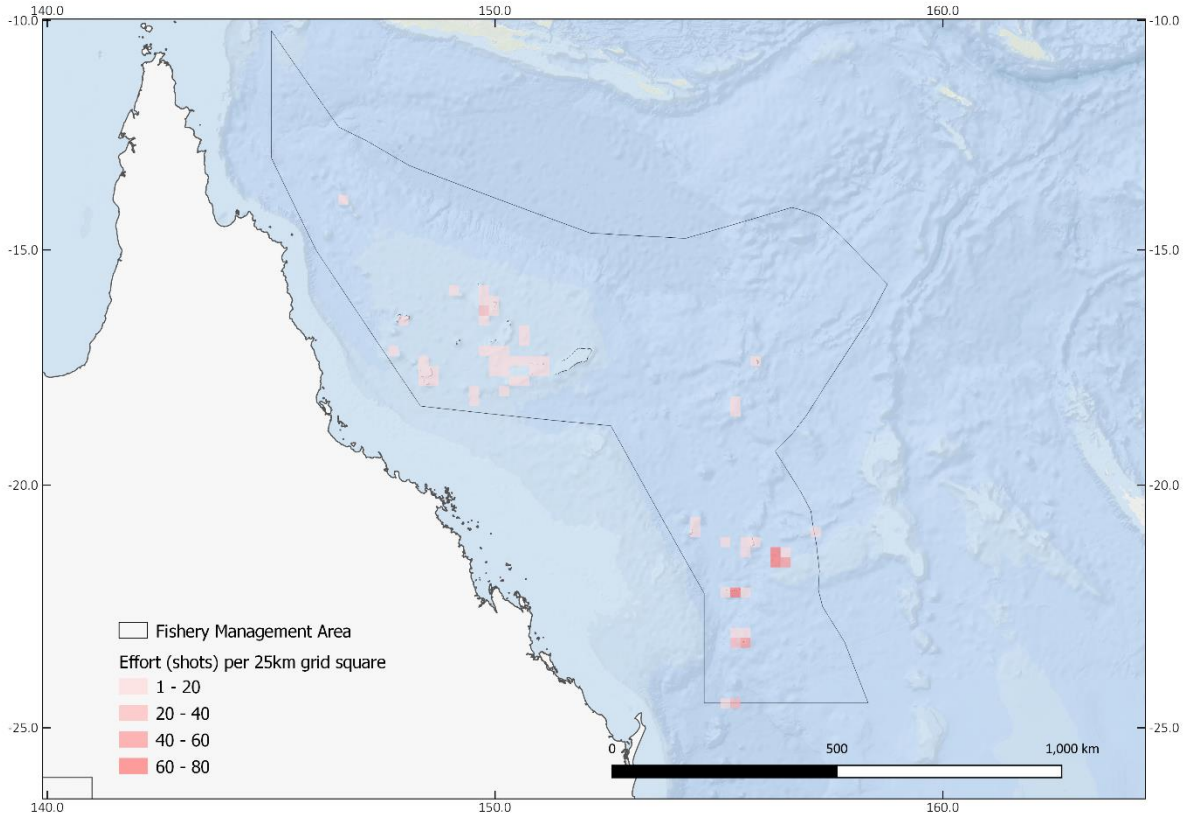


Figure 4: Distribution of fishing effort (2010-2020) in the Coral Sea Fishery

A minimum of 10 per cent observer coverage is required under the *Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (2018)*. Observer coverage, by fishery sector, between 2017-18 and 2019-20 is presented in Table 5. In 2017, a minke whale was released alive after becoming entangled in a demersal longline operation. This is the only report of an interaction with a marine mammal in the Coral Sea Fishery. Dwarf minke whales are

seasonally present along the east coast of Queensland, aggregating in the northern Great Barrier Reef each year between April and September. The estimated abundance of individuals aggregating in in this area in 2008, was 789 (SE ± 216) individuals (Sobtzick 2010 cited in (Curnock et al., 2019).

Table 5 Observer coverage in the Coral Sea Fishery, by fishing sector, between 2017-18 and 2019-20.

Year		Gear types	Fishing days	Observed days	Observer coverage (% of fishing days)
2017-18	Hand collection	Hookah diving	5	0	0%
	Line	Dropline	25	0	0%
		Handline (mechanised)	56	0	0%
		Rod and reel	13	0	0%
		Set demersal autolongline	47	15	32%
2018-19	Trawl	Bottom otter trawl	3	3	100%
	Line	Dropline	12	0	0%
		Handline (mechanised)	41	0	0%
		Set demersal autolongline	35	18	51%
2019-20	Hand collection	Hookah diving	14	0	0%
	Line	Dropline	2	0	0%
		Set demersal autolongline	27	7	26%

2.4 Eastern Tuna and Billfish Fishery

The ETBF operates from Cape York in Queensland to the Victoria – South Australia border, including Tasmania, out to the limits of the EEZ and the adjacent high seas (Fig. 5). The predominant gear used is pelagic longlines, with a small amount of effort using minor line methods (trolling, rod and reel, handline). Since the 1st of July 2015, EM has been mandatory on all full-time pelagic longline vessels in the ETBF, and at least 10% of all shots are reviewed per fishing season to verify logbook accuracy. There are additional requirements to monitor the deployment of seabird bycatch mitigation devices. Effort in the fishery has been around eight million hooks in recent years, with 37 vessels operating in the fishery in 2019 (Larcombe et al., 2020). The ETBF has export approval under the EPBC Act until August 2022.

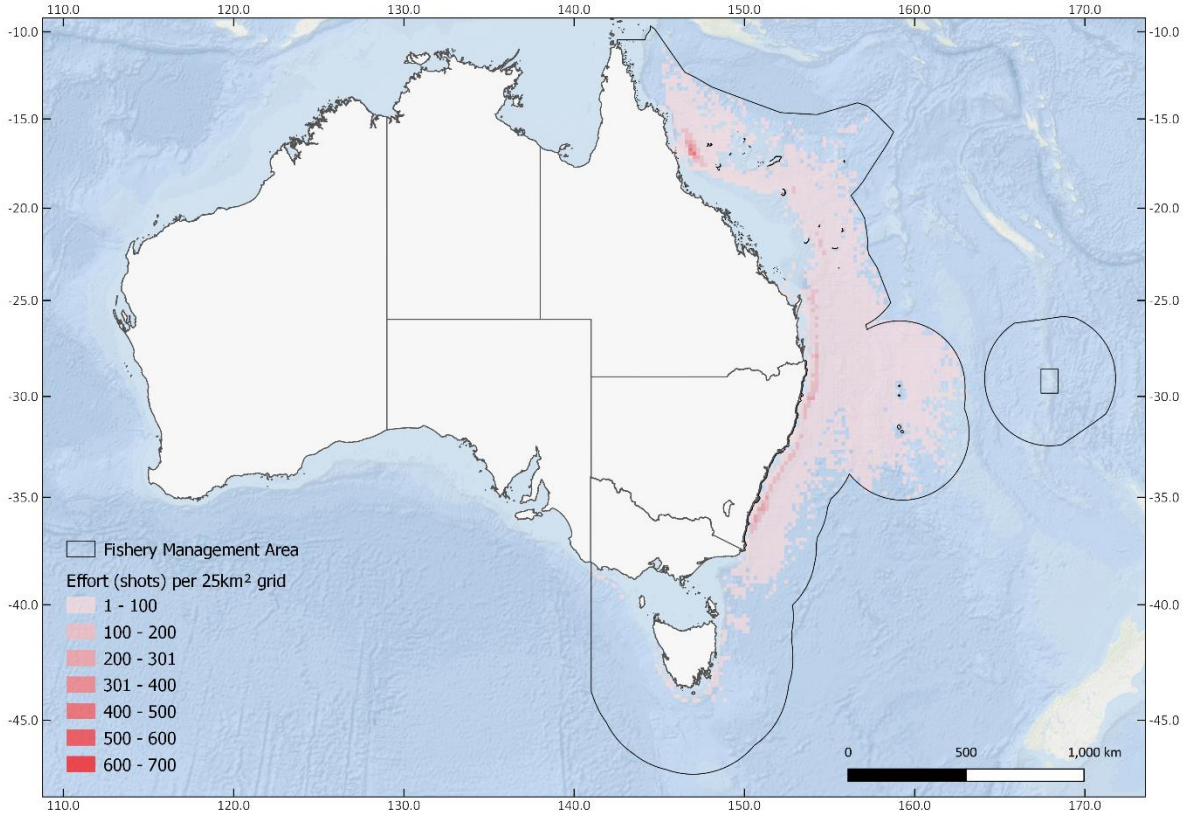


Figure 5: Distribution of fishing effort (2010-2020) in the Eastern Tuna and Billfish Fishery

During the most recent ERA, a PSA was undertaken for 43 cetacean and three seal species. After residual risk analysis, the risk posed by the fishery to these species was considered low or medium (Sporcic et al., 2019).

Current protected species bycatch mitigation measures in the fishery include the use of circle hooks, Tori lines, and line weighting regimes. Guidance is provided to industry on best practice for handling and releasing protected species, and vessels must carry dehookers and line cutters to assist in freeing entangled or hooked individuals. The ETBF is investigating the use of acoustic pingers to mitigate interactions with depredating toothed whales in the fishery (AFMA, 2019a). In order to improve logbook verification and species identification through EM, future actions listed in the Fishery Management Strategy are for AMFA to review camera angles on vessels, and conditions that will improve the identification of species that are cut off / disentangled in the water (AFMA, 2019a).

Since 2010, nine species of marine mammals (two pinniped, seven cetacean) have been reported as interacting in the fishery (Table 6, 7, Fig. 6, Fig. 7), with most interactions involving individuals that are released alive. A total of 113 interactions with cetaceans were reported with the fishery resulting in 13 mortalities. Of these, 28% were identified as short-finned pilot whales (*Globicephala macrorhynchus*), 24% as 'dolphins', and 12% as 'whales mixed' (Table 6). Seven of these interactions occurred when an observer was onboard. These were four short-finned pilot whales, one long-finned pilot whale (*G. melas*), and two common dolphins. All individuals were released alive. The 13 cetacean mortalities reported in fishery logbooks were three short-finned pilot whales, two melon-headed whales (*Peponocephala electra*), two 'whales mixed', two common dolphins and one bottlenose dolphin. There are no abundance estimates in the area of the fishery for any of the cetacean species that have been observed or reported to interact with the fishery.

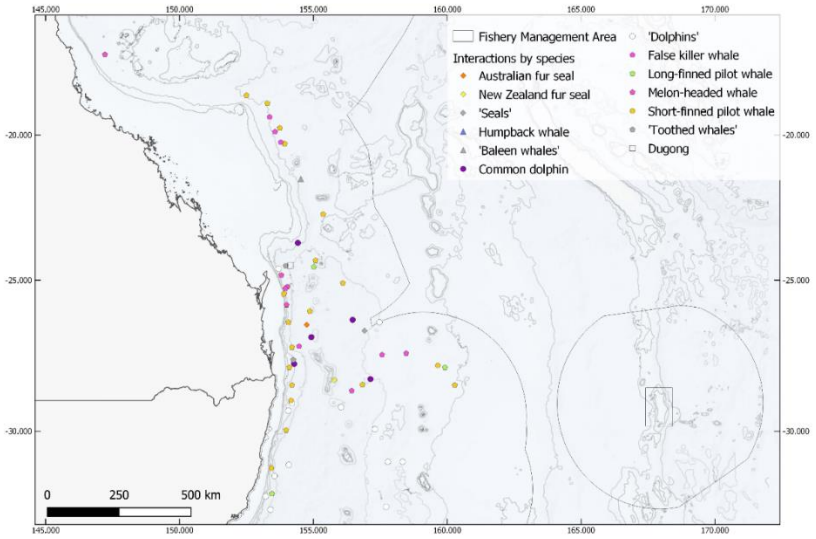


Figure 6: Location of all interactions with marine mammals in the northern region of the Eastern Tuna and Billfish Fishery between 2010 and 2020

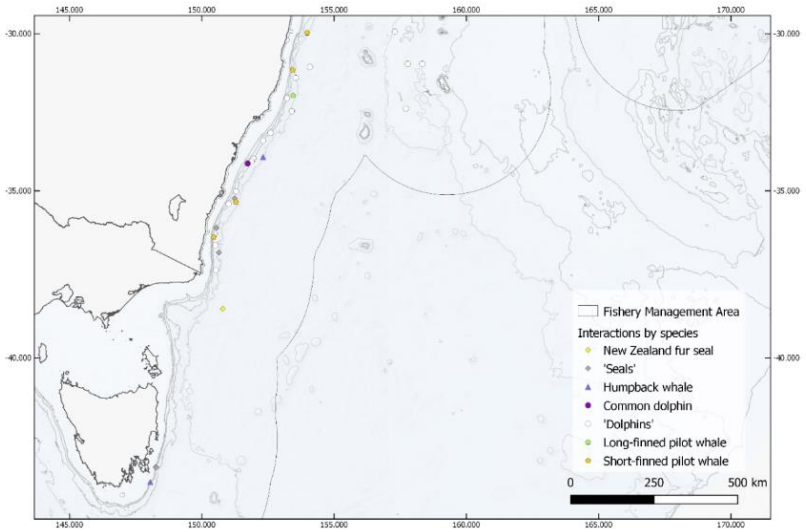


Figure 7: Location of all interaction with marine mammals in the southern region Eastern Tuna and Billfish Fishery between 2010 and 2020

Of the 15 pinniped interactions reported in fishery logbooks, 13 were released alive (three Australian fur seals, three New Zealand fur seals and nine unidentified seals), and two mortalities, both New Zealand fur seals, were reported (Table 7). An observer was onboard for one pinniped interaction, and the species was recorded as an Australian fur seal. The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals respectively (Appendix B).

An analysis of logbook reported interactions with protected species found a significant increase in interaction rates reported in the first two years of EM in the fishery, compared to the previous six years of fishery logbook data (Emery et al., 2019a). Since the implementation of EM in the fishery the average annual interaction rate with cetaceans reported in logbooks is 0.004 between 2016 and 2020, which is four times higher than the logbook reported rate between 2010 and 2015 (0.001) (Table 6). Post-release survival of marine mammals after interactions with longline gear will be dependent on the nature of the interactions. Serious injury can occur if individuals ingest or retain hooks, and severe injuries may occur from entanglement in branchlines under pressure. Almost half (42%) of the interactions with cetaceans since 2016 were not recorded to species level. The logbook report of an interaction with a dugong in 2017 was validated by EM. This is a surprising interaction as the reported event occurred in deep-water and outside the range of the species which typically forages on seagrass in shallow habitats. Although all interactions with protected species are reviewed by EM analysts, validation of species identification is not reported with publicly available summaries of logbook reports. An analysis of the level of congruence between two years of fishery logbook data and EM analyst data from the ETBF found that a greater number of interactions with protected species were reported in logbooks (Emery et al., 2019b). Confidence in species identification is required to determine the impacts of interactions. Four species which have been reported in logbooks but not recorded by observers prior to the implementation of EM in the fishery are false killer whales (*Pseudorca crassidens*), melon-headed whales, humpback whales and bottlenose dolphins.

Table 6: Effort, observer coverage, and cetacean interactions reported in the Eastern Tuna and Billfish Fishery (2010 – 2020).

Year	Number of shots	Observer/ EM* audit coverage (% shots)	'Baleen whales'	'Toothed whales'	'Whales mixed'	Unidentified dolphins	Bottlenose dolphin sp.	Common Dolphin	False Killer Whale	Humpback Whale	Long-finned Pilot Whale	Melon-headed Whale	Short-finned Pilot Whale	Logbook Interaction Rate (cetacean / shot)	Observer Interaction Rate (cetacean / shot)
2010	5,812	3.8%	0	0	2 (2)	0	0	0	0	0	0	1(1)	4	0.001	0.014
2011	5,016	6.1%	0	0	0	0	0	0	0	0	1	0	1	0	0.003
2012	4,715	6.0%	0	0	0	0	0	0	0	0	0	0	0	-	-
2013	4,593	6.3%	0	0	0	0	0	2	0	0	0	0	0	0	0.007
2014	4,637	2.9%	0	0	0	0	0	0	0	0	0	0	1	0	0.008
2015	5,326	2.4%	1	0	2	0	0	3	0	0	0	1	3	0.002	-
2016	4,973	8.8%*	0	2	1	3	0	0	0	0	1	0	5	0.002	-
2017	5,286	10.1%*	0	0	5	9	1(1)	0	1	1	4	4(1)	6(1)	0.006	-
2018	4,538	11.3%*	0	0	0	4(1)	0	0	0	1	1	0	7(2)	0.003	-
2019	4,796	11.6%*	0	0	1	7(2)	1	3 (1)	4	0	0	0	3	0.004	-
2020†	3,827	10.1*	0	0	2	4	1	3 (1)	3	0	0	2	1	0.004	-
† Data to November 2020			1	2	13 (2)	27(3)	3(1)	11 (2)	8 (0)	2 (0)	7 (0)	8 (2)	31 (3)		

Table 7: Effort, observer coverage, and pinniped interactions reported in the Eastern Tuna and Billfish Fishery (2010 – 2020).

Year	Number of shots	Observer/ EM* audit coverage (% shots)	Unidentified seals	Australian Fur Seal	New Zealand Fur Seal	Logbook Interaction Rate (pinniped / shot)	Observer Interaction Rate (pinniped/ shot)
2010	5,812	3.8%	0	0	0	-	-
2011	5,016	6.1%	0	0	0	-	-
2012	4,715	6.0%	0	0	0	-	-
2013	4,593	6.3%	0	2	1(1)	0.0004	0.00692
2014	4,637	2.9%	0	0	0	-	-
2015	5,326	2.4%	0	0	0	-	-
2016	4,973	8.8%*	1	1	0	0.0004	-
2017	5,286	10.1%*	2	0	0	0.0004	-
2018	4,538	11.3%*	5	0	0	0.0011	-
2019	4,796	11.6%*	1	0	0	0.0002	-
2020†	3,827	10.1*	0	0	1(1)	-	-
† Data to November 2020			9	3	2 (2)		

2.5 Western Tuna and Billfish Fishery

The WTBF operates from Cape York, Queensland, westwards around Australia to the South Australia – Victoria border, out to the limits of the EEZ including the waters around the Cocos (Keeling) Islands and Christmas Island, and a high seas zone in the Indian Ocean. (Fig. 8).

Fishing effort in recent years has predominantly been off the south-west of Western Australia (Williams et al., 2020). The fishery uses pelagic longlines to target several species including broadbill swordfish (*Xiphias gladius*), bigeye (*Thunnus obesus*) and yellowfin tuna (*T. albacares*), and striped marlin (*Kajikia audax*). Electronic monitoring became mandatory in July 2015 on all full-time pelagic longline vessels in the WTBF, with at least 10% of all shots reviewed to verify logbook accuracy. Fewer than five vessels have been active in the fishery since 2005 (Williams et al., 2020). The WTBF has export approval under the EPBC Act until November 2022.

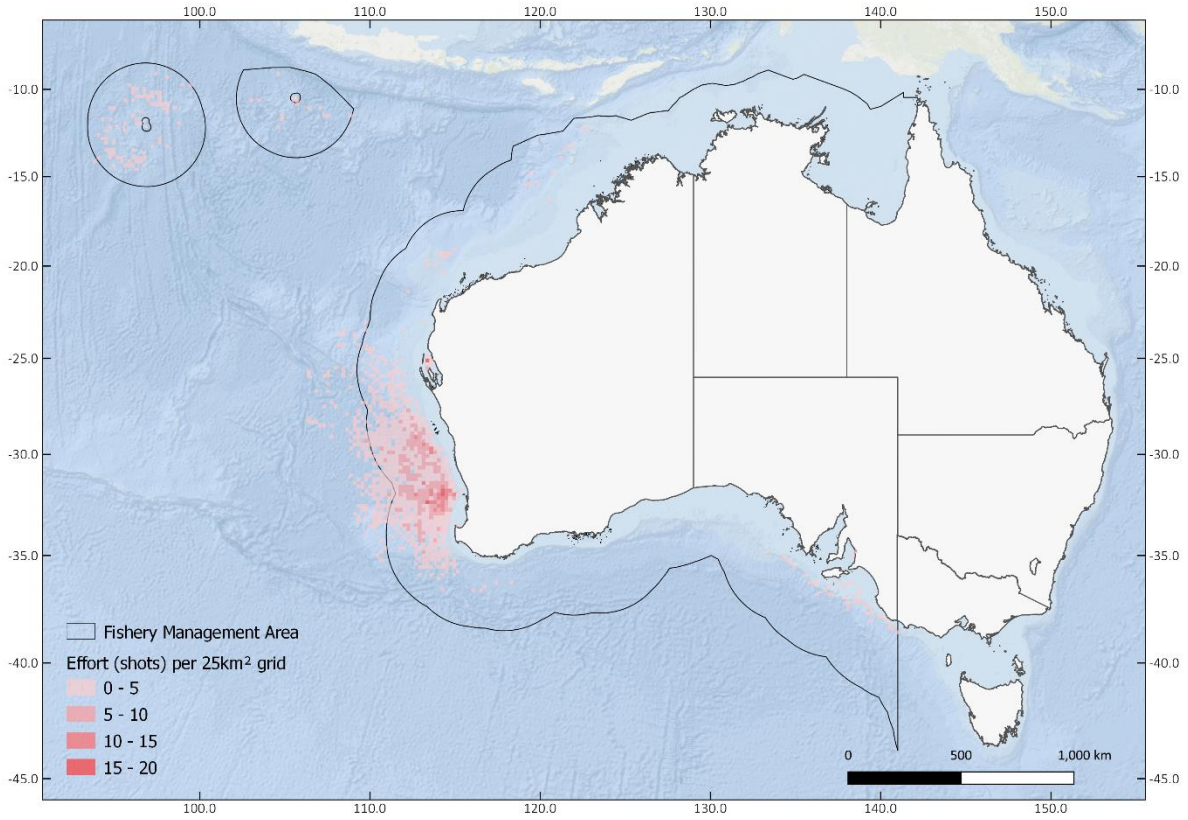


Figure 8: Distribution of fishing effort (2010-2020) in the Western Tuna and Billfish Fishery The most recent ERA conducted PSA analysis for 45 cetacean species, five seal species, and the dugong. After residual risk analysis, the risk posed by the fishery to these species was assessed as low or medium (AFMA, 2010). Current protected species bycatch mitigation measures in the fishery include the use of circle hooks, Tori lines, and line weighting regimes. Guidance is provided to industry on the best practice for handling and releasing protected species. A revised ERA for the fishery will be undertaken before 2022. Since 2010, interactions with seven species of mammal (three pinnipeds, four cetaceans) were reported in logbooks in the fishery (Fig. 9). Eight interactions were reported with cetaceans: three short-finned pilot whales, two long-finned pilot whales, one false killer whale, one Cuvier's beaked whale (*Ziphius cavirostris*) and one "mixed" whale (Table 8). One mortality of a long-finned pilot whale was recorded, with all other individuals released alive. There are no estimates of abundance for these species in the area of the fishery. There are no observer records of cetacean interactions in this fishery, and all species identifications should be verified through EM.

Three species of pinniped have been recorded in protected species logbook data between 2010 and 2020; four Australian sea lions, two New Zealand fur seals, one Australian fur seal and one 'seal'. The only observer record was of an interaction with an Australian fur seal in 2010. As all interactions occurred in longlines fishing off the shelf-break of Western Australia in the Indian Ocean, the Australian sea lion and Australian fur seal records are dubious. The Australian sea lions only forages on shelf waters and the reported interaction with the Australian fur seal occurred outside the know range of the species. It is likely all interactions are with New Zealand fur seals, however, as with all marine mammal interactions in this fishery, confirmation of species identification from EM is required. The minimum population estimates for New Zealand fur seals, based on the most recent pup abundances (Shaughnessy et al., 2015) is 117,101 individuals (Appendix B).

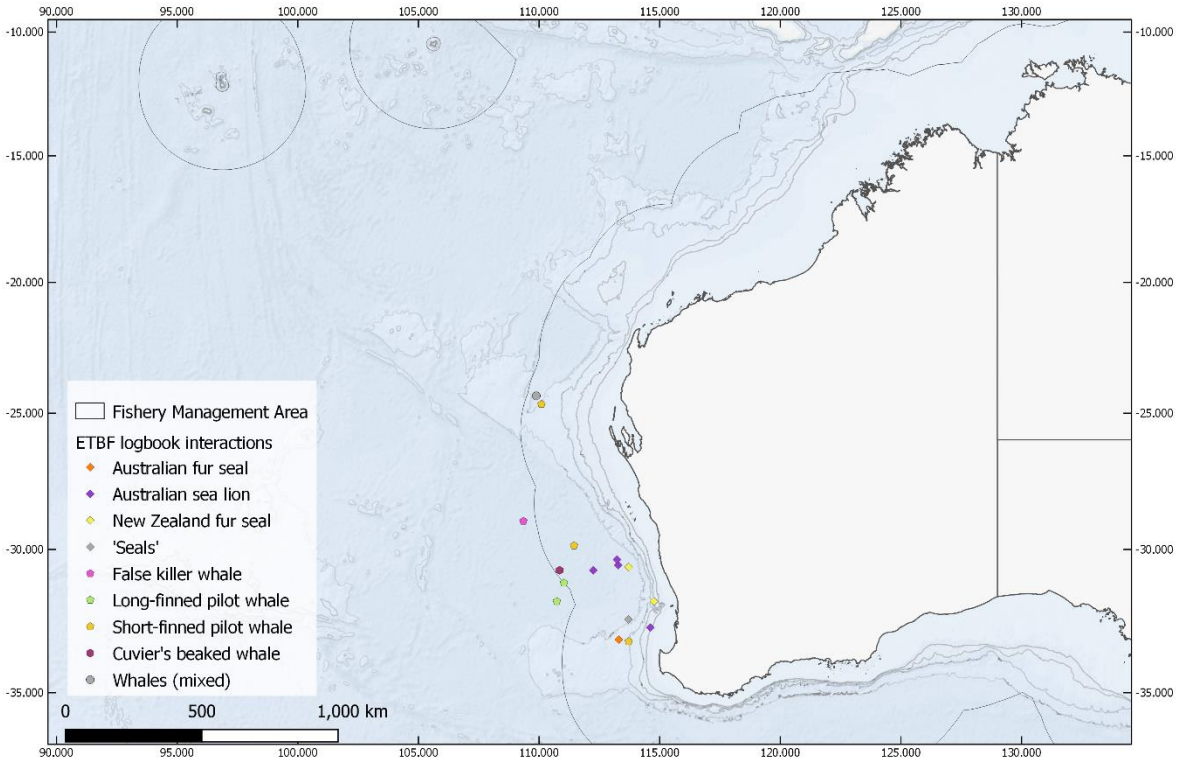


Figure 9: Location of all interaction with marine mammals in the Western Tuna and Billfish Fishery between 2010 and 2020

Table 8: Effort, observer coverage, and cetacean interactions reported in the Western Tuna and Billfish Fishery (2010 – 2020).

Year	Number of shots	Observer / EM* audit coverage (% shots)	Short-finned Pilot Whale	Long-finned Pilot Whale	False Killer Whale	Cuvier's Beaked Whale	Whales (mixed)	Australian Fur Seal	Australian Sealion	New Zealand Fur Seal	Seals	Logbook Interaction Rate (cetacean / shot)	Logbook Interaction Rate (pinniped / shot)
2010	420	2%	0	0	0	0	0	1	0	0	0	0.000	0.002
2011	235	0%	0	0	0	0	0	0	0	0	0	0.000	0.000
2012	367	3%	0	0	0	0	0	0	0	0	0	0.000	0.000
2013	344	0%	0	0	0	0	0	0	0	0	0	0.000	0.000
2014	290	9%	0	0	0	0	0	0	0	0	0	0.000	0.000
2015	259	2%	0	0	0	0	0	0	0	0	0	0.000	0.000
2016	231	10% EM*	0	0	0	0	0	0	3	0	1	0.000	0.017
2017	275	10% EM*	2	0	0	0	1	0	0	2	0	0.011	0.007
2018	276	10% EM*	0	1 (1)	1	1	0	0	0	0	0	0.011	0.000
2019	242	10% EM*	1	0	0	0	0	0	0	0	0	0.004	0.000
2020†	139	10% EM*	0	0	0	0	0	0	1	0	0	0.000	0.007
† Data to November 2020			3	1 (1)	1	1	1	1	4	2	1		

2.6 Southern Bluefin Tuna Fishery

The SBTF operates within the Australian Fishing Zone. The fishery mostly targets juvenile southern bluefin tuna which are caught using purse seine gear, and then transferred to aquaculture pens off Port Lincoln, South Australia. About 5-8 vessels operate annually in the purse seine sector of the fishery. The SBTF has approval for export under the EPBC Act until 11 November 2022. There is also some longline fishing effort for southern bluefin tuna in the ETBF and the WTBF. See relevant sections for marine mammal interactions in those sectors.

There were no observed or reported interactions between marine mammals and purse seine operations in the SBTF between 2010 and 2020. Observer coverage over this period ranged from 2% to 23% of shots (Table 9).

Table 9: Effort and observer coverage in the purse seine sector of the Southern Bluefin Tuna Fishery

Year	Effort (shots)	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	111	7%	0
2011	191	16%	0
2012	266	7%	0
2013	210	7%	0
2014	140	12%	0
2015	235	6%	0
2016	189	13%	0
2017	145	23%	0
2018	315	13%	0
2019	337	7%	0
2020	226	10%	0

2.7 Small Pelagic Fishery – Purse Seine Sector

Since 2010, most effort in the purse seine sector of the SPF has been undertaken off northern New South Wales. A condition of the EPBC Act accreditation is that 10% of days fished are observed (Noriega and Steven, 2020).

Three vessels operated in the fishery in 2019-2020, with total fishing effort of 41 shots, and 5% observer coverage (Table 10). No interactions between marine mammals and purse seine gear were reported in fishery logbooks between 2010 and 2020, and no observed interactions. However, there was no, or low observer coverage in this sector of the SPF during this period (Table 10). The purse seine sector of the fishery operates under the Commonwealth Small Pelagic Fishery Purse Seine Fishery Code of Practice (2008). The Code of Practice lists several methods to reduce marine mammal interactions, including assessing the presence of TEP species prior to setting gear, and aborting the shot if a TEP species has been encircled and cannot be easily released.

Table 10: Fishing effort and observer coverage in the purse-seine sector of the Small Pelagic Fishery from 2010-2020

Year	Shots	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	200	8%	0
2011	95	0%	0
2012	55	2%	0
2013	24	0%	0
2014	57	5%	0
2015	54	0%	0
2016	58	0%	0
2017	59	0%	0
2018	89	4.4%	0
2019	86	0%	0
2020	41	5%	0

2.8 Southern and Eastern Scalefish and Shark Fishery

The SESSF is a multi-gear and multisector fishery that operates in Commonwealth waters from southern Queensland to south east Western Australia as well as several Australian state waters (Helidoniotis et al., 2020a) (Fig. 10). The four sectors of the fishery are the Commonwealth Trawl Sector (CTS), the Gillnet Hook and Trap Sector (GHAT), the East Coast Deepwater Trawl Sector (ECDT) and the Great Australian Bight Trawl Sector (GABT). The sectors of the SESSF that are seeking export approval under the provisions of the US MMPA are the Blue Grenadier Trawl Sector (BGTS), and sectors of the orange roughy fishery of the CTS, and the Manual hook and the Autolongline sector of the GHAT.

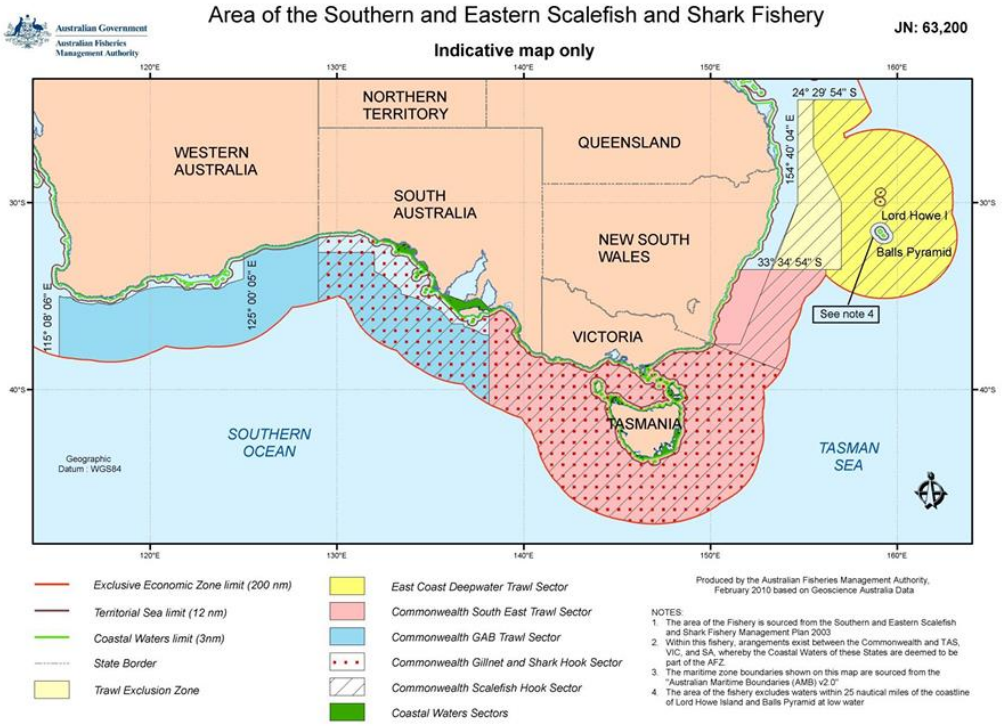


Figure 10: Sectors of the Southern and Eastern Scalefish and Shark Fishery (SESSF). Blue Grenadier Trawl Sector

Within the CTS, the winter BGTS operates between June and August off western Tasmania, using large factory freezer vessels that are typically brought over from New Zealand. The use of seal excluder devices (SEDs) is mandatory for all factory freezer vessels, and 100% of fishing effort is observed. Information on fishing effort and marine mammal interaction rates in the fishery are presented in Table 11. A total of 61 interactions (51 mortalities) were recorded with Australian fur seals between 2010 and 2020, with a further 11 interactions (seven mortalities) with New Zealand fur seals, and three mortalities of unidentified seals. The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals respectively (Appendix B).

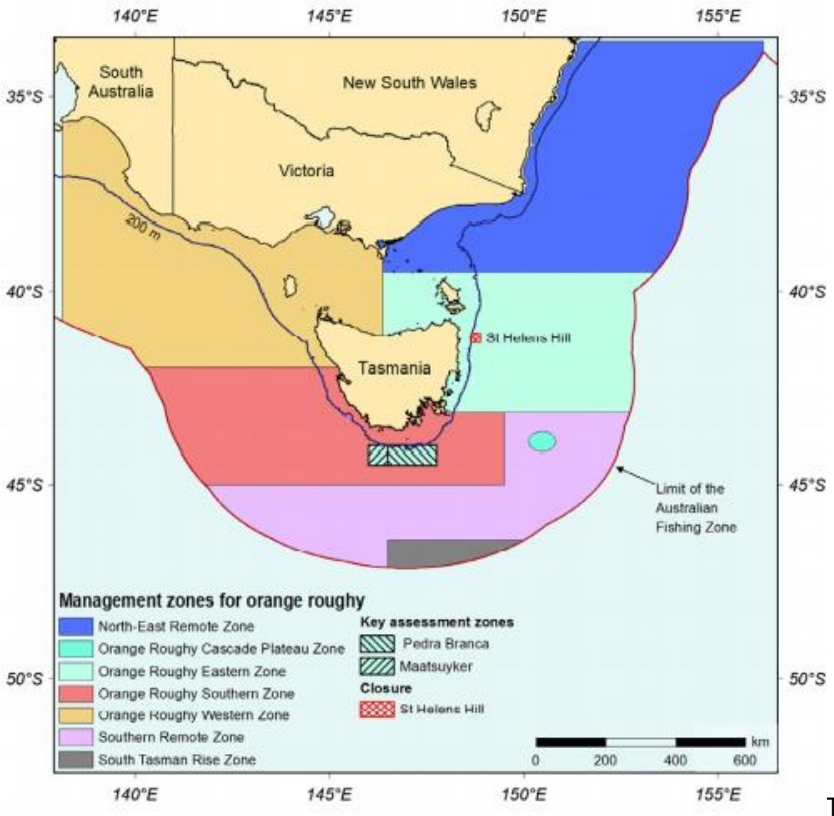
Table 11: Effort, observer coverage and number of individual marine mammal interactions by species in the Winter Blue Grenadier Trawl Sector of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	No. of trawled hours	Observer Coverage (% shots)	Australian fur seal	New Zealand Fur Seal	seals
2010*	229	444	100%	20 (19)	0	0
2011*	173	109	100%	8 (8)	0	0
2012*	179	133	100%	24 (21)	4 (4)	0
2013*	271	300	100%	8 (2)	0	0
2014**	0	0	0	0	0	0
2015**	0	0	0	0	0	0
2016**	0	0	0	0	0	0
2017**	0	0	0	0	0	0
2018**	0	0	0	0	0	0
2019**	182	331	100%	0	4 (2)	3 (3)
2020**	399	649	100%	1 (1)	3 (1)	0
				61 (51)	11 (7)	3 (3)

2.8.2 Orange Roughy Fishery

Within the CTS, the orange roughy fishery targets spawning aggregations of orange roughy using otter board trawl gear, on the Cascade Plateau, and on seamounts off the eastern and southern coast of Tasmania. There are seven management zones for orange roughy in the CTS (Helidoniotis et al., 2020b, Fig. 11), with three of these zones seeking export approval under the provisions of the US MMPA. These are the Eastern Orange Roughy, Cascade Orange Roughy and Pedra Branca (within the Southern Orange Roughy Zone).

Since 2010, trawl effort (shots) for Eastern orange roughy has accounted for approximately 2% of total trawl effort in the CTS. Two interactions with Australian fur seal were recorded, both when an observer was onboard, with one interaction resulting in a mortality (Table 12). No marine mammal interactions were observed or reported in the Cascade or Pedra Branca sectors of the orange roughy fishery between 2010 and 2020 (Table 13, Table 14). The minimum population estimates for Australian fur seals based on the most recent pup abundances (McIntosh et al., 2022), is 89,262 individuals (Appendix B).



Tab

Figure 11: Management zones for Orange Roughy in the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery. Table 12 Effort, observer coverage and number of individual marine mammal interactions by species in the Eastern orange roughy zone of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	Effort shots	Observer coverage (% shots)	Australian Fur Seal	Logbook interaction rate (interactions / shot)	Observer interaction rate
2010	42	0%	0	0	0
2011	26	0%	0	0	0
2012	5	0%	0	0	0
2013	52	63%	1 (1)	0.019	0.030
2014	1	0%	0	0	0
2015	135	47%	0	0	0
2016	229	16%	0	0	0
2017	189	33%	0	0	0
2018	245	30%	1	0.004	0.014
2019	260	43%	0	0	0
2020	221	64%	0	0	0
			2 (1)		

Table 13: Effort, observer coverage and number of individual marine mammal interactions by species in the Cascade management zone of the orange roughy fishery of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	44	7%	0
2011	0	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	32	78%	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	27	96%	0
2020	116	80%	0

Table 14: Effort, observer coverage and number of individual marine mammal interactions in the Eastern Pedra Branca area of the Southern Orange Roughy Zone of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	Effort shots	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	200	10%	0
2011	95	3%	0
2012	55	11%	0
2013	24	3%	0
2014	57	9%	0
2015	54	40%	0
2016	58	46%	0
2017	59	55%	0
2018	89	58%	0
2019	86	55%	0
2020	41	53%	0

2.8.3 Autolongline Sector of the Gillnet Hook and Trap Sector

The Automatic Longline sector within the GHAT sector of the SESSF, uses automatically baited longline to target several species of Scalefish. However, since 2019 there has been an increase in targeting shark species. EM is mandatory for all boats using automatic baited demersal longline gear in the SESSF.

Interactions with Australian fur seal, New Zealand fur seal and “seals” were reported in fishery logbooks in this sector between 2010 and 2020 (Table 15). Of the ten interactions with pinnipeds, four were reported as mortalities. Three of these were ‘seals’ not identified to species, and the fourth mortality was identified as an Australian fur seal. The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals respectively (Appendix B). One interaction with a killer whale, resulting in a mortality, was reported in a fishery logbook in 2016. There are no estimates of abundance for killer whales in Australian waters.

Table 15: Effort, observer coverage and number of interactions with marine mammals, by species, in automatic longline gear in the hook sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	No. of hooks	Observer coverage (% shots)	Australian fur seal	New Zealand fur seal	Seals	Killer Whale
2010	540	4,876,500.00	31.5%	0	0	0	0
2011	629	4,736,910.00	35.1%	0	0	0	0
2012	718	4,934,935.00	41.8%	0	0	0	0
2013	409	3,213,820.00	89.7%	0	0	0	0
2014	387	2,959,614.00	83.2%	0	0	0	0
2015	286	2,357,500.00	36.0%	1	0	0	0
2016	308	2,602,806.00	7.8%	0	0	0	1 (1)
2017	363	3,688,605.00	17.9%	0	0	3 (2)	0
2018	434	3,367,065.00	12.0%	2 (1)	0	2 (1)	0
2019	638	4,420,374.00	8.3%	1	0	0	0
2020	777	5,189,411.00	0.0%	0	1	0	1
				4 (1)	1	5 (3)	1

2.8.4 Manually baited hook sector of the Gillnet Hook and Trap Sector

The Manual Hook sector of the GHAT uses multiple types of line gear, with most effort undertaken using demersal longline and dropline. While this sector mainly targets shark species, some operators target scalefish species. EM is mandatory for all boats that fish more than 100 days per fishing season (01 May – 30 April).

Between 2010 and 2020, interactions with seven New Zealand fur seals, three Australian sea lions, four 'seals' and two killer whales were reported in the fishery (Table 16). Four New Zealand fur seal mortalities were reported, with all other individuals released alive. There has been little to no observer coverage in this sector over this period.

Table 16: Effort, observer coverage and number of interactions with marine mammals, by species, in manual line gear in the hook sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	No. of hooks	Observer coverage (% shots)	New Zealand fur seal	Sealions	Seals	Killer Whale
2010	3,067	816,341	0%	0	0	0	0
2011	5,352	776,854	1.0%	2	0	0	0
2012	2,798	1,158,555	1.5%	0	2	0	0
2013	3,568	1,751,401	2.5%	1 (1)	0	0	0
2014	4,391	2,302,341	0%	3 (2)	0	2	0
2015	6,037	2,552,578	0%	0	0	2	0
2016	6,813	1,268,354	0%	1 (1)	0	0	0
2017	7,615	2,099,173	0%	0	0	0	0
2018	5,592	2,145,475	0.1%	0	1	0	0
2019	7,790	2,532,638	0%	0	0	0	2
2020	6,123	2,348,187	0%	0	0	0	0
				7 (4)	3	4	2

2.8.5 East Coast Deepwater Trawl Sector

The ECDTS of the SESSF operates in waters beyond the 4,000 m isobath off eastern Australia, and since 2000, has primarily targeted alfonsino (*Beryx splendens*). Four types of trawl gear are permitted in the fishery: mid-water, demersal otter, Danish-seine, and pair trawl. Effort in the fishery is very variable, with one active vessel undertaking 14 trawl hours in 2019-20, with 7 days of observer coverage (Butler and Steven, 2020). No marine mammal interactions were reported in fishery

logbooks in the ECDTS between 2010-2020. It was not possible to determine the level of effort or observer coverage in this sector of the fishery.

2.8.6 Great Australian Bight Trawl Sector

The Great Australian Bight Trawl Sector (GABTS) predominantly uses bottom otter trawl and Danish-seine gear to target deepwater flathead (*Neoplatycephalus conatus*) and Bight redfish (*Centroberyx gerrardi*). The fishery operates in three distinct areas; on the continental shelf, on the upper continental-slope, and on the mid to lower slope in depths of 700-1000 m (Moore et al., 2020). It was not possible to determine the level of effort or observer coverage in this sector of the fishery. No marine mammal interactions were reported in fishery logbooks in the GABTS between 2010-2020.

2.9 Heard Island and McDonald Island

The HIMI fishery operates in waters between 12 and 200 nm from Heard and McDonald Islands in the southern Indian Ocean, within the area covered by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) (Fig. 12). The main fishing gear is demersal longline, with some demersal and mid-water trawl effort, and the key target species are Patagonian toothfish and mackerel icefish (*Champsocephalus gunnari*). Mackerel icefish are targeted using demersal and mid-water trawl gear. Five vessels operated in the fishery in the 2018-19 fishing season (Patterson and Steven, 2020a). The HIMI has export approval under the EPBC Act until October 2026.

2.9.1 Demersal longline sector

Since 1997 there has been 100% observer coverage in the fishery, with two observers aboard each vessel, rotating 12-hour shifts. Longlines are baited with squid, with between 15-18 million hooks fished each year since 2015.

Since 2012, three species of pinniped have been reported to interact with longline gear in the fishery, with most interactions (45) and mortalities (40) occurring with southern elephant seals (Table 17). Two crabeater seal (*Lobodon carcinophagus*) mortalities, and one Antarctic fur seal (*Arctocephalus gazella*) mortality have also been reported (Table 17). In addition, six fatal interactions with unidentified seals have also been reported in fishery logbooks. The species involved should be confirmed using observer records. The most recent abundance estimate of southern elephant seals in the area of the fishery is 61,933 individuals (Slip and Burton 1999, cited in Hindell et al. 2016). Based on the most recent pup abundance data (Page et al., 2003), the Nmin for Antarctic fur seals in the area of the fishery is 4,048 individuals (Appendix B).

Sperm whale (*Physeter macrocephalus*) depredation of longline gear in the HIMI have been reported since 2011, with depredation events occurring between April and July (Welsford and Arangio, 2015). In order to mitigate depredation, vessels in the fishery haul longlines when sperm whales are sighted and steam to another location before resetting lines. There are no abundance estimates of sperm whales in the area of the fishery.

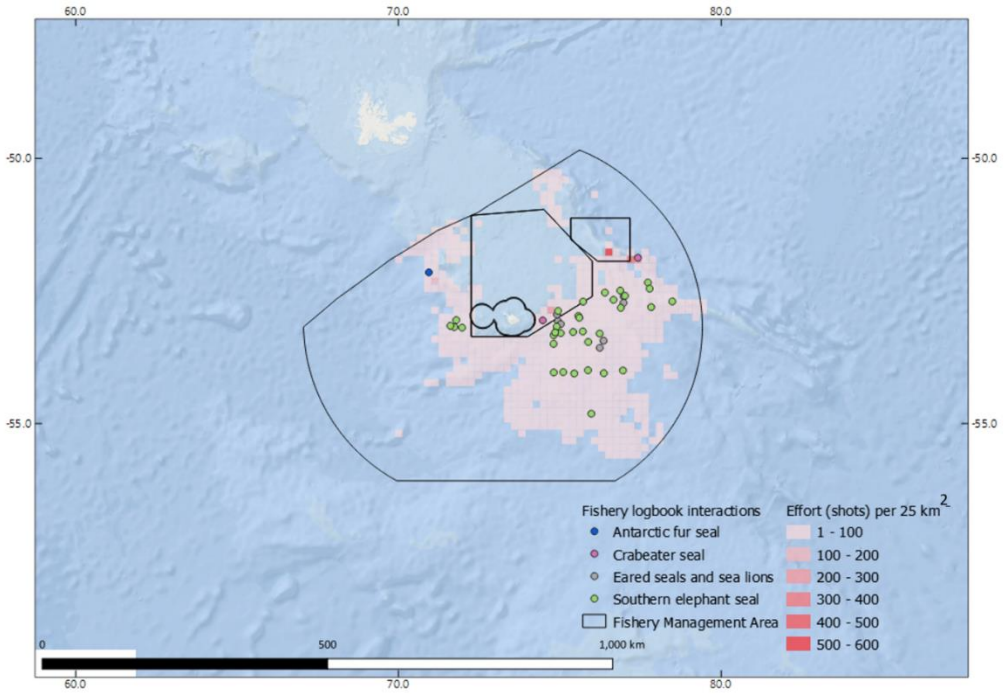


Figure 12: Distribution of fishing effort between 2010 and 2020 and fishery logbook reports of interactions with marine mammals between 2012 and 2020 in the demersal longline sector of the Heard Island and McDonald Island Fishery.

Table 17: Effort), observer coverage, and number of interactions with marine mammals reported in the demersal longline sector of the Heard Island and McDonald Island Fishery between 2012 and 2020.

Year	Effort (no. of shots)	Observer coverage (% shots)	Southern elephant seal	Crabeater seal	Antarctic fur seal	Unidentified seal
2012	545	100%	3 (1)	0	0	0
2013	785	100%	6 (6)	0	0	2 (2)
2014	834	100%	2 (2)	0	1 (1)	0
2015	1447	100%	5 (5)	0	0	1 (1)
2016	1316	100%	8 (8)	2 (2)	0	1 (1)
2017	1618	100%	4 (4)	0	0	2 (2)
2018	1560	100%	9 (8)	0	0	0
2019	1686	100%	5 (4)	0	0	0
2020*	829	100%	3 (2)	0	0	0
*Fishing effort is to August 2020.			45 (40)	2 (2)	1 (1)	6 (6)

The most recent ERAEF for the HIMI Demersal Longline Fishery, that was undertaken using fisheries data from 2010/11 to the 2014/15, considered six marine mammal species. These were the southern elephant seal, Antarctic fur seal, New Zealand fur seal, crabeater seal, Ross seal (*Ommatophoca rossii*) and sperm whale (Bulman et al., 2017). As none of these species had a score above three after Level 1 analysis, they were not considered for Level 2 analysis (Bulman et al., 2017).

2.9.2 Demersal Trawl Sector

No interactions with marine mammals were recorded in the demersal trawl sector of the HIMI between 2010 and 2020 (Table 18). The last observed interactions with marine mammals in the fishery were two Antarctic fur seal mortalities in 2003 (CCAMLR, 2020).

Table 18: Effort , observer coverage, and number of interactions with marine mammals reported in fishery logbooks in the demersal trawl sector of the Heard Island and McDonald Island Fishery between 2012 and 2020.

Year	No of shots	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	1004	100%	0
2011	652	100%	0
2012	921	100%	0
2013	752	100%	0
2014	444	100%	0
2015	214	100%	0
2016	406	100%	0
2017	243	100%	0
2018	244	100%	0
2019	454	100%	0
2020	282	100%	0

2.10 Macquarie Island Toothfish Fishery

The Macquarie Island Toothfish Fishery (MITF) targets Patagonian toothfish (*Dissostichus eleginoides*) using longlines in the waters around Macquarie Island (Fig. 13). The MITF is currently certified as sustainable by the MSC. Effort in the fishery is comprised of one or two vessels, each operating with 100% observer coverage (Patterson and Steven, 2020b). No interactions between marine mammals and longline gear were reported in the fishery between 2010 and 2020 (Table 19). The fishery has export approval under the EPBC Act until 9 October 2026.

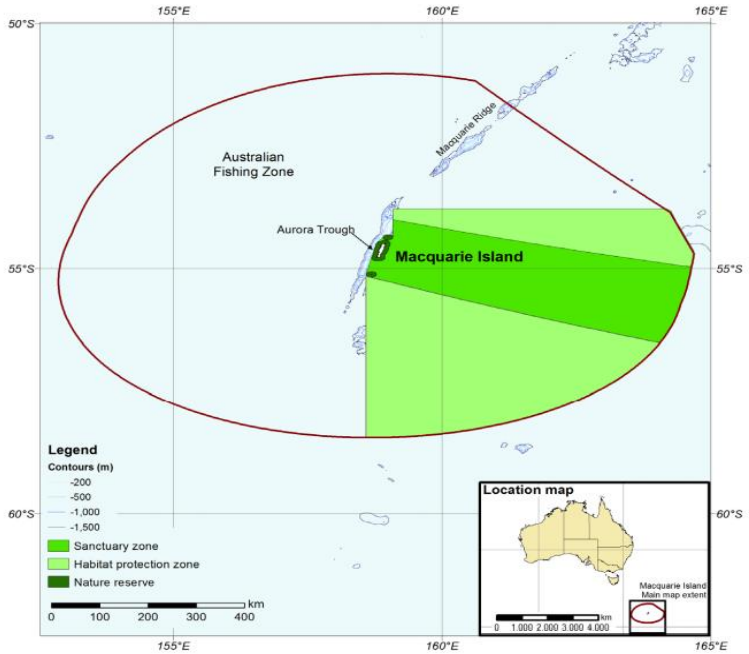


Figure 13: Area of the Macquarie Island Toothfish Fishery.

Table 19 Effort , observer coverage, and number of interactions with marine mammals reported in fishery logbooks in the Macquarie Island Toothfish Fishery between 2012 and 2020.

Year	Number of shots	Number of hooks	Observer coverage (% shots)	Observed or reported marine mammal interactions
2010	52	277,050	100%	0
2011	171	983,950	100%	0
2012	206	1,095,640	100%	0
2013	181	1,327,410	100%	0
2014	149	953,580	100%	0
2015	256	1,485,590	100%	0
2016	349	2,267,297	100%	0
2017	306	2,296,220	100%	0
2018	272	2,026,880	100%	0
2019	267	1,797,020	100%	0
2020	331	1,992,827	100%	0

2.11 Marine mammal interactions in Commonwealth managed fishery sectors not seeking to export product under the provisions of the US MMPA

The following section provides a summary of fishing effort, observer coverage, and reported numbers of interactions with marine mammals in Commonwealth managed fisheries between 2010 and 2020, that are not seeking export approval. This information is required under the provisions of the US MMPA.

2.11.1 Commonwealth Trawl Sector of the SESSF

The CTS is a multi-gear and multi-species fishery that extends south from the tip of K'gari (Fraser Island) in Queensland, to east of Kangaroo Island, South Australia. The predominant gears used are demersal otter board trawl gear and Danish-seine. In 2019-20, 30 trawl vessels and 19 Danish-seine vessels operated in the CTS (Emery et al., 2020).

Between 2010 and 2020, 1,636 interactions with pinnipeds, resulting in 1,322 mortalities, were reported in otter board trawl gear in the CTS (Table 20). The majority of interactions (59%) and mortalities (62%) were reported with Australian fur seals. Over a third (37%) of reported interactions were with 'seals' not identified to species, with 3% of interactions and 4% of mortalities reported as New Zealand fur seals. The average observer coverage during this period was 4% of fishing effort. The South East Trawl Fishery Industry Association (SETFIA) produced an industry code of practice to minimise interactions with seals (SETFIA, 2007). A trial in the fishery investigated whether shortening the codend in demersal trawls could reduce seal interactions, but found interaction rates were identical in shortened and standard nets (Koopman et al., 2014). A total of 44 Australian fur seals interactions, resulting in 35 mortalities, were recorded during 1,117 trawl shots, with interactions occurring in 3% of shots, giving an interaction rate of 0.039 Australian fur seals per shot (Koopman et al., 2014). The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals respectively (Appendix B).

Between 2010 and 2020, 33 interactions with dolphins, resulting in 32 mortalities, were reported in otter board trawl gear in the CTS (Table 21). These included 16 common dolphin mortalities, 14 mortalities of 'dolphins' not identified to species, and two mortalities of bottlenose dolphins. The average observer coverage during this period was 4% of fishing effort. There are no abundance estimates for common or bottlenose dolphins in the area of the fishery.

Table 20: Effort, observer coverage and number of individual pinniped interactions by species in the Commonwealth Trawl Sector using otter board trawl gear of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	% Observer coverage	Australian Fur Seal	New Zealand Fur Seal	Seals	Antarctic Fur Seal / Eared Seal	Sealions
2010	14,626	1.1%	2 (2)	11 (10)	94 (74)	1 (1)	1 (1)
2011	16,038	1.6%	51 (41)	9 (9)	190 (144)	0	0
2012	15,261	2.0%	111 (98)	1	83 (67)	0	0
2013	13,917	2.4%	86 (76)	0	98 (78)	0	0
2014	14,220	1.9%	79 (70)	3 (2)	39 (27)	0	0
2015	13,662	2.6%	78 (66)	3 (1)	16 (10)	2 (1)	0
2016	13,198	2.1%	78 (67)	1(1)	10 (8)	0	0
2017	13,558	3.1%	114 (93)	1 (1)	8 (3)	0	0
2018	12,778	2.2%	147 (115)	18 (16)	27 (18)	0	0
2019	12,894	3.0%	122 (104)	4 (1)	24 (16)	0	0
2020	11,371	0.7%	99 (82)	7 (7)	20 (12)	0	0

	967 (814)	56 (48)	609 (457)	3 (2)	1 (1)

Table 21: Effort, observer coverage and number of individual cetacean interactions by species in the Commonwealth Trawl Sector using otter board trawl gear of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	Trawl hours	% Observer coverage	Dolphins	Common Dolphin	Bottlenose Dolphin
2010	15,141	59,824	3%	0	0	0
2011	16,237	67,311	3%	0	3 (3)	0
2012	15,445	59,737	3%	1	0	0
2013	14,240	54,624	4%	1 (1)	0	0
2014	14,221	55,817	2%	3 (3)	0	0
2015	13,829	54,526	3%	0	0	0
2016	13,427	52,929	3%	0	1 (1)	0
2017	13,747	55,941	4%	4 (4)	3 (3)	1 (1)
2018	13,023	55,347	3%	2 (2)	2 (2)	1 (1)
2019	13,363	55,566	6%	3 (3)	6 (6)	0
2020	12,107	50,909	6%	1 (1)	1 (1)	0
				15 (14)	16 (16)	2 (2)

2.11.2 Danish-seine sector of the CTS

Between 2010 and 2020, most Danish-seine effort in the CTS occurred off the southeast coast of Victoria. A total of 221 interactions with pinnipeds, resulting in 136 mortalities, were reported in fishery logbooks over this period (Table 22). The majority of pinniped interactions (62%) and mortalities (60%) were with seals not reported to species, with 37% of interactions and 40% of mortalities reported to be Australian fur seals. Three interactions with New Zealand fur seals, resulting in one mortality, were also reported. One interaction with a dolphin not identified to species, was reported in a Danish-seine operation in fishery logbooks in 2018, the interaction resulted in a mortality. The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals, respectively (Appendix B). Between 2010 and 2020, the average observer coverage in this fishery was less than 1% of fishing effort. Nineteen Danish-seine vessels operated in the fishery in 2019-2020 (Moore et al., 2020).

Table 22. Effort, observer coverage and number of pinniped interactions by species in Danish-seine gear in the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	Observer coverage (% shots)	Australian Fur Seal	New Zealand Fur Seal	Seals
2010	7423	0.1%	0	0	9 (7)
2011	7934	1.2%	4 (1)	0	22 (13)
2012	8319	0.8%	0	0	9 (6)
2013	8352	1.3%	5 (3)	0	8 (4)
2014	9712	1.1%	0	2	10 (4)
2015	10081	0.8%	1	0	7 (3)
2016	10669	1.2%	5 (4)	0	6 (5)
2017	10137	0.9%	15 (11)	0	7 (6)
2018	10235	0.8%	23 (16)	1 (1)	18 (7)
2019	10370	1.1%	8 (5)	0	16 (13)
2020	11509	0.5%	20 (14)	0	25 (13)
			81 (54)	3 (1)	137 (81)

2.11.3 Gillnet Sector of the SESSF

The gillnet sector of the SESSF uses demersal gillnets to target several shark species. The fishery extends from South Australia, east to the Victoria and New South Wales border. Most fishing effort is undertaken throughout Bass Strait and in coastal waters. Since July 2015, EM has been mandatory on all vessels fishing gillnet gear for more than 50 days per season. All protected species interactions reported in fishery logbooks are reviewed, and a minimum random sample of 10% of each vessel's shots are audited. An analysis of two years of fishery logbook data and EM analyst data from the gillnet sector of the SESSF found congruence in reporting rates of interactions with marine mammals (Emery et al., 2019b).

Two management strategies are in place to mitigate marine mammal interactions in the gillnet sector, one for the Australian sea lion and the other for dolphins. The Australian sea lion management strategy (AFMA, 2015) uses a multi-tiered system of management measures. These include permanent closures to gillnet fishing around all Australian sea lion breeding colonies in South Australian Waters, and spatial bycatch limits which are individually set for each of seven sea lion management zones in South Australia. If the bycatch limit within a zone is reached, that zone is closed to fishing for 18 months. All gillnet fishing operations in South Australia must have 100% monitoring, either through onboard observers or EM, with 100% of EM footage audited for all effort undertaken in the Australian Sealion Zone. Between 2010 and 2020, interactions with 20 Australian sea lions, resulting in two mortalities were recorded (Table 23). The implementation of the Australian sea lion management strategy has led to large declines in gillnet fishing effort in South Australian and a concomitant reduction in Australian sea lion bycatch mortalities. Goldsworthy et al. (2022) estimated that the bycatch mortality of Australian sea lion in June 2021 was 98% lower than pre-management levels. Gillnet fishing effort was estimated to have declined by 95% off South Australia and by 98% within the Australian sea lion management zone (Goldsworthy et al., 2022)

Interactions with Australian and New Zealand fur seals are also reported in the fishery (Table 23). Between 2010 and 2020, 75 Australian fur seal and 46 New Zealand fur seal mortalities were reported in fishery logbooks, with a further 127 mortalities of seals, not identified to species, reported over the same period. Although EM cameras are placed at angles that reduce the likelihood of missing any marine mammal carcass that may drop out of a gillnet during hauling, there remains concern over the potential for this to occur. A study in the fishery found that 10 of 12 dead Australian sea lions dropped out from gillnets as they were being raised to and above the surface (Hamer et al., 2013).

Interactions between dolphin species and gillnet operations in the SESSF are managed under the Gillnet Dolphin Mitigation Strategy (AFMA, 2019b). In 2014, the first iteration of the Gillnet Dolphin Mitigation Strategy was developed, with the management strategy adopting an individual responsibility approach, with individual fishers responsible for minimising interactions and staying within defined performance criteria. The strategy was initially applied in the Coorong Zone when it was re-opened to gillnet fishing in September 2015, with mandatory 100% EM and bycatch trigger limits set at the individual vessel level. In 2017, the strategy was applied across the entire fishery, with the current Maximum Interaction Rate in the fishery defined as one dolphin per 210,000 m of gillnet set. The performance criterion for each individual vessel is its dolphin interaction rate within a six-month review period. Management responses increase if interaction rates increase, or if the Maximum Interaction Rate is exceeded over subsequent review periods. Each vessel must have a Dolphin Mitigation Plan that is approved by the AFMA before they are permitted to fish with gillnets. If an interaction with a dolphin occurs, the vessel must submit a Dolphin Interaction Evaluation Report within 48 hours of landing along with the hard drive from the EM system. In 2019, additional management measures were introduced. If a vessel has more than three interactions within the

South Australian Dolphin Zone, or exceeds the Maximum Interaction Rate then it is require to cease fishing and excluded from fishing in the zone for six months.

Between 2010 and 2020, 223 interactions with common dolphins, 22 interactions with bottlenose dolphin species, and 227 interactions with dolphins not identified to species, were reported in logbooks in the fishery, resulting in 361 mortalities (Table 24). An expert review of video footage of dolphin interactions in the fishery in 2012 reported, that of the 40 dolphin mortalities that could be identified to species, 38 were common dolphins and two were bottlenose dolphins (*Tursiops* sp.) (AFMA, 2019b). Abundance estimates for common dolphins are only available for discrete areas with only small overlap with the fishery. Abundance estimates for bottlenose dolphins in the region are for coastal Indo-Pacific bottlenose dolphin and there is no information on the abundance of bottlenose dolphin species over the shelf-region off southeast South Australia or in Bass Strait where most interactions were reported.

Table 23: Effort, observer coverage and number of pinniped interactions by species in gillnet operations in the Gillnet Hook and Trap Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	Length of gillnet (km)	Observer / EM Coverage* (% shots)	Seals	Australian Fur Seal	New Zealand Fur Seal	Australian Sea Lion
2010	10,730	39,929	1.8%	1 (1)	0	0	4 (3)
2011	9,563	36,662	4.2%	5 (4)	4 (2)	2 (2)	1 (1)
2012	8,291	32,873	7.2%	0	6 (2)	0	6 (6)
2013	7,255	31,910	6.8%	1 (1)	1 (1)	4 (4)	1 (1)
2014	7,449	32,504	4.3%	5 (5)	2 (1)	0	1 (1)
2015	7,082	30,940	2%	11 (11)	10 (9)	1 (1)	2 (2)
2016	6,827	30,770	9%*	20 (17)	10 (10)	5 (5)	2 (1)
2017	7,631	34,800	10%*	26 (26)	7 (6)	1 (1)	0
2018	7,241	35,685	11%*	28 (26)	16 (16)	6 (6)	2 (2)
2019	6,602	32,539	10%*	21 (19)	23 (15)	22 (22)	1 (1)
2020	5,374	30,573	10%*	23 (18)	10 (10)	5 (5)	0
				141 (128)	89 (72)	46 (46)	20 (18)

Table 24: Effort, observer coverage and number of cetacean interactions by species in gillnet operations in the Gillnet Hook and Trap Sector of the Southern and Eastern Scalefish and Shark Fishery.

Year	No. of shots	Length of gillnet (km)	Observer coverage / EM Coverage* (% shots)	Dolphin	Bottlenose Dolphin	Common dolphin
2010	10,730	39,929	1.8%	4 (4)	0	3 (3)
2011	9,563	36,662	4.2%	41 (3)	0	10 (10)
2012	8,291	32,873	7.2%	17 (17)	0	1 (1)
2013	7,255	31,910	6.8%	0 (0)	1 (1)	8 (7)
2014	7,449	32,504	4.3%	17 (14)	0	3 (3)
2015	7,082	30,940	2%	19 (19)	2 (2)	7 (7)
2016	6,827	30,770	9%*	15 (15)	0	22 (20)
2017	7,631	34,800	10%*	43 (43)	4 (4)	20 (19)
2018	7,241	35,685	11%*	26 (26)	4 (4)	26 (26)
2019	6,602	32,539	10%*	17 (17)	7 (7)	12 (12)
2020	5,374	30,573	10%*	25 (1)	4 (4)	11 (11)
				227 (159)	22 (22)	123 (36)

2.11.4 Small Pelagic Fishery Mid-water trawl sector

The mid-water trawl sector of the SPF operates between southern Queensland and southern Western Australia. The fishery is divided into two sub areas, based on stock structure of a number of target species, east and west of latitude 146°30' S. One mid-water trawl vessel was active in the fishery in the 2019-2020 fishing season (Noriega and Steven, 2020). The SPF is accredited until October 2023 under part 13 of the EPBC Act.

Since 2015, most mid-water trawl effort has been along the shelf, and shelf break, off southern New South Wales. To operate in the fishery all mid-water trawl vessels must have EM installed, and a minimum of 10% of all fishing operations are audited for all trips when an observer is not aboard.

All mid-water trawl vessels operating in the SPF must also develop a Vessel Management Plan which specifies measures to mitigate interactions with protected species, including the use of equipment such as barrier nets and excluder devices. Interactions with dolphins in the mid-water trawl sector of the SPF are managed under the Small Pelagic Fishery Dolphin Mitigation Strategy (AFMA, 2019c). Under the strategy, when an interaction occurs, the completion of a Dolphin Interaction Evaluation Report is mandatory. For subsequent and persistent interactions, a series of escalating management responses are followed, such as spatial and temporal exclusions.

The dolphin bycatch limit in the fishery, known as the Maximum Interaction Rate, is one dolphin per 50 trawl shots, per six-month review period. This limit is applied separately to the two areas of the fishery. If a vessel exceeds the Maximum Interaction Rate within the first review period it must cease fishing, return to port, and have a new Dolphin Mitigation Plan reviewed and approved before fishing can recommence. If the limit is reached for a second review period, the vessel is excluded from the sub-area where the interaction occurred for a six-month period. If the vessel then exceeds the interaction rate for a third consecutive review period, the vessel is excluded from the entire fishery for six months.

In addition to a maximum rate, there is also a cap on the number of individual dolphin bycatches within the review periods. If three or more dolphins are bycaught across three or more sets, the vessel must return to port and have a new Dolphin Mitigation Plan approved before fishing can recommence. If six or more dolphins are caught but the Maximum Interaction Rate has not been exceeded the vessel must cease fishing, return to port, and have a new Dolphin Mitigation Plan approved and must cease fishing for any subsequent interaction within that review period. If more than six dolphins are caught and the Maximum Interaction Rate has also been exceeded for the previous two review periods, the vessel is excluded from that fishing sub-area for six months, and if the six-dolphin cap is reached twice within a 12-month period the vessel will be excluded from the fishery for six months.

A summary of relevant information for the mid-water trawl sector of the SPF is provided in Table 25, including data on fishing effort, observer coverage and interactions. The common dolphin is the cetacean species that is most frequently recorded to interact with the fishery, with 37 interactions including 36 mortalities recorded between 2015 and 2020 (Table 25). All common dolphin interactions occurred off the east coast of Australia, and all but one occurred near the shelf-break or slope. Five interactions with bottlenose dolphins, all mortalities, have been recorded since 2015 (Table 25). As these interactions occurred near the shelf edge in waters of depths greater than 200 m it is likely the species involved was the common bottlenose dolphin. There are no abundance estimates for either common dolphins or common bottlenose dolphins in the area of the fishery where interactions were recorded.

Of the pinniped species, 71 interactions were reported with Australian fur seals and 53 interactions were reported with New Zealand fur seals, with most interactions resulting in mortalities (94% and

96%, respectively) (Table 25). The minimum population estimates for Australian fur seals and New Zealand fur seals, based on the most recent pup abundances (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015), are 89,262 and 117,101 individuals respectively (Appendix B). A mortality of a seal reported as an Antarctic fur seal in the fishery logbook, was recorded in 2016 south of Kangaroo Island, South Australia. While records of vagrants in Australia are infrequent, there have been two sightings of Antarctic fur seals at Kangaroo Island (Shaughnessy et al., 2014b).

Table 25: Effort, observer coverage and number of marine mammal interactions by species in mid-water trawl operations in the Commonwealth Small Pelagic Fishery.

Year	Number of shots	Hours Trawled	Observer coverage (% shots)	Common Dolphin	Bottlenose Dolphin	Australian Fur Seal	New Zealand Fur Seal	Seals
2015	179	583.3	100%	9 (9)	0	15 (15)	0	0
2016	347	1288.9	100%	0	4 (4)	50 (45)	8 (8)	1 (1) *
2017	69	245.4	100%	3 (3)	0	2 (2)	0	0
2018	265	989.7	100%	0	0	5 (5)	17 (15)	1 (1)
2019	363	1273.6	11%	15 (14)	1 (1)	0	12	0
2020	515	1019.8	4%	10 (10)	0	0	19	1 (1)
				37 (36)	5 (5)	71 (67)	56 (23)	3 (3)

***** The seal species was identified as an Antarctic Fur Seal in the fishery logbook record

3 Northern Territory

3.1 Marine mammal occurrence

The marine coastal waters of the Northern Territory are the fourth largest of the State and Territories, with a coastline length, including islands, of 10,954 km and an area of 71,839 km^2 (source Geoscience Australia). Nineteen species of marine mammals (18 species of cetacean and the dugong), have been recorded in Northern Territory waters from sightings and / or strandings (Palmer et al., 2017a). Marine mammals in Northern Territory waters are managed under the *Territory Parks and Wildlife Conservation Act 2001* (TPCW Act). The North Marine Bioregional Plan lists nine cetacean species as occurring regularly in the Commonwealth waters of the North Marine Region and another 15 species that occur infrequently (Table 1, DSEWPaC, 2012f).

3.1.1 Dugongs

Dugongs are a key cultural species for Aboriginal and Torres Strait Traditional Owners in the Northern Territory who have the right to hunt dugongs in their sea country for non-commercial use under section 122 of the Commonwealth *Native Title Act* 1993 (NT Act) and the (TPCW Act). Dugongs are listed as Near Threatened under the TPCW Act and there is relatively robust information on the abundance and distribution of the species in the Northern Territory, and some of the Commonwealth waters off the coast.

Dugongs are marine herbivores, and their distribution is related to the distribution of seagrass. While generally coastal, they have been sighted in waters up to 35 m in depth and have been reported at Ashmore Reef over 800 km west of Darwin (Saalfeld and Marsh, 2004). Although distributed throughout the waters of the Northern Territory, most of the species occurs in the Gulf of Carpentaria, with more patchy distribution in western waters. The most recent population estimate from an aerial survey of over 20,547km^2 of the Gulf of Carpentaria was 5,783 (±767) dugongs in 2014 (Groom et al., 2015). Comparisons of abundance estimates with previous estimates from aerial surveys of the same region in 1994 and 2007 indicate a stable population. During the 2007 aerial surveys, 38% of sightings were in Commonwealth waters of the Gulf of Carpentaria (Marsh et al., 2008). In 1995, an aerial survey produced an estimate of 1,763 (±956) dugongs in a survey area of 9,096 km^2 in Northern Arnhem Land (Saalfeld 2000 cited in Saalfeld and Marsh, 2004). Bycatch in commercial fisheries was assessed as being of potential concern for dugongs in the North Marine Region which includes the Commonwealth waters off the Northern Territory (DSEWPaC, 2012g).

3.1.2 Cetaceans

Dolphins and whales have cultural significance for many Traditional Owner groups in the Northern Territory. Six cetacean species are considered resident or are known to occur regularly in Northern Territory coastal waters. The Australian snubfin dolphin, the Australian humpback dolphin and bottlenose dolphin (*Tursiops aduncus* and / or *T. truncatus*) are widely distributed in coastal waters, while the dwarf spinner dolphin (*Stenella longirostris roseiventris*) and the false killer whale (*Pseudorca crassidens*) show more restricted distributions (Brooks et al., 2017; Palmer et al., 2017a, 2014, 2009). The dwarf spinner dolphin is currently not listed in the cetacean species report card for the North Bioregion Plan and is therefore not included in Table 1 (Section 1.3). The Australian snubfin, Australian humpback and dwarf spinner dolphins are listed as Data Deficient under the NPWC Act, while both bottlenose dolphin species and false killer whales are classified as Least Concern.

To determine the distribution and abundance of coastal dolphins in the Northern Territory, count data were collected by helicopter at 39 randomly chosen sites along the coastline using strip transect methods out to 10 km from the coastline or islands (Palmer et al., 2017b). Using generalised linear models (GLMs) the minimum abundance estimates for the three species within 10km of the continental coastline or large islands generated from these surveys was 6,058 (± 1,011) Australian snubfin dolphin, 1,753 (± 438) Australian humpback dolphin, and 2,594 (±1,647) bottlenose dolphins (Palmer et al., 2017b). Australian snubfin and Australian humpback dolphins were widely distributed along the coast, while bottlenose dolphins were significantly more abundant at coastal sites compared to estuaries. The only other cetaceans recorded during the helicopter surveys were 13 sightings of dwarf spinner dolphins. Sighting densities were not significantly different with distance to the shore, and this finding suggests the distribution of these species extends beyond 10 km from the Northern Territory coastline (Palmer et al., 2017b).

The abundance of Australian snubfin, Australian humpback and Indo-Pacific bottlenose dolphins has also been estimated within Port Essington Harbour, a semi-enclosed bay covering an area of 325km^2, and within Darwin Harbour and two neighbouring bays encompassing an area of 1,086km^2 (Brooks et al., 2017; Palmer et al., 2014). The estimated abundance of dolphin species in Darwin Harbour between 2008 and 2009, based on robust-design analysis of capture-recapture data, varied from 136 (95% CI = 58–317) to 222 (95% CI = 146–336) snubfin dolphins, 48 (95% CI = 24–95) to 207 (95% CI = 113–379) humpback dolphins, and 34 (95% CI = 14–83) to 75 (95% = CI 39–145) bottlenose dolphins (Palmer et al., 2014). The mean abundance estimates in Darwin Harbour and two neighbouring bays were 90 humpback dolphins, 41 snubfin dolphins and 27 bottlenose dolphins (Brooks et al., 2017). For both areas, variation in species abundance over the survey periods likely reflects movements by individuals in and out of the survey areas (Brooks et al., 2017; Palmer et al., 2014).

Palmer et al. (2017b) also estimated the extent of occurrence of the six-resident coastal cetacean species in the Northern Territory based on survey, sightings and strandings records. Australian snubfin dolphins were the most widely distributed species, estimated to occur in 89% of Northern Territory waters, followed by Australian humpback dolphins (88%) and bottlenose dolphins (84%). False killer whales and dwarf spinner dolphins had an estimated area of occurrence of 56% and 51%, respectively. There is no abundance data, and only limited distribution data for these latter two species. False killer whales have been sighted in coastal estuarine waters in the Northern Territory during the wet season (October to April) (Groom et al., 2015; Palmer et al., 2009). Information on movement and distribution of the species is limited to data collected from four individual false killer whales that were satellite tagged in Coburg in in March and April of 2014 (Palmer et al., 2017a). Over the period of seven to twelve weeks that the satellite tags transmitted, these individuals spent most time in water depths of 33-40 m, with a maximum distance of 188 km from the coast.

Killer whales and humpback whales are regarded as occasional visitors (Chatto and Warneke, 2000; Palmer and Chatto, 2013). Humpback whales that visit Northern Territory waters are at the northern extremity of the distribution of the western Australian population (Stock D). The only other record of live baleen whales is an incidental sighting of two Bryde's whales (*Balaenoptera edeni*) off Cape Arnhem. Additional cetacean species that have been recorded in the stranding record are the pantropical spotted dolphin (*Stenella attenuata*), the spinner dolphin (*Stenella longirostris*), melon-headed whale (*Peponocephala electra*)(mass stranding), short-finned pilot whale (*Globicephala macrorhyuchus*), Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*), dwarf sperm whale (*Kogia simus*), and blue whale (*Balaenoptera musculus*) (Chatto and Warneke, 2000).

There is limited information on cetacean species that occur in the Commonwealth waters off the Northern Territory and northern Western Australia. However, an indication of which species may occur in the region is provided by observer data collected between 1981-1985 in a Taiwanese gillnet

fishery that operated in the northern waters of the Australian Fishing Zone (Fig. 14). Observer coverage over this period was just over 2% of gillnet fishing effort and 319 cetacean bycatches were recorded in 407 observed gillnet sets (Harwood and Hembree, 1987). The majority (60%) of observed cetaceans that could be identified to species were bottlenose dolphins and spinner dolphins (*Stenella longirostris*) (35%). The remaining observed bycatches were 12 pantropical spotted dolphins (*Stenella attenuate*), one false killer whale and one humpback dolphin. The total estimated bycatch of cetaceans in the fishery over the observed period was 14,000 individuals for all species combined (Harwood and Hembree, 1987). Foreign fishing fleets ceased operations in Northern Australia in late 1986.

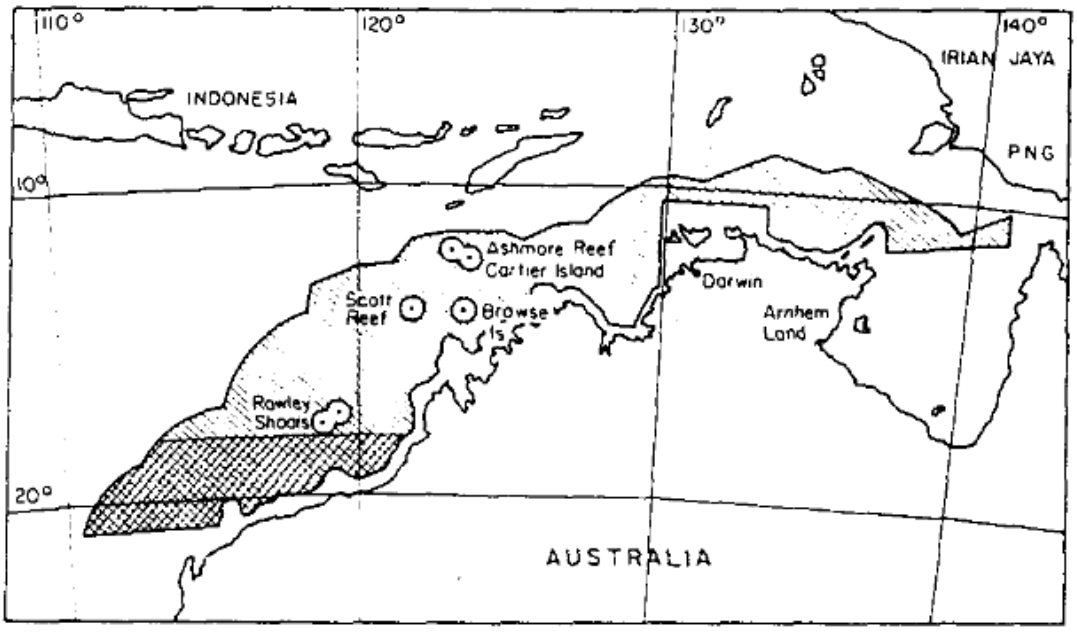


Figure 14: Map of the area fished by the Taiwanese gillnet fishery.

3.2 Northern Territory managed fisheries

Commercial fisheries in the Northern Territory are managed under the NTF Act and the NT *Fisheries Regulations 1992* (NTFR) which are is administered by the Department of Primary Industries and Resources (DPIR). All fisheries must comply with the TPCW Act, and the customary fishing rights of Aboriginal people is recognised under the NTF Act.

There are 14 commercial wild harvest fisheries in the Northern Territory. Of these nine are inshore fisheries operating within 3 nm of the coastline. The remaining five are offshore fisheries and operate from 3 nm to 15 nm out to the boundary of the Australian Fishing Zone (AFZ). Three of these fisheries, the Offshore Net and Line Fishery, Demersal Fishery, and Timor Reef Fishery, are co-managed by the Northern Territory and Commonwealth governments via the Northern Territory Fisheries Joint Authority (NTFJA), with the DPIR responsible for the day-to-day fisheries management. Interactions with TEP species and commercial fishing activities must be recorded in fishery logbooks. Information on logbook and / or observer reports of interactions with TEP species is provided in annual "Status of Northern Territory fish stocks" reports.

Three Northern Territory fisheries are seeking a comparability finding under the provisions of the US MMPA: the Offshore Net and Line Fishery, the Demersal Fishery and Timor Reef Fishery. Dugong interactions have been recorded in gillnets in the Northern Territory Barramundi Fishery which operates in coastal waters within 3 nm of the shore from February to the end of September. A total

of nine interactions, including four mortalities, were reported in fishery logbooks in 2017 (NTG, 2019).

3.2.1 Northern Territory Offshore Net & Line Fishery

The Offshore Net and Line Fishery (ONLF) targets grey mackerel (*Scomberomorus semifasciatus*), using pelagic nets, and blacktip sharks (*Carcharhinus tilstoni and C. limbatus*) using demersal and pelagic longlines. The fishery operates in an area of approximately 542,000 m^2 from the coast out to the edge of the AFZ and is managed in two zones, east and west of 136˚ 58.767 E (Fig. 15). There are, on average 10 vessels operating in the fishery with total effort per fishing season of around 600 days (NTG, 2020). Nets are shot from the stern and then attached to the bow of the vessel with both drifting in the tide until the net is hauled, and are set as near surface nets, with a floating headline and weighted footrope. Gillnets have a mesh size of 160-185 mm, a drop length of 50-100 meshes, and a maximum length of 2,000 m, although most operators use nets of 1,000 – 1,500 m in length (NTG, 2019). Nets cannot be set within 2 nm of the low water mark. Demersal and pelagic longlines can also be used in the fishery, although pelagic longlines may only be set outside of 3 nm from the shoreline (NTG, 2020). Longlines have not been used in the fishery since 2014 (NTG, 2019). The fishery is accredited under the EPBC Act until March 2022. No information on the spatial distribution of fishing effort was available.

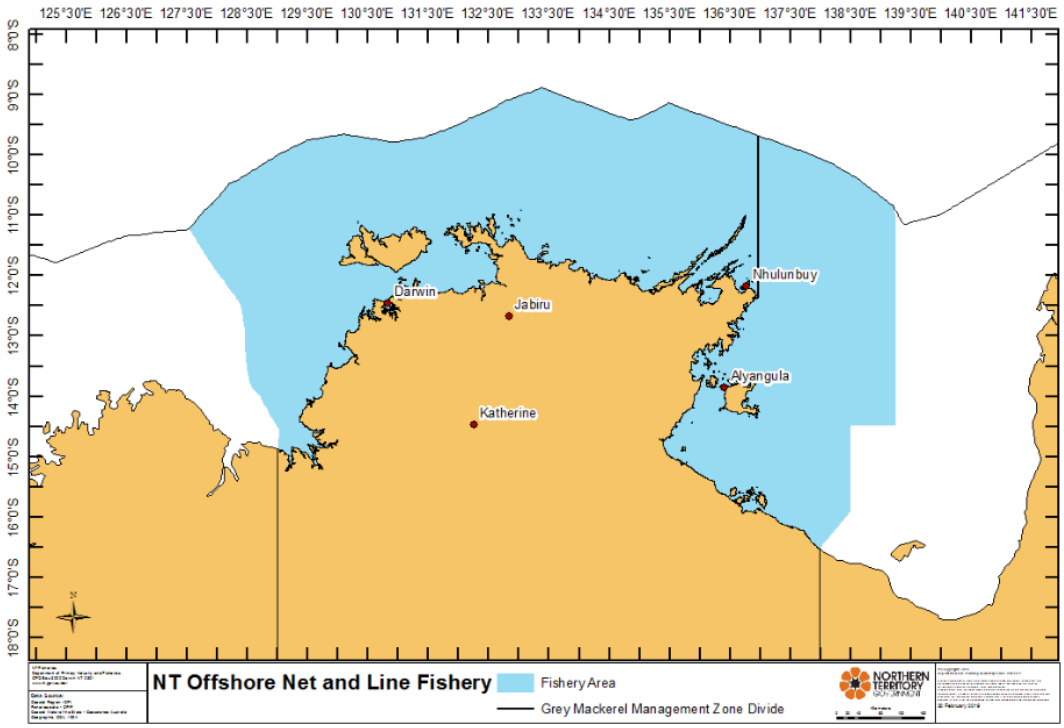


Figure 15: Area of the Northern Territory Offshore Net and Line Fishery.

Onboard observer coverage in the fishery is set at 10% (information provided by DAWE). Seven interactions with dolphins, resulting in five mortalities, occurred in the fishery between the 2014-15 and 2018-19 fishing seasons (Table 26, (NTG, 2015a, 2016a, 2016b, 2018, 2019, 2020). Dolphin interactions were not identified to species. It is assumed that all interactions were in pelagic gillnets, as longlines have not been used in the fishery since 2013 (NTG, 2019). During the period that longlines were used in the fishery, EM was required on all vessels fishing that gear, with 10% of fishing effort audited.

Table 26:. Number of dolphin interactions and fate of individuals reported in the Northern Territory Offshore Net and Line Fishery between the 2014-15 and the 2018-19 fishing seasons.

Fishing Season	Total individuals	Released Alive	Mortalities
2018-19	0	0	0
2017-18	2	1	1
2016-17	1	0	1
2015-16	2	1	1
2014-15	2	0	2

'Dolphins' were the only marine mammal group considered during an ERA of the fishery undertaken in 2020 (NTG, 2020). The risk to this group was assessed as low based on the following justifications. The species involved was the "Common Dolphin", and there was "no evidence that inshore dolphin species were being impacted by the fishery". That the "estimates for the Eastern Tropical Pacific Dolphin population are very high > 3,000,000 individuals", and that very "limited numbers" were caught in the fishery. The "Common Dolphin" mentioned in the ERA is assumed to mean the common bottlenose dolphin.

The impact of the fishery on TEP species is measured against the previous year's interactions with specific responses in the Management Strategy (DPIR, 2018). Management responses are triggered if the number of TEP species interactions increase by more than 30% from the previous year, or if more than 20% of interactions (based on fishery logbook data) are from a single operator. If the fishery-level trigger is reached, a review of fishing operations will be undertaken within six months, and a review of gear and an evaluation of the impact of that gear undertaken within 12 months. The results of this review may lead to gear being modified or abolished (DPIR, 2018). The management response for an individual operator who breaches a trigger is that the vessel can install EM, or they must have at least one additional observer trip to evaluate fishing operations. A condition of the most recent EPBC Act accreditation was that DPIR provide a review of EM auditing protocols to DAWE, and ensure the protocols are appropriate for individual operators who trigger EM requirements.

There is limited information on the spatial or temporal distribution of marine mammals in the operational areas of the ONLF, but information on cetacean species bycaught in the Taiwanese gillnet fishery that operated in the same area between 1979 and 1986 provide an indication of what species likely occur. The most frequently bycaught species recorded by observers in the fishery between 1981-1985 were bottlenose dolphins (159 individuals) and spinner dolphins (93 individuals) (Harwood and Hembree, 1987). The other cetacean species observed as bycatch were 12 pantropical spotted dolphins, one false killer whale and one humpback dolphin (Harwood and Hembree, 1987). While the nets used in the Taiwanese gillnet fishery were much longer (8 km – 16 km) than those used in the ONLF (maximum net length of 2 km), the similar manner in which the nets were fished means that cetacean species recorded as bycatch in the former have the potential to interact with the ONLF. There is no published information on the occurrence or distribution of spotted dolphins in the area of the ONLF. Movement data collected from four satellite tagged false killer showed individuals moved within the area of the ONLF over the seven to twelve week period that the tags transmitted (Palmer et al., 2017a). False killer whale bycatch has been recorded in gillnet, trawl, purse seine and longline fisheries (Baird, 2018). The observed record of a humpback dolphin being bycaught in offshore waters by the Taiwanese gillnet fishery may seem strange given the species is considered to have a coastal distribution. Humpback dolphins have been recorded around mid-shelf reefs in Queensland 50 km from the coast, and at the Montebello Islands in Western Australia which are around 80 km from the coast (Corkeron et al., 1997; Raudino et al., 2018b), and their distribution across the Arafura Sea over the continental shelf between Australia and Indonesian New Guinea is unknown (Parra and Cagnazzi,

2016).

The fishery also has the potential to interact with dugongs in Northern Territory and Commonwealth waters. No interactions with dugongs were observed or reported in the ONLF between 2013 and 2017.

3.2.2 Northern Territory Demersal Fishery

The Northern Territory Demersal Fishery (DF) targets tropical snappers (Lutjanus spp. and Pristipomoides spp.) using trawls, traps, handlines, and droplines. The area of the fishery extends from 15 nm from the coast out to the limits of the AFZ, except for the waters of the Timor Reef Fishery (TRF). Demersal trawl nets are restricted to two zones in the fishery, whilst fish traps and line gear are permitted throughout the area of the fishery (Fig. 16). Between five to ten vessels operate in the fishery, with four vessels operating trawl gear. Information on the exact characteristics of gear in the fishery could not be obtained. Since 2006, BRDs have been mandatory in all trawl nets in the Offshore Snapper Fishery (OSF), which includes the DF. The fishery was accredited under the EPBC Act until June 2020.

Interactions with TEP species are reported in annual "Status of Northern Territory fish stocks" reports, however the level of observer coverage relative to fishing effort is not reported. Table 27 provides a summary of observed interactions with marine mammals in the DF between 2013 and 2017 from these reports. Two dolphin mortalities, not identified to species were observed in 2014. The report does not specify which gear the interactions occurred in. In addition four dolphin interactions, not recorded to species, were reported in fishery logbooks in 2017 (NTG, 2019). Three were reported as mortalities and one was released alive. These were the only marine mammal interactions reported in fishery logbooks between 2013 and 2017 (NTG, 2015a, 2016a, 2016b, 2018, 2019).

Under the fishery's Management Arrangements, performance indicators with regards to TEP species are that all protected species interactions are reported, that observer data validates reporting practices, and if there is a breach of performance indicators by operator(s) a review of fishery operating practices is triggered. If there is concern for the sustainability of any TEP species component of the gear will be reviewed and modified, or abolished, to address the identified issue(s), and a review of relevant data relating to the species will be undertaken (NTG, 2012). A new management arrangement framework is being developed for the OSF, which comprise the Northern Territory DF and TRF.

The species of dolphin(s) that were observed and reported to interact with the fishery is not provided, nor is the gear type that the interaction(s) occurred in. Given the fishery operates further than 15 km from shore and, based on the species observed bycaught in the Taiwanese gillnet fishery that operated in a similar area to the DF, the species involved could have been bottlenose dolphin, spinner dolphin, spotted dolphin or humpback dolphin. Given the more offshore nature of this fishery it is unlikely to interact with Australian snubfin dolphin.

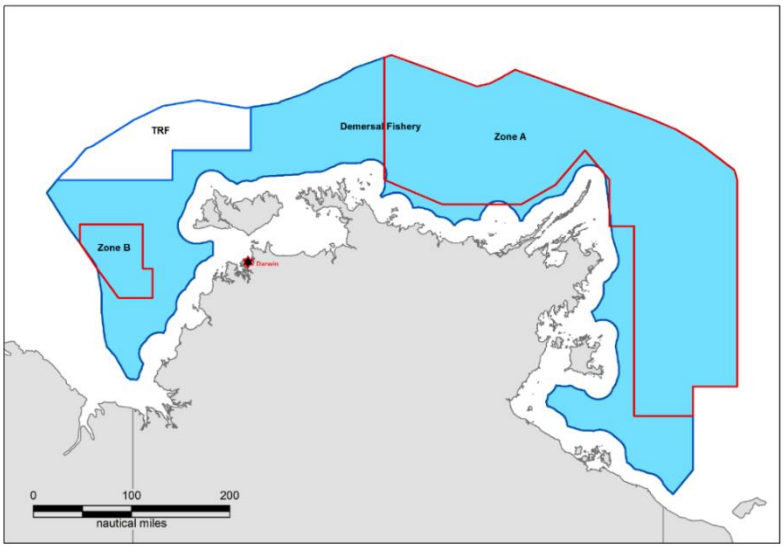


Figure 16: Area of the Northern Territory Demersal FisheryTable 27: Observed marine mammal interaction in the Northern Territory Demersal Fishery between 2013 and 2017.

Year	Observed days	No. of observed interactions with marine mammals
2017	Does not mention observer data	0
2016	Five fishing trips	0
2015	31 days	0
2014	40 days	2 dolphins, not identified to species
2013	30 days	0

3.2.3 Northern Territory Timor Reef Fishery

The TRF operates northwest of Darwin in an area of approximately 8,400 nm^2 (Fig. 17). The fishery primarily targets tropical snapper (*Lutjanus* spp. and *Pristipomoides* spp.), with most catch taken in baited fish traps, and a limit of 45 traps per licence (NTG, 2015b). There are three to six vessels operating in the fishery (DPIR, 2019b). Demersal longlines, drop-lines and handlines may also be used in the fishery, and one vessel trialled demersal trawl gear between 2014-2018. Since 2006, BRDs have been mandatory in all trawl nets in the OSF, which includes the TRF. It is unclear if a trawl vessel is still operating in the fishery. The fishery has EPBC accreditation until June 2020. Interactions with TEP species are reported in annual "Status of Northern Territory fish stocks" reports, however the level of observer coverage relative to fishing effort is not reported. The only reference to observed TEP interactions in the TRF was in 2015, with no marine mammal interactions recorded from 35 days of observed fishing (NTG, 2016b). There were no logbook reports of marine mammal interactions with the TRF between 2013 and 2017 (NTG, 2019, 2018, 2016a, 2016b, 2015a).

The TRF Policy Framework outlines a number of performance indicators, trigger points and management actions relating to interactions with TEPs (NTG, 2015b). If an operator is found to not have not reported and interaction with a protected species, that operator must arrange at least one additional observer trip to evaluate their fishing operations within one month. Additional management actions that may be taken include a review of gear in the fishery to evaluate impacts on the TEP species or ecological community, and a review of relevant data relating to the TEP species or ecological community (NTG, 2015b). A new management arrangement framework is being developed for the OSF which comprises the TRF and the DF.

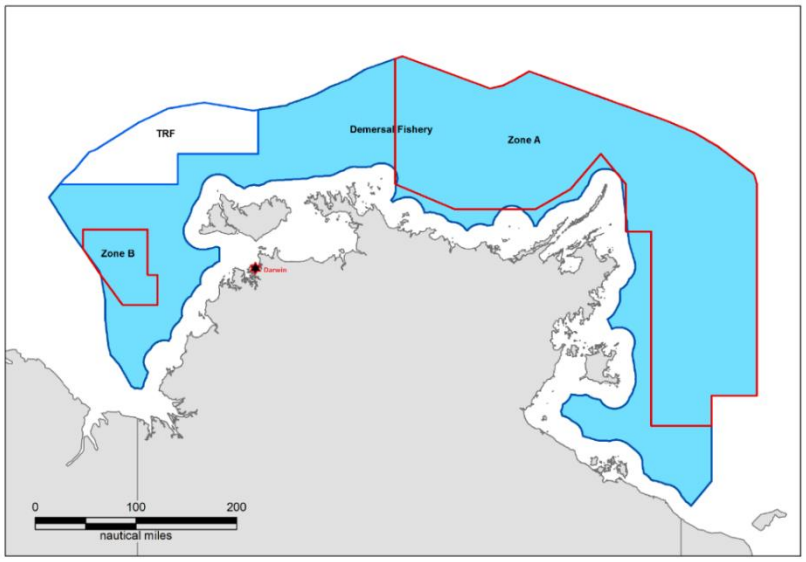


Figure 17: Map of the Northern Territory Timor Reef Fishery area. .

4 Queensland

4.1 Marine mammal occurrence

The marine coastal waters of Queensland are the largest of the State and Territories, with a coastline length, including islands, of 13,352 km and an area of 121,994 km^2 (source Geoscience Australia). The sub-tropical southeast of the State is dominated by two large embayments (Moreton and Hervey Bay), and the tropical waters north of these are dominated by the Great Barrier Reef that extends along the east coast to the Torres Strait. The Gulf of Carpentaria in the northwest of the state is a large shallow shelf that connects the Arafura Sea and Torres Strait. The Great Barrier Reef Marine Park (GBRMP) covers an area of 344,400 km^2 and extends from the northern tip of Queensland to just north of Bundaberg.

Marine mammals in Queensland are protected under the *Queensland Nature Conservation Act 1992* (QNC Act) and under the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act) within the GBRMP. A total of 37 marine mammal species (32 cetacean, one sirenian and four pinniped) have been recorded from sightings or strandings in Queensland waters (WWW.QLD.gov.au). Information on the abundance and / or distribution of most marine mammal species is lacking. No pinniped species breed in Queensland, and sightings and strandings of individuals can be considered vagrants.

4.1.1 Dugongs

Dugongs are distributed along the entire coast of Queensland, and the State waters support one of the largest dugong populations in the world (Marsh et al., 2011). The species is listed as Vulnerable under the QNC Act. Dugongs have important cultural significance for Aboriginal and Torres Strait Traditional Owner groups who have the right to hunt them under the Commonwealth NT Act and are considered as cultural keystone species.

Off the coastal waters of Queensland and the Northern Territory, the Torres Strait is one of the most important dugong habitats. The dugong harvest that occurs in this area is classified as a traditional fishery that is regulated within Australian waters by the CTSF Act and the QTSF Act. In the Torres Straits Protected Zone (TSPZ), the fishery is managed by the Protected Zone Joint Authority. In addition, culturally based management arrangements known as Dugong and Turtle Management Plans have been developed by individual communities in the Torres Strait. Hunting is prohibited in the dugong sanctuary which covers a large area (>13,000 km^2) of the Western Torres Strait. The abundance of dugongs in the Torres Strait was estimated to be 102,519 (SE ± 20,146) in 2013 (Hagihara et al., 2016). The dugong harvest is considered sustainable, based on abundance estimates, and the fact that the harvest only occurs in 5% of the area of high dugong density (Marsh et al., 2015).

Dugongs also occur in significant numbers around the Wellesley Island ground in the Gulf of Carpentaria. Within the Great Barrier Reef Marine Park (GBRMP) region, a number of Traditional Use of Marine Resources Agreements (TUMRA's) have been developed for the management of traditional resources, and to enable joint management of the reef by Traditional Owners and the Marine Park Authority. This includes the management of traditional take of culturally important species such as dugong. There are currently nine TUMRA involving eighteen Traditional owner groups. Recent genetic evidence suggests there are at least two stocks of dugong on the east coast of Queensland with a genetic break around the region of the Whitsunday's (Marsh et al., 2019). The most recent abundance estimates for these two regions are 2,822 (SE ± 600) dugongs in the southern Great Barrier Reef and 6,558 (SE ± 1141) dugongs in the northern Great Barrier Reef (Marsh et al., 2019). The abundance of dugongs in the southern Great Barrier reef was estimated to have declined by

1.46% between 2005 and 2006, and by 3.14% per annum between 2006 and 2013 in the northern Great Barrier Reef, with declines thought to be a result of seagrass habitat loss due to severe weather events (Marsh et al., 2019).

4.1.2 Cetaceans

Dolphins and whales have cultural significance for many Traditional Owner groups in Queensland, and four species of dolphin occur year-round in coastal waters: the Australian snubfin dolphin, Australian humpback dolphin, Indo-pacific bottlenose dolphin and spinner dolphin. Snubfin dolphins are generally distributed in inshore waters where their distribution overlaps with humpback dolphins. However, off the northern east coast of Queensland where there are almost continuous reef and sandflat areas, humpback dolphins have been sighted out to the outer reef, with an average sighting distance of 6.4 km from the land (Corkeron et al., 1997). Most of the available abundance estimates for dolphin species are from small geographical areas along the east coast of Queensland.

Estimates of abundance of snubfin dolphin from areas surveyed along the east coast of Queensland are 71-80 individuals in Keppel Bay, 122 individuals in Rodds Bay to Port Alma, 111 individuals in Repulse Bay and 69-133 individuals in Cleveland Bay (Brooks et al., 2019; Cagnazzi, 2010; Cagnazzi et al., 2013; Parra et al., 2006). Estimates of abundance of humpback dolphin from surveyed areas along the east coast of Queensland are 150 individuals in the Great Sandy Strait Marine Park, 122 individuals from Rodds Bay to Port Alma, and 34-86 individuals in Cleveland Bay (Brooks et al., 2019; Cagnazzi et al., 2013, 2011; Parra et al., 2006). Both species generally occur in relatively small populations that are geographically separated from each other.

While sightings of Indo-Pacific bottlenose dolphins have been recorded along the coast of Queensland, estimates of abundance are primarily from the southeast coast of the State. These are 193 (95% CI = 181–207) and 446 (95% CI = 336–556) individuals for South and North Moreton Bay, respectively, 895 (± SE 74) individuals off the seaward coast of North Stradbroke Island, 70 in the Great Sandy Strait and Hervey Bay, and 50 individuals in Keppel Bay (Ansmann et al., 2013; Chilvers and Corkeron, 2003; Woinarski et al., 2014). There are no abundance estimates for spinner dolphins in Queensland waters.

Between 1996 and 2012, entanglements of 46 bottlenose dolphins (31 mortalities) (*Tursiops* spp.), 27 humpback dolphins (24 mortalities), 16 snubfin dolphins (13 mortalities) and 17 spinner dolphins (16 mortalities) were recorded in nets or drumlines that were deployed as part of the Queensland Shark Control Program (Meager and Sumpton, 2016). Entanglement of 151 common dolphins (136 mortalities), and 80 dolphins (68 mortalities) not identified to species, were also recorded in shark nets over the same period (Meager and Sumpton, 2016). There is no information on the distribution or abundance of these species in Queensland waters. Shark nets have been replaced with drumlines in some areas. For example, drumlines replaced shark nets in the Cairns area in 2013, the region where 54% of the snubfin dolphin mortalities were recorded between 1996 and 2012 (Meager and Sumpton, 2016). Between 2013 and 2020, entanglements of 21 bottlenose dolphins (19 mortalities), 56 common dolphins (47 mortalities), two spinner dolphins (one mortality) and four humpback dolphins (all mortalities) were recorded in the Queensland Shark Control Program.

Humpback whales are present in Queensland between June and September to calve and breed in the Great Barrier Reef. The species is listed as Vulnerable under the QNC Act. The core breeding area is south of the Whitsundays to an area offshore of Mackay (Curnock et al., 2019). Humpback whales that calve and breed in Queensland belong to the eastern Australian humpback whale subpopulation (Stock E1), that migrates annually from Antarctica along the eastern coast of Australia. There is a low level of interchange between the eastern and western Australian subpopulations of humpback whale (Kaufman et al., 2011), with low but significant genetic differentiation between the two breeding populations (Schmitt et al., 2014). Movements of individuals between the eastern Australian E1 stock

and the Oceania E2 stock have also been recorded (Garrigue et al., 2007). The estimated population growth rate for Stock E1 is 10.6%-11% per annum with the most recent abundance estimate of 24,545 individuals (95% CI = 21,631–27,851) (Noad et al., 2019). During northward migration along the Queensland coast, 90% of whales pass within 5 km of North Stradbroke Island (Noad et al. 2019). A study of 214 incidents with humpback whales that were recorded between 1989 and 2014, found that 37% involved gear attributed to the Queensland Shark Control Program and 27% involved fishing gear. The majority (75%) of entanglements were reported in the Gold Coast region of the southeast. Between 2015 and 2020, 32 humpback whale entanglements, resulting in one mortality, were recorded in gear deployed by the Queensland Shark Control Program. A further seven entanglements, mostly involving trap gear, were reported in Queensland waters in national reports to the International Whaling Commission (www.iwc.int).

Dwarf minke whales are seasonally present along the east coast of Queensland, and aggregate in the northern Great Barrier Reef northeast of Port Douglas, each year between April and September. Peak sightings occur in June and July. The aggregation area is the site of swim-with-whales tourism. Photo-ID from swim-with-tour boats provide baseline estimate of abundance of dwarf minke whales in the area where they operate. Using open population models the estimate of abundance was 789 (SE ± 216) individuals in 2008 (Sobtzick 2010 cited in (Curnock et al., 2019). Satellite tracking data showed individuals used habitats west of the Ribbon Reefs and around Lizard Island before migrating southward along the Australian east coast (Birtles et al., 2015). South of the Great Barrier Reef, whales travelled at a mean distance of 22 km from the coast, predominantly over the continental shelf. After crossing Bass Strait a number of whales spent some time potentially foraging south east of King Island, Tasmania (Birtles et al., 2015).One whale migrating along the east coast of Tasmania until its tag stopped transmitting when it was off Bruny Island (Birtles et al., 2015). Migratory tracks into subantarctic waters were obtained for three individuals, and a photo-ID match of one of the tagged individuals was obtained the subsequent year in the Great Barrier Reef.

The southern right whale is listed as Least Concern under the QNCA Act status. As the species continues to recover post-whaling, their austral winter range along the east coast of Australia has extended, including sightings of individuals in southern Queensland, with occasional cow-calf pairs sighted in Moreton Bay, and individuals sighted as far north as Hervey Bay (Lanyon and Janetzki, 2016).

4.2 Queensland managed fisheries

Queensland fisheries are currently going through a large structural reform. This includes major changes to fisheries legislation in September 2019. The key pieces of legislation are the *Queensland Fisheries Act 1994,* the Fisheries (General) Regulation 2019, the Fisheries (Commercial Fisheries) Regulation 2019, the Fisheries Declaration 2019, and the Fisheries Quota Declaration 2019. The 'Queensland Sustainable Fisheries Strategy: 2017-2027' was released in 2017 and outlines actions to be delivered across ten reform areas. These include improving monitoring and research, undertaking ERAs, and developing harvest strategies. The ERA process in Queensland is a modified version of the ERAEF framework used to assess Commonwealth commercial fisheries. Vessel tracking, via satellite monitoring, became mandatory on all commercial primary and dory vessels in Queensland in January 2019.Three fisheries in Queensland are managed jointly by the State and Commonwealth government by the Queensland Fisheries Joint Authority (QFJA). These are the Gulf of Carpentaria Inshore Fin Fish Fishery, the Gulf of Carpentaria Line Fishery, and the Gulf of Carpentaria Developmental Fin Fish Trawl Fishery. Only one commercial fishery, the East Coast Otter Trawl Fishery, is seeking a comparability finding under the MMPA.

Since 2002, commercial fishers are required to complete a species of conservation interest (SOCI) logbook for any interaction with a protected species. There were 101 interactions with marine

mammal recorded in fishery logbooks between 2006 and 2019. These included 25 mortalities, and five individuals recorded as injured. Three species accounted for 82% of records, these were dugongs (38%), humpback whales (24%) and 'offshore' bottlenose dolphins (20%). More than half (57) of interactions were reported in gillnet gear and consisted of 38 dugongs (18 mortalities), six humpback whales, four Australian snubfin dolphins (three mortalities), four 'offshore' bottlenose dolphins (three mortalities), two false killer whale mortalities, and one report of an interaction with an Australian humpback dolphin that was released alive. The two commercial gillnet fisheries in Queensland are the Gulf of Carpentaria Inshore Fin Fish Fishery, and the East Coast Inshore Fin Fish Fishery.

Almost a third (29%) of interactions were reported in line gear and involved 30 individuals, all reported to be released alive. Of these, 15 were 'offshore' bottlenose dolphins, nine were humpback whales (two released injured) and six were minke whales. The remaining logbook reported interactions over this period were six interactions with humpback whales all released alive (four with crab pots, and two with dilly fishing), one interaction of a short-finned pilot whale with dilly fishing that was released alive and one interaction of a dugong in a ring net that was released alive. Three 'dolphin' interactions (two mortalities) were also reported in trawl gear in the East Coast Otter Trawl Fishery, further information on these interactions is provided in the section below relating to the fishery.

Dugongs are also incidentally caught in nets used by the Queensland Shark Control program, with a total of 18 dugong mortalities recorded between 2001 and 2020 (www.qld.gov.au). Queensland fisheries is investigating the potential to replace shark control nets with drumlines as a means of reducing bycatch and entanglements of non-target species. Since 2019, there are only two shark control nets used in the GBRMP region.

4.2.1 East Coast Otter Trawl Fishery and River and Inshore Beam Trawl Fishery

The East Coast Trawl Fishery (ECOTF) is a multi-species trawl fishery that targets prawn species, saucer scallops, Moreton Bay bugs and squid. Prawns represented 84% of the total fishery catch between 2010 and 2019 (DAF, 2021). The fishery operates in all tidal waters between Cape York and the New South Wales border, out to the offshore constitutional settlement boundary. The ECOTF operates year-round, but there are several permanent temporal and spatial closures. Fishing is prohibited north of 22˚S between 15 December and 1 March, and south of 22˚S between 20 September to 1 November, with specific fishing seasons for different target species. The waters of the Moreton Bay Marine Park, the Great Sandy Strait Marine Park, and areas of the Great Barrier Reef World Heritage Area are closed to trawling.

Trawl nets are rigged in either triple or quad net arrangements, depending on the target species, and since 2002, the use of TEDs and BRDs is mandatory. Otter trawl nets must be no longer than 32.5m in length in Moreton Bay and specified inshore areas, no longer than 88m when principally targeting fish, no longer than 109m when principally targeting saucer scallops and bugs, and 184m when fishing in the 'deep water net area'. Specified minimum mesh sizes depend on the area where fishing is undertaken, with a mesh size range of 28-85mm. As part of recent management changes, the otter trawl fishery is now divided into five trawl management regions: southern inshore, southern offshore, central trawl, northern trawl, and Moreton Bay. In 2019, effort in the ECOTF amounted to 35,780 trawl days undertaken by 299 active licences (DAF, 2021). Most effort (51% of trawl days) was in the Great Barrier Reef World Heritage Area, with 37% in 'other east coast', and 12% in Moreton Bay.

The River and Inshore Beam Trawl Fishery (RIBTF) targets prawn species using beam trawl gear. There are currently 50 vessels working in the fishery. The fishery operates in Queensland coastal waters, including several river estuaries, with effort predominantly in southern Queensland. Both

TEDs and BRDs are required in the fishery when operating outside rivers or creeks. There are several gear restrictions, depending on the area of operation, and boats are restricted to 9 m in length. In addition to permanent area closures in waters of the Woongarra Bay, Hervey Bay, Great Sandy Straits Marine Park, Moreton Bay Marine Park and GBRMP, daytime and weekend closures apply in estuaries and in some inshore areas.

As part of fishery reforms, several draft harvest strategies have been developed for different sectors of the ECOTF. The timeline for the implementation of harvest strategies was September 2021, with a Protected Species Management Strategy to be developed in 2021-2022 (DAF, 2021).

Cetaceans and dugongs were considered as part of an initial risk assessment of the ECOTF on the GBRMP (Pears et al., 2012). The report concluded that cetaceans have negligible direct interactions with the fishery, based on the available information at the time. This was there were no reported interactions in fishery logbooks in 2008 or 2009, and that none of the cetacean mortalities (~15 per year), or dugong mortalities (~45 per year), recorded in the Queensland Marine Wildlife Stranding and Mortality Database between 2000 and 2006 were attributed to trawl nets.

The most recent ERA in the ECOTF and RIBTF was undertaken in 2015 and did not include any marine mammal species (Jacobsen et al., 2018). This ERA was undertaken prior to the Fisheries Queensland Ecological Risk Assessment Guideline that was published in 2018. The Fisheries Queensland CFISH Database shows that between 2010-2019 the ECOTF recorded one interaction with a dolphin (species unspecified) in 2016, one interaction with an 'offshore bottlenose dolphin' in 2017, and one interaction with a short-beaked common dolphin in 2018 (DAF, 2021). The nature of these interactions, or fate of these individuals was not reported. Over the same period 9,436 interactions with sea snakes, 43 interactions with leafy sea dragons, 43 interactions with sawfish, and 43 interactions with marine turtles were recorded (DAF, 2021). The majority (85%) of individuals were released alive, 8% were reported as injured and 7% as dead.

Several marine mammal species occur in the area of the fishery. Dugongs are distributed along the coast of Queensland, and Australian snubfin, Australian humpback and Indo-Pacific bottlenose dolphins occur in inshore waters. There are resident populations of Indo-Pacific bottlenose dolphins and Australian humpback dolphins in Moreton Bay.

In the late 1990's Indo-Pacific bottlenose dolphins in southern Moreton Bay were observed to have formed two distinct social groups, with one group foraging in association with trawlers and feeding on discarded bycatch (Chilvers and Corkeron, 2001). However, with the reduction of trawling by around 50% in the subsequent decade, the separation of social groups into 'trawler' and 'non-trawler' dolphins has disappeared (Ansmann et al., 2012). Indo-Pacific humpback dolphins have also been observed to forage in association with trawlers in Cleveland Bay and Keppel Bay, Queensland (Cagnazzi, 2010; Parra, 2006).

5 New South Wales

5.1 Marine mammal occurrence

The marine coastal waters of New South Wales are the smallest of the State and Territories, with a coastline length, including islands, of 2,101 km, and an area of 8,802 km^2 (source Geoscience Australia). The marine environment ranges from temperate waters in the south to subtropical waters in the north, with tropical water ingress into northern shelf waters brought by the East Australian Current.

Marine mammals in New South Wales waters are protected under the *National Parks and Wildlife Act 1974* (NPW Act) and the *New South Wales Biodiversity Conservation Act 2016* (NSWBC Act). Seven pinniped, 32 cetacean and one sirenian species have been recorded from sightings and or strandings in New South Wales (Smith, 2001). Many of these species are considered rare or vagrant, or their occurrence in New South Wales represents either the very northern or southern extremities of their range. The Temperate East Bioregional Plan describes the marine environment and conservation values of Commonwealth waters between the southern boundary of the GBRMP in Queensland to the Bermagui in southern New South Wales (DSEWPaC, 2012a). The plan lists 40 species of cetacean, two pinniped species and the dugong as occurring in the region (DSEWPaC, 2012a).

5.1.1 Cetaceans

Dolphins and whales have cultural significance for many Traditional Owner groups in New South Wales. Bottlenose dolphin species are one of the two most frequently recorded small cetacean in strandings data (Lloyd and Ross, 2015). Both common bottlenose dolphins and Indo-Pacific bottlenose dolphins are present, but abundance data are only available for the latter (Table 28). Several communities are present year-round along the New South Wales coast, with resident or semi resident groups occurring in several bays and estuaries. Genetic analyses have revealed considerable differentiation between most of the resident dolphin communities, with at least three distinct subpopulations in northern New South Wales, Port Stephens, and southern New South Wales (Möller et al. 2007; Wiszniewski et al. 2010). Nine Indo-Pacific bottlenose dolphin and ten common bottlenose dolphin mortalities were recorded in New South Wales shark control nets between 2012 and 2019 (www.sharksmart.nsw.gov.au).

Table 28: Abundance estimates for Indo-Pacific bottlenose dolphins in New South Wales

Location	Source	Year of Estimate	Estimate
Byron and Ballina coast	Hawkins 2007	2003-2005	865 (95% CI = 861–869)
Richmond River	Fury and Harrison, 2008	2003-2006	34 (95% CI = 19–49)
Clarence River	Fury and Harrison, 2008	2003-2006	71 (95% CI = 62–81)
Port Stephens	Möller et al., 2002	1999–2000	143 (95% CI = 132–165)
Jervis Bay	Möller et al., 2002	1998–1999	61 (95% CI = 58–72)

Common dolphins were the second most frequently recorded small cetacean to strand in New South Wales (Lloyd and Ross, 2015). They have been observed present along the coast in all months (Smith,

2001), but there are no abundance estimates for the species in either State or Commonwealth waters. A recent Australian / New Zealand study found three distinct regional populations; the southern coast of Australia, the eastern coast of Australia, and a New Zealand and Tasmania population (Barceló et al., 2021). Within New South Wales waters fine scale spatial genetic structure along the coast coincides with oceanographic features (Moller et al., 2007). Between 2013 and 2019, 27 common dolphin mortalities were recorded in New South Wales shark control nets. The New South Wales Shark Meshing (Bather Protection) Program operates under a Joint Management Agreement and Management Plan under the *Fisheries Management Act 1994* (NSWFM Act). The Management Plan outlines trigger points for 'minimising the impact to non-target and threatened species'. In 2019-2020 this trigger point was reached, when seven mortalities were recorded. Pingers (both 10 kHz and 70 kHz) have been trialled on shark control nets but did not eliminate dolphin entanglements. The 2019-20 'Trigger Point Review Report' recommended further investigation into alternative dolphin deterrent devices to reduce dolphin interactions, or the use of SMART drumlines as an alternative to shark control nets (Regional NSW, 2020)

False killer whales were the next most frequently recorded small cetacean in strandings data. However, 50 of the of the 65 records were from a single mass stranding at Seal Rocks in the mid north coast (Lloyd and Ross, 2015). There are very few sighting records for the species, and no information on their abundance in State or Commonwealth waters off New South Wales. Although generally considered oceanic, there are locations where distinct subpopulations utilise both shallow and deep waters either seasonally, or throughout the year (Baird, 2018; Zaeschmar et al., 2014).

Humpback whales are listed as Vulnerable under the NSWBC Act and are present in State waters during northward (May to August) and southward (August to October) migrations, to and from calving and breeding grounds. These whales belong to the eastern Australian humpback whale subpopulation (Stock E1), with an estimated abundance of 24,545 individuals (95% CI = 21,631–27,851) in 2015 (Noad et al., 2019). During the northward migration, humpback whales are generally closer to shore, and travel along a narrower migration corridor than during their southern migration (Pirotta et al., 2020).

Humpback whales were one of the two species most frequently reported entangled in New South Wales between 2007 and 2013 (Lloyd and Ross, 2015). Since 1994, 255 humpback whale entanglements have been recorded in New South Wales waters (OceanWatch Australia, 2019). An assessment of materials involved in entanglements, identified gear used in New South Wales demersal fish trap, Spanner Crab, lobster trap, and demersal set line fisheries, as well as shark mitigation gear. Three entanglements (one mortality) were reported in New South Wales shark control gear between 2012 and 2019 (www.sharksmart.nsw.gov.au). Entangled whales can carry gear from other areas, and sources of entanglement material not identified as originating in New South Wales included interstate fishing gear, gear of unknown origin, and Queensland shark mitigation gears (OceanWatch Australia, 2019).

Southern right whales are listed as Endangered under the NSWBC Act and occur seasonally in New South Wales coastal waters during the austral winter. Although the numbers of whales sighted annually currently low, it is anticipated that the species will continue to recolonise coastal bays as its population continues to recover post-whaling (Allen and Bejder, 2003; DSEWPaC, 2012e; Pirotta et al., 2020).

Blue whales are listed as Endangered under the NSWBC Act. The migratory routes of pygmy blue whales off the east coast of Australia are unknown, with low records of strandings or sightings in New South Wales (Lloyd and Ross, 2015; Pirotta et al., 2020). It is suggested that Tasman-Pacific blue whales may utilise the Tasman Sea throughout the year, as vocalisations attributed to this 'population' have been frequently detected along the east coast of Australia (COA, 2015b).

Dugongs, which are listed as Endangered under the NSWBC Act, are seen occasionally in northern New South Wales, with the closest core area for the species being in Moreton Bay in southern Queensland.

The Australian humpback dolphin was listed as Vulnerable under the NSWBC Act but was removed from the listing in 2002 on the basis that there was no evidence that the species regularly occurs in New South Wales waters, and any sightings or strandings should be considered as vagrants.

5.1.2 Pinnipeds

Australian fur seals and New Zealand fur seals are both listed as vulnerable under the NSWBC Act. Populations of both species continue to recover from past exploitation (McIntosh et al., 2022; Shaughnessy et al., 2015). However, an ongoing decline in the overall pup production of Australian fur seals has been recorded since 2007 (McIntosh et al., 2022, 2018), with declines generally occurring at breeding sites north of Tasmania (McIntosh et al., 2022).New South Wales is the edge of the range for Australian fur seals, . Montague Island, which previously categorised as a haul-out site with occasional pupping, is now a breeding colony, with 20 pups born in 2013-14 (McIntosh et al., 2014). New Zealand fur seals also breed at Montague Island, with 37 pups recorded in the 2013-14 breeding season (McIntosh et al., 2014). There is very little information on the movement patterns of both species in New South Wales waters. Eleven adult male New Zealand fur seals and four adult male Australian fur seals were fitted with satellite tags near Jervis Bay (Salton et al., 2021). Whilst they remained within the New South Wales region, Australian fur seal foraging trips were concentrated in shelf waters, whilst New Zealand fur seals foraged in both shelf and pelagic waters (Salton et al., 2021).

5.2 New South Wales managed fisheries

Commercial fisheries in New South Wales are managed under the NSWFM Act which is administered by the New South Wales Department of Primary Industries (DPI). Aboriginal cultural fishing in New South Wales is managed through the Aboriginal Cultural Fishing Interim Access Arrangement.

In 2005, DPI implemented mandatory reporting of TEP species interactions for all commercial fisheries. Environmental Impact Statements (EIS) and Fishery Management Strategies are prepared for each of the main commercial fisheries. In addition, under the *Marine Estate Management Act 2014* the Marine Estate Management Authority produced a Threat and Risk Assessment Report (TARA) for the New South Wales Marine Estate (DPI, 2017a), which includes an assessment of all commercial fisheries. The TARA considers the New South Wales Marine Estate in three major regions: Northern Region (Tweed River to Port Stephens), Central Region (Hawkesbury Shelf Bioregion) and Southern Region (Shell Harbour to the Victorian border).

There are eight commercial marine fisheries in New South Wales, an Inland Restricted Fishery, and occasional Developmental Commercial Fisheries. Five of these fisheries are seeking a comparability finding under the new MMPA regulations. The New South Wales Lobster fishery has already been classified as Exempt under the MMPA assessment.

5.2.1 Estuary General Fishery

The New South Wales Estuary General Fishery (EGF) is a multi-gear fishery that operates in 76 estuaries, with the majority of catch taken from ten estuaries (DPI, 2017a). Although a multi-species fishery, the most frequently caught species is sea mullet (*Mugil cephalus*). Access to the EGF is limited to shareholders, with 588 participants. Within each estuary the use of gear type is subject to a range of temporal and spatial closures. Most fishing effort involves ‘meshing’ nets and haul netting (DPI, 2017a). The maximum boat length is 10 m, and meshing nets have maximum length of 725 m

and a minimum mesh size of 80 mm. The maximum headline length of hauling nets used to target finfish species is 375 m, with a minimum mesh size of 80 mm on the wings. The use of hauling nets to target smaller species such as pilchard and anchovy is limited to specific rivers. Prawn hauling nets have a maximum length of 40 m and prawn seine nets have a maximum length of 140 m. Both methods have a minimum and maximum mesh size of 30 mm and 36mm. Traps are used to catch fish, crab, and eel.

More than half (65%) of the State-wide catch in the fishery is taken in the northern region, with 70% taken from five estuaries: the Clarence, Wallis Lake, Port Stephens, Richmond, and Myall Lakes. The central region accounts for 27% of the State-wide catch with most catch taken from four estuaries (Hawkesbury, Tuggerah Lake, Hunter, and Lake Illawarra). Most of the catch in the southern region is taken from one estuary (Shoalhaven and Wallaga Lake) (DPI, 2017a). The fishery has approval under the EPBC Act until March 2028.

Three marine mammal species were considered as part of the EIS for the fishery: the humpback whale, southern right whale and Indo-Pacific humpback dolphin (since reclassified as the Australian humpback dolphin) (NSWF, 2001). The EIS concluded the EGF would not have an adverse effect on the marine mammal species considered, but noted that humpback dolphins could be at risk of direct capture in northern estuaries (NSWF, 2001). The recorded southern range limit of the Australian humpback dolphin is the border between New South Wales and Queensland (Parra and Cagnazzi, 2016), and the species is no longer listed under the NSWBC Act as there was no evidence that it regularly occurs in New South Wales waters. Resident or semi-resident populations of Indo-Pacific bottlenose dolphins have been recorded in several estuaries where the EGF operates (Table 28)

No interactions with marine mammals were reported in fishery logbooks between 2012 and 2016 (DPI, 2017b). There has been some observer coverage in the fishery. During a study investigating bycatch in gillnet gear in the EGF, no interactions with any marine mammal were recorded from 265 gillnet sets that were observed between January and December 2001 across six estuaries, although ‘dolphins’ were observed in estuaries (Gray et al., 2003). Reports of one ‘dolphin’ injury in mesh gear in 2017, and one ‘mammal’ released unharmed from a prawn net in 2018 were provided to the project by DAWE.

5.2.2 Estuary Prawn Trawl Fishery

The Estuary Prawn Trawl Fishery (EPTF) uses demersal otter trawls to target school prawns (*Metapenaeus macleayi*) and eastern king prawn (*Melicertus plebejus*), as well as a number of squid species. The Clarence and Hunter Rivers and Port Jackson are closed to prawn fishing during winter, and BRD are mandatory in all trawl nets (Fig. 18). The fishery has approval under the EPBC Act until March 2028.

A specified goal under the management plan for the fishery is “To promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary Prawn Trawl Fishery”, which includes undertaking a risk-based assessment of the fishery (NSWF, 2003).

Three marine mammal species were considered as part of the EIS for the fishery: the humpback whale, southern right whale and Indo-Pacific humpback dolphin (NSWF, 2002). The EIS concluded the EPTF would not have an adverse effect on the marine mammal species considered (NSWF, 2002). No interactions with marine mammals were recorded in this fishery during scientific studies conducted in the 1990’s (Ganassin and Gibbs, 2005). No interactions with marine mammals were reported in fishery logbooks between 2012 and 2016 (DPI, 2017c).

Indo-Pacific bottlenose dolphins are commonly sighted in New South Wales estuaries, however abundance data are only available for one estuary, the Clarence river, where the resident population was estimated to be 71 (95% CI = 62-81) individuals from data collected between 2003-2006 (Fury and Harrison, 2008). Bottlenose dolphins have been recorded associating with prawn trawls in New South Wales, including removing catch from the trawl codend (Broadhurst, 1998).

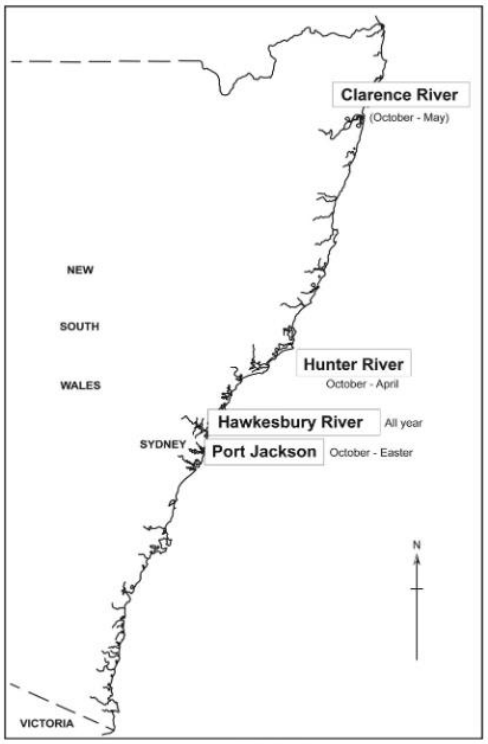


Figure 18: Location of the four estuaries in the New South Wales Estuary Prawn Fishery.

Ocean Hauling Fishery

The Ocean Hauling Fishery (OHF) operates on specified ocean beaches and estuaries in New South Wales. It targets schooling fish using beach set hauling nets and purse seine nets. The main species include sea mullet, salmon, sardines, and blue mackerel. Haul nets may not be used on weekends or public holidays, garfish nets are restricted year-round, and all other beach hauling nets are restricted from November to February. The fishery has approval under the EPBC Act until March 2028.

The New South Wales Purse Seine Industry Code of Practice has several guidelines that relate to interacting with TEP species (www.dpi.nsw.gov.au). The presence or absence of TEP species should be assessed prior to deploying and hauling the purse seine net. If TEP species are detected within the purse seine, one or more mitigation measures outlined in the Code of Practice must be implemented. These include releasing the individual, either by physical removal or terminating the shot. The Code of Practice mentions 'seals and sea lions' but not the species involved. It specifies that unless 'seals or sea lions' interacting with the purse seine appear to be in distress, then the shot does not have to be abandoned as 'both enter and exit purse seine nets of their own free will'. Interactions with free swimming 'seals or sea lions' that swim away uninjured from the net, and do not require physical removal from the net, do not need to be reported, although the event should still be logged. Dolphins and seals have been observed feeding off catch or discards from haul nets in New South Wales (Ganassin and Gibbs 2005). There are also anecdotal reports of seals depredating catch from purse seines and damaging nets (Stewardson, 2007). No interactions with marine mammals were reported in fishery logbooks between 2012 and 2016 (DPI, 2017d), and no interactions with marine

mammals were observed during surveys of ocean haul netting from beaches in New South Wales (MRAG 2005 cited in (DPI, 2017a).

5.2.4 Ocean Trap and Line Fishery

The Ocean Trap and Line fishery (OTLF) operates year-round in New South Wales continental shelf and slope waters, and adjacent Commonwealth waters out to the 4000 m isobath (Fig. 19). It is separated into three sectors, spanner crab net, ocean line and fish trap. The spanner crab fishery is subdivided into a Northern and Southern Zone. The ocean line sector is subdivided into two zones, east and west of the 183 m depth contour. Each fisher has a maximum of 40 spanner crab nets, with recent effort around 650 fishing days. The OTLF trap sectors target several finfish species using demersal fish traps and a variety of line and hook gear including trolling and setlines. Targeted groups include sharks, snapper, trevalla, and kingfish. There are several gear limits or restrictions in the fishery, including the mandatory use of circle hooks on all set lines. The fishery has approval under the EPBC Act until July 2021.

Figure 19: Map showing the area of the Ocean Trap and Line fishery (OTLF), including Marine Parks, Marine Bioregions, and critical habitats for grey nurse sharks. Figure reproduced from the Fisheries Management Strategy for the OTLF (DPI, 2006a).

An observer program in the ocean line sector of the fishery in 2007-2009 recorded one interaction with a marine mammal from 1.1% observed handline effort (142 days), 2.2% set/trotline effort (88 days), and 3.1% dropline effort (77 days)(Macbeth and Gray, 2015). The interaction involved a humpback whale that briefly made physical contact with a handline. Dropline and handline fishers in the OTLF have previously reported depredation of catch by seals (Hickman 1999, cited in Ganassin and Gibbs, 2005). An observer survey of line fishing in the West Zone (west of the 183 m depth contour) of the OTL commenced in September 2019, with no marine mammal interactions observed in 275 trips to June 2021 (DPI, 2021). Management strategies to minimise the impact of the OTLF on the marine environment, include a prohibition of bottom set lines with wire trace line in waters

within 3 nm from the coast, fishery closures to protect grey nurse sharks (*Carcharias taurus*) and the collection of information on the number of fish traps lost during fishing operations. Principles listed under the code of practice for the fishery include using the shortest rope possible for head gear to reduce the risk of entanglements, and to cease fishing immediately if a marine mammal is captured.

The demersal fish trap sector had 165 shareholders in 2016. The majority (75%) of recent effort was undertaken by 24 fishers, with 40% of catch (by value) landed between July and September (OceanWatch Australia, 2019). A maximum of 30 pots can be fished at one time. Between 2007 and 2016, 43 entanglements of humpback whales in trap gear were recorded in New South Wales, with most entanglements identified as being with gear from the OTLF, although some were also attributed to the New South Wales commercial lobster fishery and recreational trap gear (DPI, 2017a). An 'East Coast Whale Entanglement Mitigation Program' has been developed to respond to this issue. Two projects are currently underway to mitigate whale entanglement in the OTLF, these are funded through the Australian Government's National Landcare Program and the Australian Government Marine Park Fisheries Assistance Extension Program (OceanWatch Australia, 2019). Methods to mitigate whale entanglements in the OTLF include the use of 'weak ropes' on demersal fish traps, and the use of neutral or negatively buoyant rope on spanner crab fishing gear (OceanWatch Australia, 2019). The New South Wales commercial lobster fishery has trialled several strategies to reduce the amount of vertical rope and floats in the water column including acoustic and galvanic time release devices and grappling configurations (Ocean Watch Australia, 2019).

Between 2016 and 2020, Australia's annual national reports to the International Whaling Commission recorded a further 94 humpback whale entanglements, and one southern right whale entanglement, in New South Wales waters (www.iwc.int). Entanglements were reported by both fishers and members of the public, with gear types reported as pot gear, hook and line gear, miscellaneous or unknown. One known mortality of an entangled whale was reported.

No interactions have been recorded between seal species and the OTLF, although issues with seals taking bait and depredating catch from traps were reported by fishers on the south coast in the late 1990's (Hickman 1999, cited in Ganassin and Gibbs, 2005).

5.2.5 Ocean Trawl Fishery

The Ocean Trawl Fishery (OTF) uses demersal otter trawl gear to target fish and prawns in ocean waters off New South Wales (Fig. 20). North of Barrenjoey Headland the fishery extends out to the 4000 m depth contour. South of Barrenjoey Headland the Southern Fish Trawl Restricted Fishery which is part of the OTF, targets fish using demersal otter trawls and Danish-seine gear in waters out to 3 nm (DPI, 2017e). BRD are mandatory in demersal otter trawl nets. The OTF has approval under the EPBC Act until July 2021.

Four marine mammal species were considered as part of the EIS for the OTF. The risk from the fishery to the Australian fur seals, New Zealand fur seals, and humpback whales was assessed as low to medium, and for sperm whales the risk was assessed as low (NSWF, 2004). Since 2005, it has been mandatory to report all interactions with TEPS in the fishery. Between 2012 and 2016, one New Zealand fur seal mortality was reported in a fish trawl operation (DPI, 2017e). A 'recent' observer program conducted by the DPI in the OTF recorded three seal mortalities (species not identified) from 65 days or 8% of fishing effort (DPI, 2017a).

Interactions between 'seals' and the OTF were recorded in the late 1990's. A total of two seals were observed captured from 897 observed tows off Ulladulla and 27 seals were caught from 1,109 tows off Eden, southern New South Wales (G. Liggins *pers. comm*. cited in Stewardson, 2007). The mortality rate of seals was unknown. Bottlenose dolphins have also been observed foraging in association with prawn trawls in this fishery (Broadhurst, 1998). There is a single record of a

bottlenose dolphin (species not specified) being caught and released alive from a trawl net off northern New South Wales (Waples 2005 cited in (Ganassin and Gibbs, 2005).

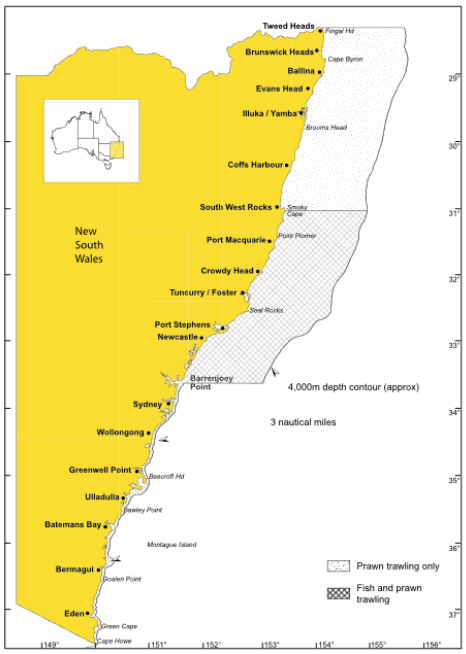


Figure 20. Map showing the area of the Ocean Trawl Fishery

6 Victoria

The marine coastal waters of Victoria are the second smallest of the State and Territories, with a coastline length, including islands, of 2,515 km and an area of 10,213 km^2 (source Geoscience Australia).

Marine mammals in Victoria are protected under the *Wildlife (Marine Mammal) Regulations 2019* and the *Wildlife Act 1975* (VW Act). The Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) provides for the listing of threatened species. Six pinnipeds and 31 cetacean species have been recorded from sightings or strandings in Victoria. The South East Marine Region incorporates the Commonwealth waters off the coast of Victoria, including Bass Strait, and lists six species of pinniped and 35 species of cetacean as occurring in the region (COA, 2015a). Marine mammals have cultural and totemic significance for Traditional Owner groups with sea country in Victoria.

6.1 Marine mammal occurrence

6.1.1 Cetaceans

Three species are resident in Victorian waters, common dolphins, bottlenose dolphins, and the Burrunan dolphin (T. c.f. *australis*), while regularly occurring species include pilot and killer whales (VEAC, 2019). Blue, humpback, and southern right whales are all listed as Threatened under the FFG Act and occur seasonally in Victorian waters.

There have been 31 species of cetacean identified through strandings in Victoria, of which the most frequently recorded is the common dolphin (Foord et al., 2019).There are no abundance estimates for common dolphins in coastal or offshore waters of Victoria. Within Port Philip Bay, there are estimated to be a group of 30 common dolphins that show atypical continued residency within the bay (Mason et al., 2016). It is unclear if lower sighting rates of the species during summer months is an artefact of reduced survey effort, or a seasonal change in distribution.

Tursiops were the next most frequently stranded species, with most individuals identified as either Common bottlenose dolphins or Burrunan dolphins. The Burrunan or Southern Australian dolphin was described as a new species by Charlton-Robb et al. (2011) and is listed as Critically Endangered under the FFG Act. However, the taxonomic status of this proposed species has not been accepted (Committee on Taxonomy, 2020), and a more recent study did not find evidence to support it as a separate Tursiops species (Jedensjö et al., 2020). Abundance estimates for resident dolphins, described as the Burrunan dolphin, are between 80-100 individuals in Port Philip Bay and 50-100 individuals in Gipplsand Lakes (Charlton-Robb et al., 2015). These are the only abundance estimates for Tursiops species in Victoria.

Coastal upwelling occurs annually along the shelf and shelf-break of southern Australia extending from western Tasmania to the Eyre Peninsula in South Australia. The area of strongest upwelling is known as the Bonney Upwelling and occurs between November and March around the shelf and shelf break off the south-west coast of Victoria. A wide range of marine mammal species forage in association with this nutrient rich upwelled water, with pygmy blue whales present in the area of the Bonney Upwelling between December and May (Gill et al., 2015). The 'Conservation Management Plan for the Blue Whale' proposes two 'populations' of pygmy blue whales, the Indo-Australian pygmy blue whale and the Tasman-Pacific blue whale (COA, 2015b). Pygmy blue whales satellite tagged off Portland, Victoria were found to leave the Bonney Upwelling area in May and migrate along the Australian continental shelf to probable breeding areas in Indonesian waters (Möller et al., 2020). Blue whale calls belonging to Antarctic blue whales, Indo-Australian and Tasman-Pacific blue whales have been detected within the same season in Bass Strait, indicating that the three

subspecies can occur together in this region (McCauley et al., 2018). The Antarctic blue whale has also been acoustically detected off the west and north coasts of Tasmania between May and December (COA, 2015b). Blue whales are listed as Endangered under the FFG Act. Other species that were regularly sighted during a decade of aerial surveys of the upwelling region included southern right whales, sei whales, humpback whales, sperm whales, long-finned pilot whales and 'dolphins' not identified to species (Gill et al., 2015).

Southern right whales are present in Victorian waters between April and October, with a calving and aggregation area at Logan's Beach, Warrnambool, and emerging aggregation areas off Peterborough, Port Campbell, Port Fairy and Portland (DSEWPaC, 2012e). Reproductive females return to calving grounds on average every three years to give birth to a single calf. Two subpopulations are considered to occur in Australian waters based on genetic analyses (Carroll et al., 2011), with those calving in Victoria belonging to the southeast Australia population (SEA). The most recent estimate of abundance for the SEA population using a superpopulation mark-recapture model was 268 individuals in 2017 (Stamation et al., 2020). The southern right whale is listed as Endangered under the FFG Act. Movement of individuals from Victorian to South Australian breeding grounds has been reported, and genetic analyses did not find differentiation between whales sampled for SEA and New Zealand calving grounds (Carroll et al., 2015). A recent comparison of Photo-ID matches between catalogues found 7% of individuals photographed in Victoria had also been recorded in southwestern Australian calving and aggregation areas (Watson et al., 2021).

Humpback whales are listed as Critically Endangered under the FFG Act and are present in Victorian waters between April and August during their northward migration to breeding and calving grounds off Queensland, and again between October and December on their southward migration to Southern Ocean feeding grounds. These whales belong to the eastern Australian humpback whale subpopulation (Stock E1), that is estimated to be growing at a rate of 10.6%-11% per annum and had an estimated abundance in 2015 of 24,545 individuals (95% CI = 21,631–27,851) (Noad et al., 2019).

6.1.2 Pinnipeds

Two pinniped species breed in Victorian waters, the Australian fur seal, and the New Zealand fur seal. Four other species have been recorded occasionally and records are of vagrants. These are the sub-Antarctic fur seal, southern elephant seal, leopard seal and crab-eater seal.

The Australian fur seal is endemic to the southeast of Australia and breeds at 21 sites, of which six are in Victoria. Breeding sites in Victoria produced 69% of all pups born in Australia in 2013 (McIntosh et al., 2014), with the largest breeding colonies at Seal Rocks, Lady Julia Percy Island and Kanowna Island. Surveys of breeding sites in Victoria and New South Wales have been undertaken at approximately five-year intervals since 2002-03 (Kirkwood et al. 2005, 2010, McIntosh et al, 2018(McIntosh et al., 2022), McIntosh et al. 2022). In 2017, the estimated pup abundance was 19,836 (McIntosh et al., 2022). This estimate showed a continuing decline from an estimated abundance of 21,589 pups in 2007, and 17,503 pups in 2013. Between 2013 and 2017, live pup abundance at Seal Rocks declined by 28%. Contributing factors that may be leading to these ongoing declines could include reduced fecundity, due to climate driven ecosystem change and / or pollution, increased pup mortality, due to increased heat waves and / or storm surges, and increased juvenile or adult mortality, due to entanglement in debris or bycatch in fisheries.

The Australian fur seal is mainly a benthic forager that preys upon a wide variety of fish, cephalopods and crustacean species, with feeding generally restricted to the continental shelf (Arnould and Kirkwood, 2007; Kirkman and Arnould, 2018; Kirkwood and Goldsworthy, 2013). Lactating females typically forage within 150 km of the colony where they gave birth, and spend approximately six days at sea each foraging trip, showing strong fidelity to individual foraging hotspots (Arnould and Kirkwood, 2007; Kirkwood and Arnould, 2011). Males show less site fidelity to foraging areas than

females, and have been shown to undertake both long and short foraging trips (Knox et al., 2018). Australian fur seals are frequently caught in trawl gear in the Commonwealth Trawl Sector of SESSF (See section 2.11.1). Adult male fur seals that were satellite tagged after interacting with one sector of this fishery, the winter BGTS, were found to repeatedly target fishing operations during the fishing season and then return to foraging in southern Tasmania and Bass Strait once the fishing season had ended (Tilzey et al., 2006).

The New Zealand fur seal is listed as Vulnerable under the FFG Act, and breeds at four sites in Victoria, that accounted for 0.9% of the species pup production in 2013-14 (McIntosh et al., 2014; Shaughnessy et al., 2014a). Australian sea lions do not breed in Victoria but may forage in Victorian water. The species has recently been recommended for listing as Critically Endangered under the FFG Act due to ongoing populations declines across its range.

6.2 Victoria managed fisheries

Commercial fisheries in Victoria are managed under the *Fisheries Act 1995* (VF Act) by the Victorian Fisheries Authority (VFA). The customary fishing rights of Traditional Owner groups recognised under the Victorian Aboriginal Fishing Strategy. An objective of the VFA is to manage, develop and use Victoria's fisheries and aquatic biological resources in an ecologically sustainable manner. Fishery risk assessments are undertaken as part of the development of management plans for commercial fisheries. These risk assessments follow the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Fisheries' (Fletcher et al., 2002). Under the VW Act, FFG and VF Act, it is an offence to interact with protected wildlife. It is a requirement to report interactions with protected species, however, commercial fishers are exempt from prosecution for incidental interactions.

Of the 13 commercial fisheries in Victoria, one, the Abalone Fishery has already received a comparability finding under the MMPA. Two further fisheries, the Giant Crab Fishery and the Southern Rock Lobster Fishery are seeking a comparability finding. Information on marine mammal interactions in commercial fisheries not seeking export approval were not publicly available.

6.2.1 Southern Rock Lobster Fishery

The Victorian Southern Rock Lobster Fishery (VSRLF) uses baited pots to target southern rock lobster (*Jasus edwardsii*). Small quantities of eastern rock lobster (*Sagmariasus verreauxi*) are taken in the eastern area of the fishery. The VSRLF operates along the length of the Victorian coast with fishing in Commonwealth waters managed by the Victorian Government under an Offshore Constitutional Settlement Arrangement. The fishery is managed in two separate spatial zones. The Western Zone extends from the border with South Australia to Apollo Bay, and the Eastern Zone extends from Apollo Bay to the border with New South Wales (Fig. 21). Most catch is taken in inshore waters less than 100 m in depth. The fishing season is closed for female rock lobsters from 1 June to 15 November, and for male lobsters from 15 September to 15 November. The total number of pots in the fishery is limited, with 5,162 pots in the Western Zone and 2,021 pots in the Eastern Zone, and a maximum of 140 pots per vessel (VFA, 2017). There were 42 vessels operating in the Western Zone and 21 vessels operating in the Eastern Zone in 2016-17 (VFA, 2017). The VSRLF has export approval under the EPBC Act until 2026.

The actions listed in the VSRLF Harvest Strategy, in regards to TEP species, are to ensure commercial data recording systems capture fishing interactions, and that risks to TEP species are acceptable (VFA, 2017). The target for annual observer coverage in the fishery is 80 days in the Western Zone, and 60 days in the Eastern Zone. A recent assessment of observer coverage in the fishery found that coverage was not randomised, either spatially or temporally, or across vessels (León et al., 2020). For example, during the 2016-17 fishing season, observers sampled 12 of 42 active vessels in the Wester Zone and five of 21 active vessels in the Eastern Zone (León et al., 2020).

An assessment of all bycatch, including TEP species, was undertaken across the Southern Rock Lobster Fishery (SRLF), which includes the VSRLF, using the ecological risk assessment for the effects of fishing (ERAEF) approach (León et al., 2020). A level 2 PSA was undertaken for 31 cetacean and five pinniped species. The potential risk from the fishery was assessed as medium for 33 of the species, and as Low for the remaining three species. Risks identified were entanglement of TEP species in pot lines, and entrapment of juvenile seals and sea lions in pots where seal exclusion devices are not used. The study noted that fishery reported interaction rates with TEP species were lower than observed interaction rates (León et al., 2020). In the SRLF, observers reported that seals were present in the fishing area during more than 66% of observed trips, and dolphins, (not identified to species), were present between 33-66% of trips. The proportion of trips with marine mammals present was not broken down by individual sectors within the SRLF.

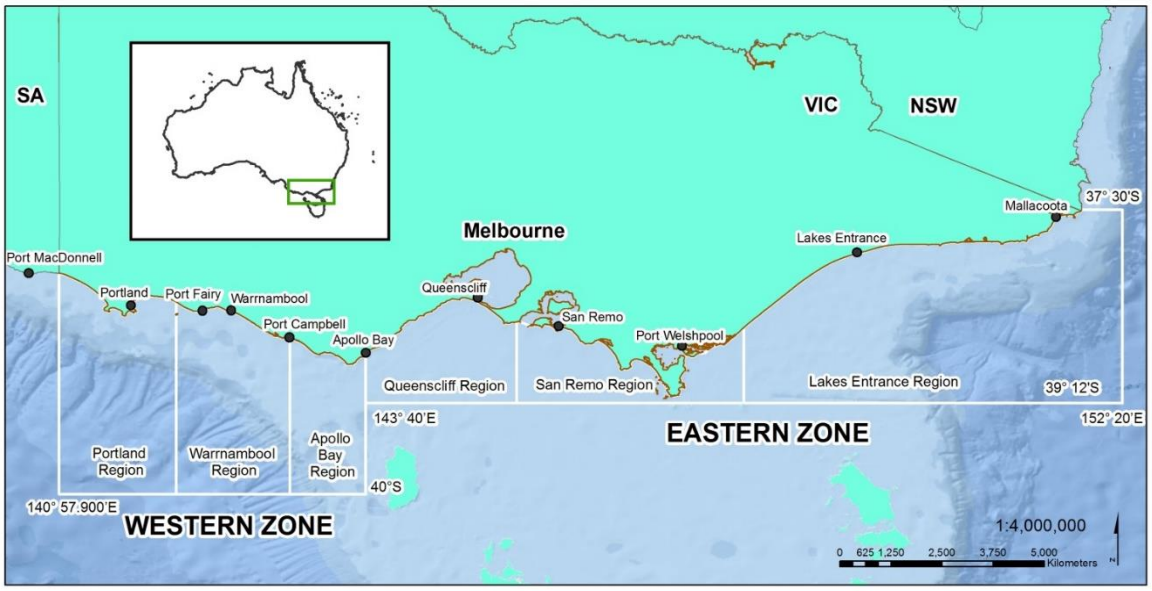


Figure 21: Fishing area of the Victorian Southern Rock Lobster Fishery. Several strategies to mitigate interactions with marine mammals are listed in the VRLF Code of Practice (SIV, 2013). The use of bait protection devices or seal excluder bars is advised to reduce the risk of seals entering pots. Recommendations for mitigating entanglements include avoiding excessive slack in pot ropes, regularly checking gear, removing gear from water if it is not going to be fished for prolonged periods, and investigating new technologies that may reduce entanglements. There is a 'whale and dolphin hotline' which can be called if a cetacean entanglement is observed with advice to safely monitor the individual until an assistance team arrives. Between 2014 and 2019, four Australian fur seal mortalities, two New Zealand fur seal mortalities and one dolphin mortality, not identified to species, were reported in fishery logbooks (Table 29). An entanglement and successful release of a juvenile humpback whale was also reported in the fishery (COA, 2016).

Table 29: Interactions between marine mammals and the Victorian Southern Rock Lobster Fishery between 2015 and 2019.

Year	Logbook recorded mortalities
2015	1 Australian fur seal
2016	No mortalities reported
2017	2 New Zealand fur seals
2018	1 Australian fur seal, 1 dolphin (not identified to species
2019	2 Australian fur seals

Most fishing effort in the VSRLF occurs in than 100 m of depth. This overlaps with the foraging areas of Australian fur seals which predominantly forage on the continental shelf of Bass Strait. New Zealand fur seals also forage in shelf waters in this region. Information on how seal mortalities occurred were not provided, but it is possible that individuals became trapped whilst depredating pots. Interactions with pinnipeds are mitigated in other lobster pot fisheries in Australia by the mandatory use of seal excluder devices in pots. While recommended in the VSRLF, their use is not mandatory. The unidentified dolphin mortality was likely a result of entanglement in the rope from the pot. The species that are likely most common in the area of the fishery are bottlenose dolphins and common dolphins.

The fishery also overlaps with seasonal migration routes taken by southern right whales and humpback whales. Southern right whales are present between April and October, with a calving and aggregation area around Warrnambool in the eastern zone of the fishery. Humpback whales are present between April and August on their northward migration to calving and mating grounds in Queensland, and between October and December on their southward migration to Southern Ocean feeding grounds. Blue whales are seasonally present between November and March off Portland in the western zone of the fishery.

Between 2015 and 2020, Victoria reported large whale entanglements of two southern right whales in 2018, three humpback whales in 2019, and two humpback whales in 2020 in national reports to the International Whaling Commission (www.iwc.int). All whales were reported to be carrying gear from the Southern Rock Lobster fishery (which includes the South Australian and Tasmanian Rock Lobster fisheries). The lead government agency that responds to entanglements is the Victorian Department of Environment, Land, Water and Planning (DELWP). One of the two southern right whales was successfully disentangled by DELWP, while the second was not resighted. Both whales were reported by members of the public. All five humpback whale entanglements were reported by fishers, and all gear was recorded as from the SRL fishery. Four of the whales could not be located by disentanglement teams, whilst the fifth was assumed to become disentangled as the gear was found floating at the reported location of the entanglement. Entanglement rates of both southern right whale and humpback whales are likely to increase as both species populations continue to recover since the cessation of commercial whaling.

6.2.2 Giant Crab Fishery

The Victorian Giant Crab Fishery (VGCF) targets giant crab (*Pseudocarcinus gigas*) using modified rock lobster pots that are set at depths of 150 to 300 metres. The VGCF fishery is managed in two separate spatial zones (Fig. 22). The Western Zone extends from the border with South Australia to Apollo Bay and is where commercial fishing takes place. The Eastern Zone which extends from Apollo Bay to the border with New South Wales is managed as a developing fishery with relatively low effort. The VGCF operates in coastal and Commonwealth waters and is managed by the Victorian Government under an Offshore Constitutional Settlement Arrangement. The fishing season is closed for female giant crabs from 1 June until 15 November, and for male giant crabs from 15 September to 15 November, respectively, with a maximum of 30 licences in the fishery. The maximum number of pots per vessel is 140. The fishery is accredited under the EPBC Act until August 2026. The EPBC Act assessment of the fishery stated that there were no TEPS concerns with the fishery.

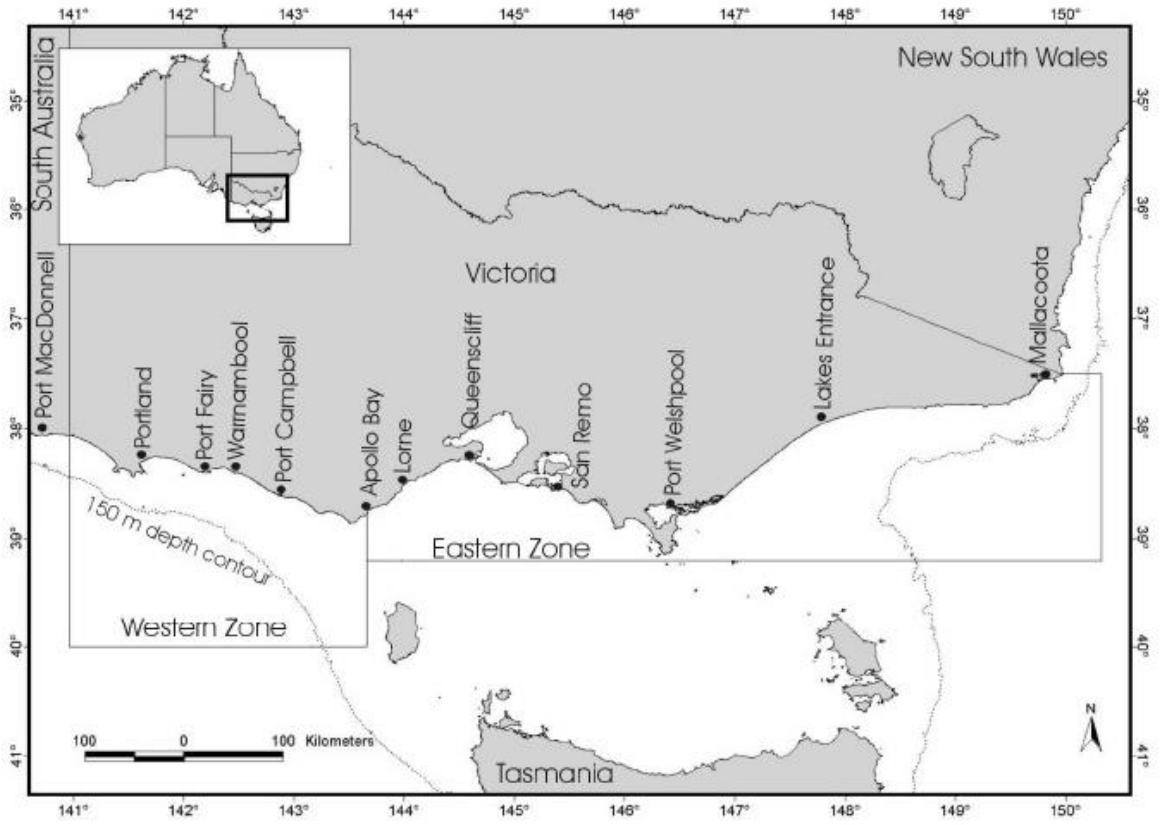


Figure 22: Fishing area of the Victorian Giant Crab Fishery.

Interactions with TEP species must be reported in Protected Species Interactions forms which are contained in the Giant Crab Daily Catch Record Book. No interactions with marine mammals were reported in fishery logbooks between 2015 and 2019.

As pots in the GCF are mostly set in depths of 150 to 300m it is less likely that seals would depredate this pots, although these depths are not outside the dive range of adult New Zealand fur seals (Page et al., 2005a). As with the VSRLF, the GCF overlaps with the seasonal migration routes of southern right whales and humpback whales. Both species have been reported entangled in gear attributed to the SRLF, which includes the VSRLF and the South Australian and Tasmanian rock lobster fisheries (see section 9.2.1). As the GCF uses modified lobster pot gear, there is a risk of entanglement to large whales that migrate through the area of the fishery. Humpback whales are present between April and August on their northward migration and between October and December on their southward migration, while southern right whales are present between April and October Entanglement rates of both southern right whale and humpback whales in pot gear in Victorian waters are likely to increase as these populations continue to recover post commercial whaling.

7 Tasmania

7.1 Marine mammal occurrence

The marine coastal waters of Tasmania are the fifth largest of the State and Territories, with a coastline length, including islands, of 4,872 km and an area of 22,357 km^2 (source Geoscience Australia). Wildlife in Tasmania are managed under the *Wildlife (General) Regulations 2010* and listed species are managed under the *Tasmanian Threatened Species Protection Act 1995* (TTSP Act). Marine mammals have cultural and totemic significance for Traditional Owner groups with sea country in Tasmania.

7.1.1 Cetaceans

Approximately 40 cetacean species have been recorded in Tasmanian waters (dpipwe.tas.gov.au). Common bottlenose dolphins, common dolphins, killer whales, southern right whales, humpback whales and blue whale are commonly sighted species, while long-finned pilot whales, sperm whales and pygmy right whales are common in the stranding record (dpipwe.tas.gov.au, Nicol and Croome, 1988).

There are no estimates of common bottlenose dolphin or common dolphin abundance in Tasmania which are two of the species most frequently involved in mass strandings (www.dpipwe.tas.gov.au). A recent study looking at genetic structure in common dolphins across Australasia found three distinct regional populations; the southern coast of Australia, the eastern coast of Australia, and a New Zealand and Tasmania population (Barceló et al., 2021). Within Australia several Management Units have been proposed for common dolphins based on genetic analyses. Of the three proposed Pacific Ocean Management Units one encompasses south-eastern Australia, Tasmania, and New South Wales, whilst the remaining two encompass central and northern New South Wales, respectively (Bilgmann et al. 2014, Möller et al. 2011).

Long-finned pilot whales are the most commonly stranded (by number of individuals) cetacean species in Tasmania, with 1,568 individuals recorded from 366 stranding events between 1990 and 2008 (Beasley et al., 2019). Five individuals that stranded on the north coast of Tasmania and were subsequently satellite tagged and released were found to stay within the Bass Strait region for the duration that the tags transmitted (12-32 days) (Gales et al., 2012). There is no information on the abundance or distribution of this species in Tasmanian waters. The distribution of long-finned pilot whales is generally associated with continental shelf and slope waters, in areas with complex bathymetry and in deep oceanic waters. The species is considered nomadic, moving in response to the distribution of preferred prey species (Olson 2018). Genetic differentiation in long-finned pilot whales has been found between ocean basins, and also between individuals sampled in Tasmania and New Zealand (Oremus et al., 2009). It is not clear if this differentiation reflects a separation in distribution or population structure that is a result of maternal fidelity or habitat specialization. A recent study which correlated tooth growth chronologies and sea surface temperatures found that pilot whales that stranded in Australia had foraged in association with the subtropical and subantarctic fronts south of Tasmania, while individuals that stranded in New Zealand had associated with areas of seasonal enhanced productivity close to New Zealand (Hamilton et al., 2019). Sperm whales also regularly mass strand in Tasmania, but there is no information on their regional abundance or distribution. Information on killer whale abundance or distribution in Tasmanian waters is also lacking. Most killer whales sighted in temperate waters in Australia resemble the Antarctic Type A morphotype, however, both the Antarctic Type B and Type C morphotype have also been recorded in Tasmanian waters (Donnelly et al., 2021).

Southern right whales were heavily exploited in Tasmanian waters during commercial whaling and are listed as Endangered under the TTSP Act. As the south-east population continues to recover the species is recorded more frequently with sightings occurring between May and November. While most whales generally travel along the Tasmanian coast to aggregation areas off the southern Australian mainland, some individuals stay for extended periods in Tasmanian waters. Emerging areas of importance for southern right whales, particularly females with calves include Great Oyster Bay and Frederick Henry Bay (DSEWPaC, 2012e). At least 109 individually identifiable whales were sighted in Tasmanian waters between 2011 and 2014 (Watson et al., 2021).

Humpback whales are listed as Endangered under the TTSP Act 1995. They are present in Tasmanian waters between May and July during their northward to breeding areas, and between September and November during their southward migration to Southern Ocean feeding grounds. Two other large whale species are listed under the TTSP Act, the blue whale which is listed as Endangered and the fin whale which is listed as Vulnerable. The Antarctic blue whale has been acoustically detected off the west and north coasts of Tasmania between May and December (COA, 2015b).

7.1.2 Pinnipeds

Two pinniped species breed in Tasmania, the Australian fur seal, and the New Zealand fur seal. The Australian furs seal is the most abundant pinniped species in Tasmanian waters, and 28% of the live pups counted across the species range in 2017 were born at sites in Tasmania (McIntosh et al., 2022). Although the number of breeding sites in Tasmania and number of pups born there is increasing, the overall estimated abundance of Australian fur seals has declined 25% since 2007 (McIntosh et al., 2022).

Australian fur seals are benthic foragers and predominantly feed on the continental shelf, preying on a wide variety of fish, cephalopods and crustacean species (Arnould and Kirkwood, 2007; Kirkman and Arnould, 2018; Kirkwood and Goldsworthy, 2013). While lactating females generally show strong fidelity to individual foraging hotspots within 150 km of the colony where they pupped, males show more variability in foraging behaviour and less fidelity to foraging areas (Arnould and Kirkwood, 2007; Kirkwood and Arnould, 2011). Australian fur seals are frequently caught in trawl gear in the CTS of the Commonwealth SESSF (see section 5.10.1). One sector of this fishery, the winter BGTS, operates around the shelf waters of Tasmania. Satellite tracking of adult male fur seals that interacted with this fishery, showed that individual repeatedly targeted trawl operations during the fishing season, and once the season ended returned to foraging areas in southern Tasmania and Bass Strait (Tilzey et al., 2006). Male Australian fur seals also interact frequently with salmon aquaculture operations in Tasmania. Seals are highly motivated to interact with pens as they provide a predictable food resource. Satellite tagged Australian and New Zealand fur seals that were trapped at salmon aquaculture farms in south east Tasmania, the then relocated between 140-470 km away, returned to farms 3-8 days after being released (Robinson et al., 2008).

The New Zealand fur seal is scheduled as Specially Protected under the *Wildlife (General) Regulation 2010* and is listed as Rare under the TTSP Act. New Zealand fur seals breed at four colonies in Tasmania, that produce around 1,000 pups annually (www.dpipwe.tas.gov.au). The largest breeding colonies are at Maatsuyker, Flat Witch and Tasman Islands, but occasional pupping has been recorded at several haul out sites (TSS, 2021). New Zealand fur seals also interact with salmon aquaculture farms in Tasmania, although less frequently than Australian fur seals.

The southern elephant seal is listed as Endangered under the TTSP Act. The species used to breed at King Island but were extirpated by the sealing industry. There have been several records since the 1970's of elephant seals with pups in Tasmania, with the most recent recorded at Bruny Island in 2001. On average, eight sightings of southern elephant seals, from a range of age classes, are reported annually in Tasmania (www.dpipwe.tas.gov.au).

The subantarctic fur seal is listed as Endangered under the TTSP Act and is rarely sighted. Records of vagrants in South Australia have mostly been of juveniles (Shaughnessy et al., 2014b). Leopard seals (*Hydrurga leptonyx)* are also occasionally sighted in Tasmanian waters.

7.2 Tasmanian managed fisheries

Commercial fisheries in Tasmania are managed under the *Living Marine Resources Management Act 1995* (LMRM Act) by the Department of Primary Industries, Parks, Water and Environment (DPIPWE). Aboriginal Tasmanian's are exempt from holding a fishing licence for recreational fishing under the LMRM Act, but all gear must be marked with unique identifier codes. There is also a provision to issue an exemption or permit for fishing activities associated with cultural or ceremonial actives.

There are nine commercial wild capture fisheries in Tasmania, and an aquaculture industry that includes the farming of salmonids, mussels, oysters, and abalone. It is a requirement for all commercial fishers to record interactions with protected species in their logbooks. Commercial fishery management plans are reviewed at legislated intervals, and there are several Fishery Advisory Committees whom the Minister is legislated to consult with prior to deciding on key management arrangements in the fishery.

The Tasmanian Abalone Fishery, Gould's Squid Fishery and Scallop Fishery have been classified as exempt under the MMPA. Two further Tasmanian wild capture fisheries are seeking a comparability finding, the Giant Crab Fishery and the Southern Rock Lobster Fishery.

7.2.1 Giant Crab Fishery

The Tasmanian Giant Crab Fishery (TGCF) targets giant crabs (*Pseudocarcinus gigas*) using modified rock lobster traps. Most fishing effort is undertaken in Commonwealth waters south of 39˚12' S in depths between 150-250m. The fishery is managed by the Tasmanian Government under an Offshore Constitutional Settlement with the Commonwealth Government. The TGCF operates year-round, with a seasonal prohibition on the take of females between 1 June and 14 November. Gear is usually set as strings of 10-20 traps, with a maximum soak time of 48 hours if set in depths less than 120m. Eighteen vessels reported giant crab catch in the 2018/19 fishing season (DPIPWE, 2019). The TGCF is managed under the Tasmanian Fisheries (Giant Crab) Rules 2013, and the LMRM Act. The fishery is accredited under the EPBC Act until January 2025. There have been no interactions with protected species reported in the fishery between 2016/17 and 2018/19 (DPIPWE, 2019).

7.2.2 Tasmanian Rock Lobster Fishery

The Tasmanian Rock Lobster Fishery (TRLF) targets southern rock lobster (*Jasus edwardsii*) using baited pots, with a maximum allowable soak time of 48 hours. The fishery operates around the coast of Tasmania, typically in waters less than 50m depth, with 200 vessels currently operating in the fishery. The fishery is divided into an Eastern and Western fishing region (Fig. 23). There is also an East Coast Stock Rebuilding Zone between Eddystone Point and Tasman Head on Bruny Island. Catch is limited in this zone in order to rebuild stocks to greater than 20% of unfished biomass by 2023. The TRLF is managed under the LMRM Act and the *Fisheries (Rock Lobster) Rules* 2011. The fishery is closed seasonally form October to mid-December, with a prohibition on the take of female lobsters from May to mid-December. The fishery is accredited under the EPBC Act until 2026. The EPBC assessment noted that DPIPWE was collaborating with the Tasmanian Rock Lobster Fisherman's Association to develop a strategy to mitigate entanglement of TEP species in lobster pot lines.

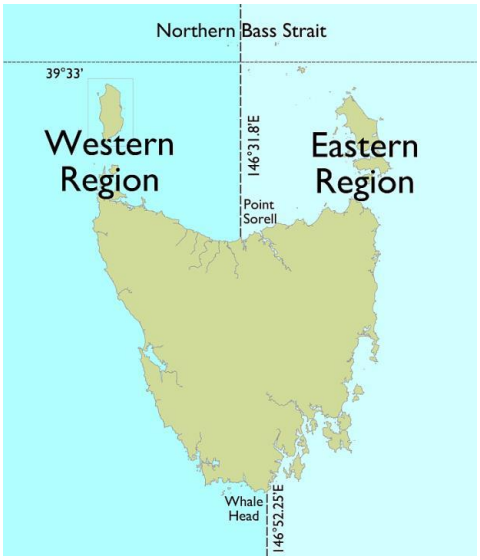


Figure 23: Fishing regions of the Tasmanian Rock Lobster Fishery .

Vessels in the TRLF take observers on a voluntary basis. In 2016 and 2017 only one vessel took observers (León et al., 2020). An assessment of all bycatch, including TEP species, was undertaken across the Southern Rock Lobster Fishery (SRLF), which includes the VSRLF, using the ecological risk assessment for the effects of fishing (ERAEF) approach (León et al., 2020). A level 2 PSA was undertaken for 31 cetacean and five pinniped species. The potential risk from the fishery was assessed as medium for 33 of the species, and as Low for the remaining three species. As observed interactions with gear in the SRLF was rare, no TEP species was considered at high risk from the fishery. However, the report noted that fishery reported interaction rates with TEP species in the SRLF were lower than observed interaction rates (León et al., 2020). Risks identified for marine mammal species were entanglement in pot lines, and entrapment of juvenile seals and sea lions in pots where seal exclusion devices are not used. In the SRLF, observers reported that seals were present in the fishing area during more than 66% of observed trips, and dolphins, (not identified to species), were present between 33-66% of trips. The proportion of trips with marine mammals present was not presented by fishery (León et al., 2020).

No interactions with dolphins or whales were reported in TRLF logbooks between 2014 and 2016. One seal mortality was reported in 2014 as a result of entanglement in fishing gear, while another two reports were made of seals removing bait from pots in the same year. In 2016 there were 25 reports of seals interfering with fishing gear, with no reports of injury or mortality. One seal mortality was reported in 2018 (data provided by DAWE).

Between 2016 and 2020, Tasmania reported seven humpback entanglements and one sei whale entanglements in annual reports to the International Whaling Commission (www.iwc.int). Four of the entanglements were recorded in rock lobster gear, two in hook and line gear, one in a lift net and one in miscellaneous gear. One of the humpback whales was actually disentangled in New South Wales, but the gear on the individual was identified as being rock lobster gear from Tasmania. A second humpback which was entangled in long-line gear and sighted in Tasmania during its southern migration, had also been sighted carrying an entanglement during its northward migration along the New South Wales coast. The report noted that the fishing gear was suspected to have originated from illegal long-line operations in the Southern Ocean. The sei whale was a sub-adult that was emaciated due to a long-term entanglement, which live stranded and subsequently died.

8 South Australia

8.1 Marine mammal occurrence

The marine coastal waters of South Australia are the fourth largest of the State and Territories, with a coastline length, including islands, of 5,059 km and an area of 60,032 km^2 (source Geoscience Australia). Ten species of pinnipeds and 33 species of cetaceans have been recorded in South Australia through sightings or strandings (Kemper et al., 2014). Marine mammals in South Australian waters are managed under the *National Parks and Wildlife Act 1972* (SANPW Act) and the *National Parks and Wildlife (Protected Animals - Marine Mammals) Regulation 2010.* Whales have important cultural significance to coastal Aboriginal peoples in South Australia, and seals were hunted in some areas.

8.1.1 Cetaceans

Information on the distribution and abundance of cetaceans in State waters is restricted to three species: Bottlenose dolphins (*Tursiops* spp.), common dolphins and southern right whales (Bilgmann et al., 2019, 2018; Charlton et al., 2019; Zanardo et al., 2016).

The common dolphin is the most abundant small cetacean in State and shelf waters of South Australia. In 2011, the estimated austral summer abundance of the species in Spencer Gulf, Gulf St Vincent and Investigator Strait (out to 100 m depth contour) was 21,733 (95% CI = 13,809–34,203)(Parra et al., 2021). The winter abundance estimate for the same surveyed area was 26,504 dolphins (95% CI = 19,488–36,046)(Parra et al., 2021). An aerial survey off the west coast of the Eyre Peninsula out to the 100 m depth contour in winter 2013 produced an abundance estimate of 20,000–22,000 individuals (Bilgmann et al., 2018). Prey species of common dolphin include fish and squid, with diet varying between individuals foraging in coastal or oceanic waters. An analysis of the stomach contents of common dolphin that were entangled in aquaculture anti-predator nets showed that individuals had mainly been feeding on Clupeidae and Carangidae species (Kemper and Gibbs, 2001). Common dolphins regularly feed on sardines in South Australian waters, and have also been recorded depredating from codends and feeding on discards from prawn trawl operations in Spencer Gulf (Svane, 2005).

In the southern Australian region, there is unresolved taxonomy of the Tursiops genus. As well as the common bottlenose dolphin and the Indo-Pacific bottlenose dolphin, a third species, the Burrunan dolphin or Southern Australian dolphin (*Tursiops australis*) is proposed. While the taxonomic status of this species is not currently accepted (Committee on Taxonomy, 2020), most of the recent published abundance estimates of bottlenose dolphins in South Australian waters assign the species as *T. australis* (Table 30) There is evidence that bottlenose dolphins inhabiting Spencer Gulf and Gulf St Vincent are genetically distinct populations (Pratt et al., 2018). A recent study applied a Population Consequences of Disturbance framework to assess the potential impacts of climate change, habitat disturbance, fishery interactions and epizootic events on these two populations over a five-year period (Reed et al., 2020). The results of the modelled scenarios showed that, compared to an undisturbed baseline population, estimated fisheries mortality had little effect on the estimated population abundance of either population. The abundance for each population used in the model was 2,192 dolphins in Spencer Gulf and 955 dolphins in Gulf St Vincent (Reed et al., 2020).

Both Indo-Pacific and common bottlenose dolphins feed on a wide range of species. Stomach contents of bottlenose dolphin species that stranded in Spencer Gulf contained fish, cephalopod and crustacean species, with regional variation in diet observed between individuals stranded in the northern and southern gulf (Gibbs et al., 2011). The same study found that common bottlenose and

Indo-Pacific bottlenose dolphins fed at different trophic levels, with the later feeding in lower trophic coastal areas (Gibbs et al., 2011). Bottlenose dolphin species in Spencer Gulf have been recorded to feed in the vicinity of Tuna aquaculture pens, to depredate from prawn trawl codends and feed on discards from prawn trawl operations (Svane, 2005).

Table 30: Estimates of abundance of Southern Australian bottlenose dolphins in South Australia

Location	Source	Year of estimate	Estimate
Adelaide metropolitan waters	(Zanardo et al., 2016)	2012-2014	95 (SE ± 45.20) in winter
Central South Australian waters	(Bilgmann et al., 2019)	2011	3,493 (95% CI = 2,327-5,244) summer /autumn, 3,213 (95% CI = 2,151-4,801) winter / spring
Coffin Bay	(Passadore et al., 2017)	2013-2015	306 (95% CI = 291–323)
Western Eyre peninsula coast	(Bilgmann et al., 2018)	2013	107

Southern right whales occupy calving and aggregation grounds in coastal Australian waters between May and October. Two subpopulations are considered to occur based on genetic analyses (Carroll et al., 2011), and different rates of population growth. The southwest Australian population is distributed from Western Australia into South Australia, with an estimated abundance of 3,164 individuals (Smith et al., 2020). The largest calving and aggregation are in South Australia is at the Head of Bight in the west of the state, with smaller aggregations at Fowlers Bay and Encounter Bay (DSEWPaC, 2012e). A population census and photo-ID study has been undertaken at Head of Bight since 1991. Peak abundance of females accompanies by calves in the study area is between early July and early September, while peak abundance of unaccompanied whales is from mid-August to early September (Charlton et al., 2019). Small numbers of southern right whales are also recorded annually in Spencer Gulf (https://www.sawhalecentre.com.au/whale-sightings/whale-sighting-log/).

Humpback whales are recorded in coastal and shelf waters in South Australia in the austral winter, during migration to and from calving grounds in northern Australia, though numbers are low (Bilgmann et al., 2018; Gill et al., 2015; Mackay and Goldsworthy, 2015).

The most frequently sighted species from a decade of aerial surveys of the shelf-break off south and south-eastern South Australia were blue whales, southern right whales, sei whales, humpback whales, sperm whales, long-finned pilot whales and 'dolphins' (Gill et al., 2015). And a total of 15 cetacean species were recorded during surveys off the shelf break off south Australia (Gill et al., 2015; Mackay et al., 2018; MCRI, 2013). Feeding aggregations of blue whales occur from November to May in the Bonney Upwelling off south-eastern Australia. Minke and killer whales have also been recorded in coastal waters, but sightings are infrequent. Nearly half (16) of the cetacean species included in the Census for the State are listed as Rare, with some species only recorded from standings records. The actual occurrence of these species in State waters is unknown.

Between 2015 and 2019, South Australia reported large whale entanglements of two unidentified whales, two southern right whales and four humpback whales to the International Whaling Commission (www.iwc.int). Four of the individuals were entangled in gear identified as being from the Southern Rock Lobster Fishery, one was entangled in net gear, and one was entangled in gear that could not be identified. Two individuals were successfully disentangled

8.1.2 Pinnipeds

Three species of pinniped, the Australian sea lion, the New Zealand fur seal and the Australian fur seal, breed and are present year-round in south Australia. The Australian sea lion is the only pinniped species that is endemic to Australia. It is listed as Endangered and Marine under the EPBC Act, and as Vulnerable in South Australia under the SANPW Act. The majority of the species (82%) occurs in South Australia where it breeds at 48 colonies, but most of these colonies produce fewer than 50 pups in a breeding season. Only four sites produce more than 100 pups: Nuyts Reef off the west Eyre Peninsula, Dangerous Reef in southern Spencer Gulf, Seal Bay on the south coast of Kangaroo Island, and The Pages, east of Kangaroo Island. There has been an estimated 64% decline in Australian sea lion pup production over the last three generations (42.3 years)(Goldsworthy et al., 2021). Australian sea lions are benthic foragers, feeding over shelf waters in depths less than 150 m. The species has a diverse diet with key prey items including cephalopods, Leatherjackets (family Myctophidae), Wrasse (family Labridae) and Goatfish (family Mullidae)(Goldsworthy et al., 2019; Peters et al., 2015). Diet and foraging behaviour vary between individuals. And adult females from the same colony have been found to display different foraging ecotypes, either specialising in shallower water inshore foraging or deeper water offshore foraging (Lowther et al., 2011; Lowther and Goldsworthy, 2011). The maximum observed foraging ranges of adult females from the colony where they were tracked is 190 km, compared to a maximum foraging range of adult males of 340 km (Kirkwood and Goldsworthy, 2013).

The New Zealand fur, which is not listed under the SANPW Act, breeds on offshore islands in South and Western Australia and southern Tasmania, with over half of the species' 65 breeding colonies occurring in South Australia. Most pup production in South Australia occurs at Kangaroo Island and the Neptune Islands which account for 49.6% and 38.6% of pups produced in 2013-2014 (Shaughnessy et al., 2015). While there are a high number of breeding sites on the west coast of the Eyre Peninsula, pup numbers at these sites are low, and account for 1.9% of the total pup production in the State (Shaughnessy et al., 2015). The estimated abundance of New Zealand fur seals in South Australia in 2013-14 was 97,200 individuals (Shaughnessy et al., 2015). New Zealand fur seals forage on both shelf and off-shelf waters with variation in foraging strategies between different age and sex classes. Adult females nursing pups initially forage in mid-outer shelf waters before shifting to longer foraging trips in pelagic waters associated with the Subtropical Front (Baylis et al., 2012). The switch from shelf to oceanic foraging is driven by changes in the strength of summer upwelling in shelf waters (Foo et al., 2019). In contrast, adult and sub-adult males mostly forage on the continental shelf (Goldsworthy et al., 2019; Page et al., 2006). New Zealand fur seals target pelagic and benthopelagic prey when foraging on shelf waters and target epipelagic prey when foraging in oceanic waters. Key prey species when foraging in shelf waters include southern garfish (*Hyporhamphus melanochir*), barracouta (*Thyrsites atun*), red arrow squid (*Nototodarus gouldi*) and southern calamari squid (*Sepioteuthis australis*), while key prey species in off-shelf waters include Lanternfish and Southern Ocean arrow squid (*Todarodes filippovae*) (Goldsworthy et al., 2019; Page et al., 2005b).

Australian fur seals are endemic to the south-eastern waters of Australia with most breeding colonies off Victoria and Tasmania. In South Australia the species is listed as Rare under the SANPW Act, with low numbers of pups produced at four breeding sites. The largest of these is North Casuarina Island which produced 76 pups in 2013-14. In the same breeding season six pups were recorded at Baudin Rocks, two were recorded at Williams Island and one was recorded at Cape Gantheaume (Shaughnessy et al., 2014a). Australian fur seals eat a wide range of prey species and forage over shelf waters in association with the sea floor.

Seven other pinniped species have been recorded in South Australia but are considered rare or vagrants. Between 1982 and 2012, 49 specimens and 37 sightings of Subantarctic fur seal were

recorded, predominantly around Kangaroo Island, Victor Harbour and the Eyre Peninsula (Shaughnessy et al., 2014b). Two sightings of Antarctic fur seals, both at Kangaroo Island, were also recorded over the same period. Between 1883 and 2011 there were 54 records of leopards seals, 36 records of southern elephant seals, including two pups, five records of crabeater seals, one record of a Weddell seal and Ross seal (Shaughnessy et al., 2012). Southern elephant seals and leopard seals are listed as Rare under the SANPW Act.

8.2 South Australian managed fisheries

Commercial fisheries in South Australia are managed under the *Fisheries Management Act 2007* (SAFM Act) which is administered by the Department of Primary Industries and Regions South Australia (PIRSA). Aboriginal traditional fishing is recognised as a distinct and unique class of fishing by the Act, and the first traditional fishing agreement was recently signed between the State Government and the Narrunga Nation.

The SAFM Act requires that the ecological impacts of a commercial fishery be identified and assessed as part of the development of a management plan for that fishery. PIRSA Fisheries and Aquaculture undertakes these ecological assessments using the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Fisheries' (Fletcher et al., 2002). In South Australia quantitative risk assessments are undertaken by experts and stakeholders who score the consequences of an activity in the fishery to the component being assessed, and then score how likely it is that the consequence will occur. The final assessment of risk is the product of the consequence score multiplied by the likelihood score.

All fishing licence holders in South Australia are provided a Wildlife Interaction Reporting Logbook to record interactions with protected species as legislated under the EPBC Act. The South Australian Research and Development Institute (SARDI) publishes an annual summary of all protected species logbook reports. In 2017/18, interactions with marine mammals were only reported in two South Australian Fisheries, the Lakes and Coorong Fishery (LCF) and the South Australian Sardine Fishery (SASF) which is part of the Marine Scalefish Fishery (MSF) (Goldsworthy and Boyle, 2019). As logbook data are fishery-dependent it is not possible to determine whether changes in reported rates over time reflect actual changes in interaction rates or changes in industry reporting over time (Goldsworthy and Boyle, 2019; Mackay, 2018). Entanglement of Australian sea lions and New Zealand fur seals in fishing gear and marine debris in the early 2000's were 1.3% and 0.9% respectively (Page et al., 2004). Australia Sea Lions were predominantly entangled in monofilament gillnet gear, while New Zealand fur seals were most commonly entangled in loops of packing tape and fragments of trawl net (Page et al., 2004).

The SASF is the only South Australian commercial fishery with a specific marine mammal observer program. However, all commercial fisheries have some level of fishery-independent monitoring as part of management of that fishery. Mitigation of marine mammal interactions with the SASF, which predominantly involve common dolphins, is managed through an industry Code of Practice. Sea Lion Exclusion Devices (SLED) are mandatory in the South Australian Northern Zone Rock Lobster Fishery to prevent bycatch of Australian sea lion Pups. Management strategies to mitigate New Zealand fur seals depredating catch in the LCF includes access to Seal Crackers (Earl et al., 2021).

The South Australian Abalone Fishery, Rock Lobster Fishery and SASF have been classified as 'exempt' under the import provisions of the US MMPA. A further four wild capture fisheries and two aquaculture sectors are seeking a comparability finding.

8.2.1 Commercial Marine Scalefish Fishery

The Commercial Marine Scalefish Fishery (MSF) is a multi-species and multi-gear fishery that operates in all coastal waters of South Australia, and for some species extends to the 200 nm limit of the AFZ. However, almost all fishing effort is undertaken in the waters of Spencer Gulf and Gulf St Vincent, and bays along the west coast of the Eyre Peninsula (Fig. 24 , Steer et al., 2020).

As of March 2019, there were 304 licence holders in the fishery (PIRSA, 2019). The main species taken are southern calamari (*Sepilteuthis australis*), snapper (*Chyrsophys auratus*), King George whiting (*Sillaginodes punctatus*), and southern garfish (*Hyporhamphus melanochir*), but over 60 marine species are permitted to be taken by licence holders (Steer et al., 2020).

There are over 30 types of fishing gear allowed in the MSF, that fall into four main gear types: fish pots and traps, gillnets and entangling nets, longlines, and purse seines. The predominant gear types used are haul nets and handlines which each accounted for around 30% of effort in 2018, followed by squid jigs (20%) and longlines (10%) (Steer et al., 2020). Set nets accounted for 1.5% of effort in 2018. The MSF has export approval under the EPBC Act until September 2022.

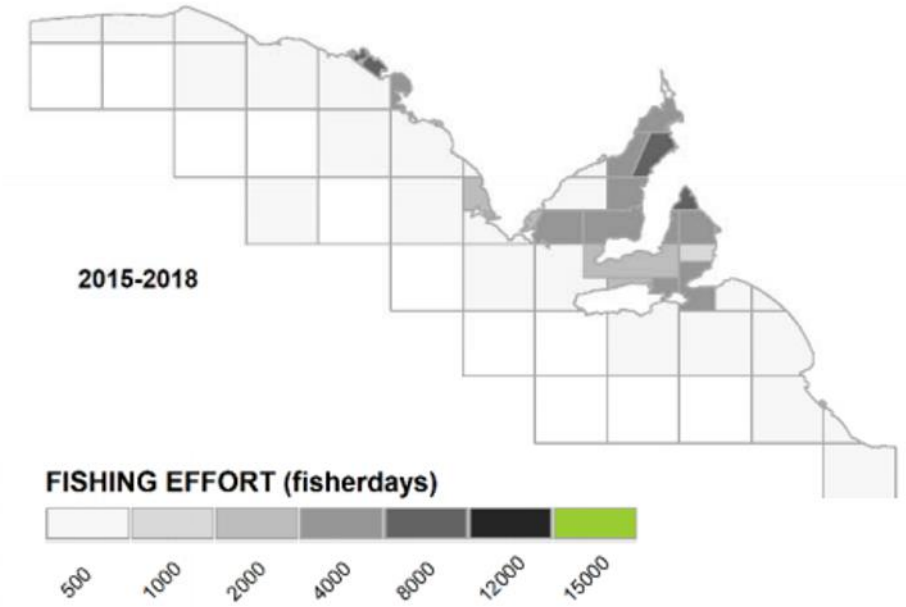


Figure 24: Fishing effort in the South Australian Marine Scalefish Fishery between 2015 and 2018.

The marine mammal species that occur year-round in the main areas of the fishery are the Australian sea lion, New Zealand fur seal, bottlenose dolphin (*Tursiops* spp.) and common dolphin. Smaller numbers of Australian fur seals are present in the lower Spencer Gulf and Kangaroo Island south of Gulf St Vincent. Southern right whales are seasonally present in State waters between May and October (Charlton et al., 2019), but their key aggregation areas are not within the core area of the fishery. A small number of humpback whales may also occur seasonally in coastal waters.

Five marine mammal species or groups were evaluated as part of the ESD risk assessment of the fishery undertaken in 2011 (PIRSA, 2011). These were the Australian sea lion, New Zealand fur seal, Australian fur seal, 'dolphins' and 'whales'. For New Zealand fur seals, Australian fur seals and dolphins the risk assessment states that 'Given the number of interactions is very low, and mortalities are rare, the impact on these species' populations was considered to be negligible'. The risk to 'whales' was assessed as low based on the justification that "there may be close encounters

with vessels, however there is no capture". The risk to Australian sea lion populations from large mesh gillnet gear in the fishery was assessed as 'moderate'.

The SASF sector of the MSF uses purse seine nets to target sardines. Sardine nets have a maximum length of 1,000 m, a maximum drop of 200 m and minimum mesh size of 14 mm (PIRSA, 2020). Since 2006, the SASF has had an independent observer program to assess the effectiveness of an industry Code of Practice at mitigating interactions with common dolphins. A report on observed interactions rates and the efficacy of the Code Of Practice for the fishing season is produced annually (e.g. Kirkwood et al., 2020). Interactions with 144 pinnipeds, most not identified to species, have been reported in fishery logbooks in the SASF since 2007/2008, of which three were mortalities (Goldsworthy and Boyle, 2019; Mackay, 2018). Most interactions are reported to involve pinnipeds repeatedly swimming in and out of the purse seine net during fishing operations (Mackay, 2018). The SASF has been assessed as an 'exempt' fishery under the import regulations of the US MMPA.

Since 2010/11, no interactions with marine mammals have been reported in fishery logbooks in any other sector of the MSF (Goldsworthy and Boyle, 2019). Prior to this, a total of nine interactions with "dolphins" and one interaction with a New Zealand fur seal were reported (Mackay, 2018). All interactions were with haul nets. Haul nets are an active fishing method where the fisher is present throughout the setting and hauling of the gear. All dolphin interactions were reported in upper Spencer Gulf, with one mortality reported in 2008/09. The remaining interactions reported dolphins being encircled in haul nets and released alive. One interaction with a New Zealand fur seal was reported in 2009/10 with the individual released alive.

Handlines and longlines could potentially pose a risk to marine mammals through entanglement with lines, or ingestion of hooks if individuals depredate gear. Longlines are used in the MSF to target snapper and shark species. Lines have a maximum of 400 hooks, and fishers are required to remain within 50m of a longline when deployed. There have been no reports in MSF logbooks of marine mammals interacting with handline or longline gear in the fishery (Goldsworthy and Boyle, 2019; Mackay, 2018). There is one record in South Australia of a southern right whale entanglement in longline gear (Kemper et al., 2008). The authors determined that the whale likely towed the gear for an extended period of time, so it is not possible to determine where the individual interacted with the gear or what fishery it was from. A live stranding of a sperm whale entangled in a longline line was recorded in South Australia in 1990 (Kemper et al., 2008).

Pots and traps are used in the MSF to target species such as crab, octopus, and ocean jackets. Ocean jacket traps are regulated separately to other fish traps. A maximum of 80 ocean jacket traps can be used, and must be set in depths greater than 60 m (Steer et al., 2020). Other traps are set in depths less than 60 m. Two entanglements of southern right whales and two entanglements of common dolphins with 'Decapod pot line' were recorded in South Australia between 1990 and 2008 (Segawa and Kemper, 2015). Although Spencer Gulf is outside of the core aggregation area for southern right whales in South Australia, a small number of individuals are seen annually in the gulf, and it is likely that numbers will increase as the population recovers and recolonises original calving grounds. Humpback whales are also seasonally present in coastal waters, but in low numbers.

Gillnets and entangling nets in the fishery are categorised as small mesh (>5-<15 cm) and large mesh (>15cm). Small mesh gillnets are restricted in length to 600 m and can only be set in a maximum depth of 5 m. As stated above, the risk assessment for the fishery concluded that Australian sea lions to be at 'high risk' from large mesh gillnets in the MSF. To reduce this risk, PIRSA has introduced a number of management arrangements. These include limits on fishing effort in areas identified as "high risk", and the closure of fishing areas if effort limits are reached. The maximum permitted length for large mesh nets in the fishery is 600 m (PIRSA, 2020).Gillnets may also pose a risk of entanglement to coastal dolphins. There have been no fishery logbooks reports of marine mammal interactions with gillnets or entangling nets in the MSF (Goldsworthy and Boyle, 2019; Mackay,

2018). However, between 1990 and 2008, three common dolphin entanglements (two in 'monofilament net' and one in a 'shark fishing net' were recorded (Segawa and Kemper, 2015) .

8.2.2 Blue Crab Fishery

The Blue Crab Fishery (BCF) targets blue swimmer crab (*Portunus amatus*) using pots and operates in two management zones, Spencer Gulf and Gulf St Vincent (Figure 25). In 2018/19, fishing effort in Spencer Gulf was 203 boat days, and was 457 boat days in Gulf St Vincent (Beckmann et al., 2020). Blue swimmer crabs can also be taken on the west coast of South Australia by licence holders in the MSF that have appropriate gear entitlements. The BCF has export approval under the EPBC Act until July 2025, with the assessment of the fishery stating that there are no bycatch or protected species concerns in this fishery (COA, 2015c). An ESD risk assessment was undertaken of the fishery in 2009. No marine mammal species were considered at risk of capture in the fishery. 'Whales', 'dolphins' and 'seals' were assessed as being of negligible risk to 'direct interaction but no capture' (PIRSA, 2009). The risk assessment noted that records of interactions at that time consisted of one entanglement of a southern right whale that was released alive (Kemper et al., 2008), and anecdotal evidence of one dolphin entanglement (PIRSA, 2009). There have been no reports of interactions with marine mammals in the BCF since Wildlife Interaction Logbooks were introduced in 2007.

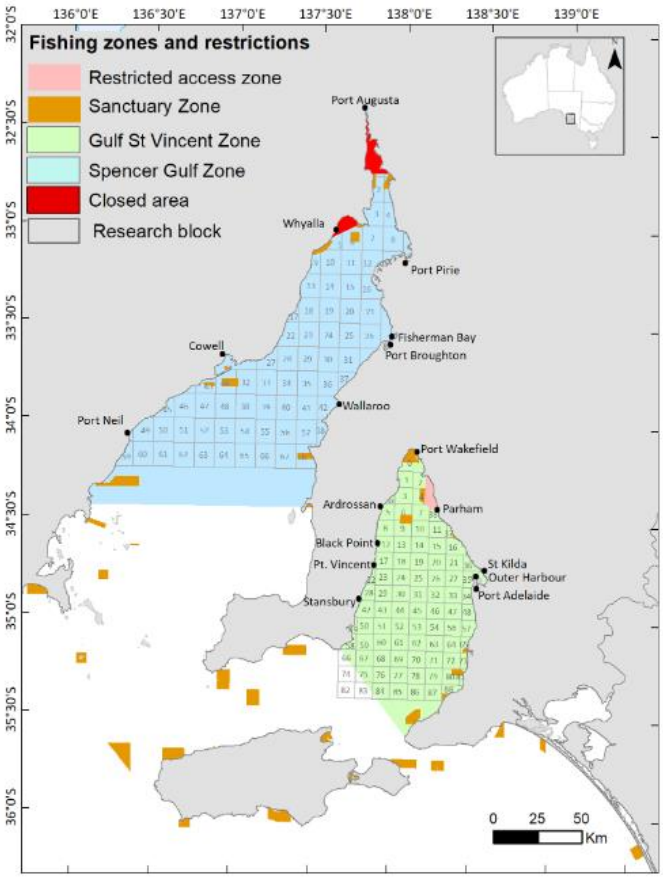


Figure 25: Map of fishing blocks in the South Australian Blue Crab Fishery in the Spencer Gulf and Gulf St Vincent Zones.

The marine mammal species that occur year-round in the main areas of the fishery are bottlenose dolphins (*Tursiops* spp.) and common dolphins. Australian sea lions and New Zealand fur seals are also present, but foraging activity the upper parts of both Gulfs is low. Although the area where the fishery operates is outside of the core aggregation area for southern right whales in South Australia, a small number of individuals are seen annually in both Gulfs, and it is likely numbers will increase as

the population recovers and recolonises original calving grounds. Humpback whales are also seasonally present in coastal waters, but in low numbers. Two entanglements of a southern right whale and two entanglements of common dolphins with 'decapod pot line' were recorded in South Australia between 1990 and 2008 (Segawa and Kemper, 2015).

8.2.3 South Australian Prawn Trawl Fisheries

Three commercial prawn fisheries in South Australian waters target western king prawns (*Melicertus latisulcatus*) using single or double rigged demersal otter trawls, that have a maximum headline length of 29.26 m. These fisheries are managed under the SAFM Act and *Fisheries Management (Prawn Fisheries) Regulations* 2017. The largest is the Spencer Gulf Prawn Fishery (SGPF) which has 39 licences and generally operates between November and July in waters deeper than 10 m in Spencer Gulf (PIRSA, 2014). Total fishing effort in the SGPF in 2017/18 was 19,472 trawl hours (Noell and Hooper, 2020). The fishery was certified by the MSC in 2011, with its current certificate set to expire in January 2022. The Gulf St Vincent Prawn Fishery (GSVPF) has 10 licences and operates between November and July in waters deeper than 10m in Gulf St Vincent. Total fishing effort in the GSVPF in 2019/20 was 1,984 trawl hours (McLeay and Hooper, 2020). The West Coast Prawn Fishery (WCPF) had three licences and operates in coastal waters of the western Eyre Peninsula between March and December. Figure 26 shows the fishing area of each of the three fisheries. South Australian prawn fisheries have export approval under the EPBC Act until July 2025.

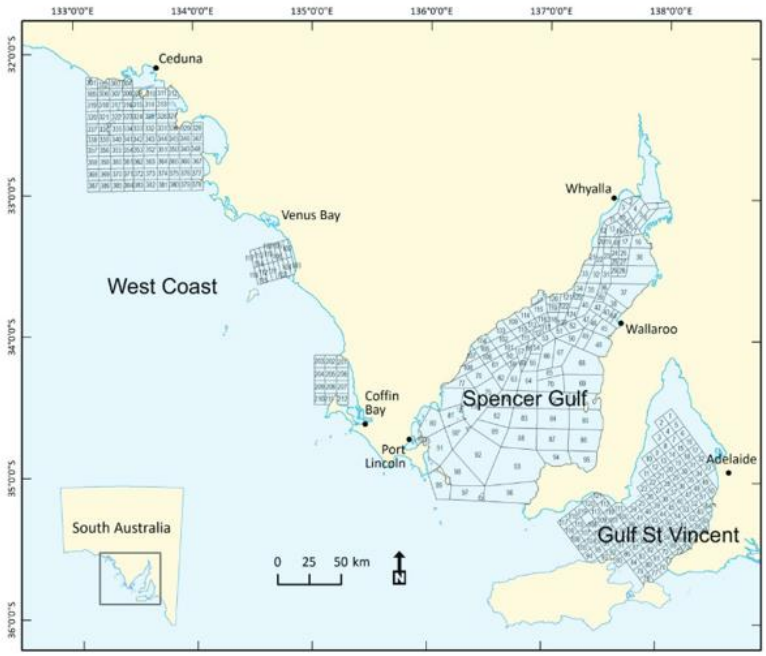


Figure 26: Map of fishing blocks in the West Coast, Spencer Gulf and Gulf St Vincent Prawn Fisheries. The marine mammal species that occur in the main areas of the fishery are the Australian sea lion, New Zealand fur seal, bottlenose dolphin (*Tursiops* spp.) and common dolphin. Smaller numbers of Australian fur seals are present in the lower Spencer Gulf and Kangaroo Island south of Gulf St Vincent. Southern right whales are seasonally present in State waters between May and October.

Using the EDS framework, the risk to cetaceans and seals from the GSVPF was assessed as negligible (PIRSA, 2016a), while the risk to 'bottlenose dolphins' from the SGPF was assessed as high (Noell and Beckmann (2019) cited in the most recent MSC Assessment of the fishery). A study that modelled the potential impacts of fishery interactions on bottlenose dolphin found that estimated fisheries mortality would have little effect on the population abundance of the species in either Gulf St

Vincent or Spencer Gulf (Reed et al., 2020). Both common dolphins and bottlenose dolphins (*Tursiops* spp.) have been recorded depredating from codends and feeding on discards from prawn trawl operations in Spencer Gulf (Svane, 2005).

Three interactions with marine mammals were reported in fishery logbooks between 2007/08 and 2017/18 (Goldsworthy and Boyle, 2019). A mortality of a 'dolphin' was reported in the SGPF in 2016/17 after the individual struck the vessels propellor. Two mortalities with 'common seal' were reported in the WCPF in 2009/10, and an entanglement of an Australian fur seal, which was subsequently released alive, was reported in the SGPF in 2010/11 (Mackay, 2018). No interactions with marine mammals were observed during fishery-independent bycatch surveys in the SPGF in 2007 and 2013 (Burnell et al., 2015).

8.2.4 South Australian Lakes & Coorong Fishery

The Lakes and Coorong Fishery (LCF) is a multi-gear, multi-species fishery that operates in the Lower Lakes of the Murray River and the Coorong estuary (Earl, 2020). Most fishing effort in the last five years was undertaken in Lake Alexandria, marine waters, and Coorong Estuary (Fig. 27). There are 36 active license holders and total effort in the LCF in 2018/19 was 5,006 fishing days (Earl, 2020). The majority of fishing effort (60-80%) is undertaken using large mesh gillnets, followed by small mesh gillnets, with minimal effort undertaken using haul nets (Earl, 2020). Large mesh gillnets (115 -150 mm mesh) are used to target finfish species in the Lower Lakes and Coorong Estuary, while small mesh gillnets (50-64 mm mesh) are used to target yelloweye mullet (*Aldrichetta forsteri*) in the Coorong. Swinger nets are used nearshore on the marine side of the mouth of the Murray River. The LCF has export approval under the EPBC Act until February 2022.

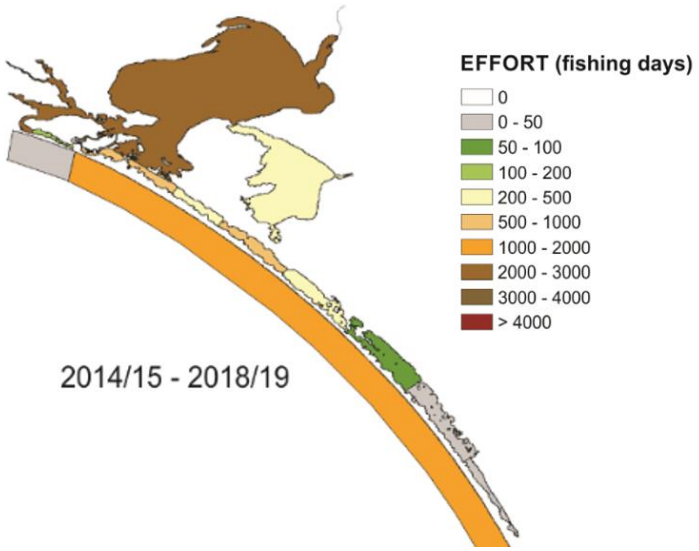


Figure 27: Fishing effort in the South Australian Lakes and Coorong Fishery between 2015 and 2018. New Zealand fur seals, bottlenose dolphins (*Tursiops* spp.) and common dolphins occur in the marine area of the fishery. Southern right whales are also seasonally present waters near the Coorong between May and October.

The only marine mammal species reported to interact with the LCF is the New Zealand fur seal, with interactions first reported by fishers in 2009/10. In 2017/18, fishers reported 630 with interactions with New Zealand fur seals, that involved 2,773 individuals (Goldsworthy and Boyle, 2019). Logbook comments report New Zealand fur seals depredating fish and damaging nets, with highest reports of interactions occurring in winter months (Goldsworthy and Boyle, 2019; Mackay, 2018). Several New Zealand fur seals that were fitted with GPS tags in or on islands adjacent to the Coorong, spent a

period of time foraging within the estuary and lakes system where the fishery occurs, before undertaking foraging trips offshore (Goldsworthy et al., 2019).

Current strategies to mitigate interactions include the use of 'seal-crackers', and a project is ongoing to assess the impacts of seals on the fishery, and on the ecosystem of the Lower Lakes and Coorong Estuary. The project aims to identify options to manage seal numbers and evaluate the costs and benefits to mitigate their impacts (Earl et al., 2021). The most recent ESD risk assessment of the fishery assessed the negative impacts (loss of catch, damage to gear) from New Zealand fur seals on the performance of the fishery as 'extreme' (PIRSA, 2016b). There have been no reports of seal mortalities in this fishery.

8.2.5 Tuna and Finfish Aquaculture Sector

Aquaculture activities in South Australia are legislated under the *Aquaculture Act 2001*, the *Aquaculture Regulations 2016* and the SAFM Act. Under these regulations all marine aquaculture licence holders must have a strategy to minimise interactions with marine mammals. They must also report all entanglements or confinements of any protected animal that occur in any equipment related to the aquaculture operation.

The results of a survey of eight southern bluefin tuna (*Thunnus maccoyii*) aquaculture operators and four yellowtail kingfish (*Seriola lalandi*) aquaculture operators found that all respondents reported interactions with either, or both New Zealand fur seals or Australian sea lions (Goldsworthy et al., 2019). Respondents said they used several management techniques to mitigate seal interactions. The predominant method was anti-predator fences, net stiffening and cage tensioning, and the use of steel mesh nets. Satellite tracking studies of male New Zealand fur seals at a haul out site adjacent to tuna aquaculture cages in Spencer Gulf showed a strong association with cages when they were stocked with fish. Within ten days of the last tuna cages being harvested, tracked individuals left Spencer Gulf and undertook more 'normal' shelf and oceanic foraging trips over 800km away from the aquaculture site (Goldsworthy et al., 2019). Diet data were unavailable for the period of time the seals were tracked, however both yellowtail kingfish and southern bluefin tuna were present in 50% and 19% of scats, respectively, collected at the haul out site where seals were tagged (Goldsworthy et al., 2019). Southern blue fin tuna was also detected in New Zealand fur seal scats, but it was not possible to determine whether fur seals were consuming live, injured or dead fish.

Since 2005, mortalities of two New Zealand fur seal and one bottlenose dolphin have been reported by the South Australian tuna and finfish aquaculture sector (data provided by DAWE). Between 1990 and 1999 a total of 29 dolphin carcasses were retrieved from anti-predator nets around southern blue fin tuna aquaculture pens in Spencer Gulf (Kemper and Gibbs, 2002). More than half were bottlenose dolphins (*Tursiops* spp.), a third were common dolphins, and the remaining 17% were not identified to species. The anti-predator nets that were used at the time, were large mesh nets that hung from the surface to the seafloor.

9 Western Australian

9.1 Marine mammal occurrence

The marine waters of Western Australia are the largest of all the States and Territories, with a length, including islands, of 10,954 km and an area of 115,740 km^2 (source Geoscience, Australia). The coastal environment varies from cold temperate waters along the southern and southeast coasts to warm tropical waters along the north and northeast coasts.

Marine mammals in Western Australia are managed under the Western Australian *Wildlife Conservation Act 1950* (WC Act) and the *National Parks and Wildlife (Protected Animals - Marine Mammals) Regulation 2010.* The Department of Biodiversity, Conservation and Attractions has the legislative responsibility to manage marine mammals under provisions of the WC Act, including responsibility for attending to TEPS entanglements or strandings. Marine mammal species have important cultural significance to many Western Australian saltwater Native Title holder groups.

Thirteen species of marine mammals occur year-round or seasonally in Western Australian waters (Waples and Raudino, 2018; Woinarski et al., 2014). Australian sea lions, New Zealand fur seals, Indo-Pacific bottlenose dolphins, Australian humpback dolphins, snubfin dolphins and dugongs are all considered resident species. Humpback whale, southern right whale, pygmy blue whale, and dwarf minke whale are seasonally present during breeding or feeding migrations, while common dolphins, dwarf spinner dolphins and killer whales are considered regular visitors. As the dwarf spinner dolphin is currently not listed in the cetacean species report card for the North-west Bioregion Plan, it is not included in Table 1 (Section 1.3). A further 35 marine mammal species are considered occasional visitors (Waples and Raudino, 2018; Woinarski et al., 2014), with 40 cetacean species recorded in the strandings records (Groom and Coughran, 2012).

9.1.1 Dugongs

Significant numbers of dugongs occur in Western Australian waters. The abundance estimates for dugongs from aerial surveys undertaken in June 2018, were 18,555 (±3,396) in Shark Bay and 4,831 (±1,965) in the Exmouth Gulf and Ningaloo regions (Bayliss et al. 2018, cited in Bayliss et al., 2019). An abundance of 11,839 dugongs (±1,391) was estimated in an area of ~33,000 km^2 in the Kimberley region in 2015 (Bayliss et al., 2015).

9.1.2 Pinnipeds

The Australian sea lion is the only pinniped species that is endemic to Australia. It is listed as Endangered under the EPBC Act, and Vulnerable under the WC Act, and around 18 % of the species (~1,872 individuals) occurs in Western Australia. Australian sea lions breed at 32 islands in Western Australia, from the Abrolhos Islands at the northern extent of the species range through to Twilight Cove in the southeast of the State. A recent study investigating trends in abundance, estimated that pup production in Western Australia had decreased on average 8.4% over three generations (Goldsworthy et al., 2021). A description of the foraging ecology of Australian sea lion is provided in Section 8.1.2.

The New Zealand fur seal is listed as a Marine species under the EPBC Act and is listed as ‘other specially protected’ under the WC Act. It breeds at 20 sites along the south coast of Western Australia, with a haul out site at Rottnest Island the northern extent of the species range (Campbell et al., 2014).In 2010-11, the pup abundance estimated from 17 of these sites was 3,518 (Campbell et al., 2014). The annual growth rate of pup production in Western Australia was estimated to be 10% per annum between 1989 and 1999, and 1% per annum between 1999 and 2011, indicating these

colonies may have reached carrying capacity (Campbell et al., 2014). New Zealand fur seals forage on both shelf and off-shelf waters, with foraging strategies varying between different age and sex classes. They prey on a broad range of species, targeting pelagic and benthopelagic prey when foraging on shelf waters and epipelagic prey when foraging in oceanic waters. There is limited information on diet of New Zealand fur seals in Western Australia, but analysis of scat samples from Rottnest Island showed the most frequent and abundant prey species were southern calamari squid (*Sepioteuthis australis*), beaked salmon (*Gonorynchus greyi*), red arrow squid (*Nototodarus gouldi*) and whiting (Silago sp.) (Hara, 2012).

9.1.3 Cetaceans

Indo-Pacific bottlenose dolphins are widely distributed in coastal waters of Western Australia. The species is listed as a cetacean species under the EPBC Act. Abundance data are available for discrete areas within the species range in coastal waters in the state (Table 31). The diet of Indo-Pacific bottlenose dolphins includes a wide variety of fish and cephalopod species. Prey species will vary between geographical areas but may also vary within an area due to individual differences specialised foraging strategies (e.g. Connor et al., 2019).

Table 31: Estimates of abundance of Indo-Pacific bottlenose dolphins in Western Australia

Location	Source	Year of estimate	Estimate
Bunbury	Smith et al., 2013	2007-2009	63 (95% CI = 59 to 73) - 139 (95% CI = 134–148)
Swan River	Chabanne et al., 2012	2003	55 (17-18 resident individuals)
Shark Bay	(Preen et al., 1997)	1994	2064 (SE ± 267)
Useless Loop, Shark Bay	(Nicholson et al., 2012)	2010	208 (95% CI = 177–245)
Onslow, Pilbara	(Raudino et al., 2018a)	2015	79 (95% CI = 43-148)
North West Cape	(Haughey et al., 2020)	2013-2015	141 (95% CI: 121–161) - 370 (95% CI: 333–407)

Australian humpback dolphins are distributed in subtropical and tropical waters in Western Australia from Shark Bay to the border with the Northern Territory. The species is listed as Cetacean and Migratory under the EPBC Act and P4 (rare, near threatened or in need or monitoring) under the WC Act. The species is found in coastal waters and is associated with habitat such as estuaries and offshore islands with fringing reefs (Allen et al., 2012; Brown et al., 2016; Raudino et al., 2018b). Abundance data are only available for a small number of discrete areas of the species Western Australian range. These are 129 individuals at North West Cape, 15-20 individuals in Cygnet Bay, and 28 individuals at the Montebello Islands (Brown et al., 2016; Hunt et al., 2017; Raudino et al., 2018b).

Australian snubfin dolphins are endemic to the tropical waters of northern Australia, and in Western Australia are distributed from Exmouth to the border with the Northern Territory. The species is listed as P4 under the WC Act. Australian snubfin dolphins are generally distributed in shallow (<20 m) coastal tropical waters particularly around estuaries. Information on the distribution and abundance of the species are limited to discrete areas where surveys have been undertaken, and, there is no abundance data for most of the species geographic range (Bouchet et al., 2021; Brown et al., 2016). Estimates of abundance for Cygnet Bay and Roebuck Bay were 54 (95% CI = 51-60) and 48 (95% CI = 41-58),respectively (Brown et al., 2016). There are limited data on the diet of Australian snubfin dolphins, but analysis of stomach contents of individuals from Queensland indicate they are

generalist feeders, and consume a range of fish and cephalopod species associated with shallow water and estuarine environments (Parra and Jedensjö, 2014).

Key knowledge gaps for Australian humpback, Australian snubfin and common dolphins in Western Australian waters include information on abundance and distribution, population demographics, and areas of ecological importance (Waples and Raudino, 2018). A study assessing the genetic diversity and differentiation of Australian snubfin and humpback dolphins in the north west of Western Australia indicate that both species likely exist in small subpopulations that are mostly isolated from each other with little gene flow between subpopulations (Brown et al., 2014).

Humpback whales are listed as Conservation Dependent in Western Australia under the WC Act. The species is seasonally present in Western Australian waters during annual migrations between Southern Ocean feeding grounds and lower latitude breeding and calving grounds. Humpback whales migrate northwards along the Western Australian coast from May to August each year to key calving and aggregation sites in the southern Kimberly region, Exmouth Gulf and Shark Bay. The southward migration occurs between September and November. Humpback whales that aggregate and breed off Western Australia belong to breeding Stock D, as defined by the International Whaling Commission. Recent abundance estimates for Stock D are between 17,810 (95% CI = 14,210–27,720) and 28,830 (95% CI = 23,710-40,100) individuals (Hedley et al. 2011, Salgado-Kent et al. 2012), and the recovery of the species post-whaling is estimated to be close to its maximum biological growth rate. Obtaining accurate abundance data for Stock D is difficult as whales generally travel along a broad migration corridor along the coast of Western Australia, and there is inter-annual variation in the distances that whales migrate from the shore. Areas along the coast where the migratory route narrows and individuals migrate within 30 km of the coastline include the waters from Geographe Bay to Rottnest Island, and the waters inshore of the Houtman Abrolhos Islands (DSEWPaC, 2012h).

Southern right whales are listed as Vulnerable under the WC Act. The species migrates annually between mid- to high latitude feeding grounds and austral winter calving grounds from Western Australia to New South Wales and are present in coastal waters between May and October. Based on genetic analyses, two subpopulations are considered to occur in Australian waters (Carroll et al., 2011). Southern right whales that calve in Western Australia are considered part of the southwest Australian population, estimated to have an abundance of 3,164 individuals, and a population growth rate of approximately 6% per annum (Smith et al., 2020). Key calving and aggregation sites in Western Australia are Doubtful Island, Yokinup and Israelite Bay, with emerging aggregation areas around Augusta, Bremmer Bay and Twilight Cove (DSEWPaC, 2012e).

Pygmy blue whales are seasonally present in the waters of southwest Western Australia from November to June. Between February and June, whales migrate northwards along the coast to breeding grounds. Individual pygmy blue whales satellite tagged at the Perth Canyon, migrated northwards in April and May and reached potential breeding grounds in Indonesian waters in June. During this northward migration the tagged individuals migrated within 100 km of the coastline, until they reached the North West Cape after which they moved further offshore (Double et al., 2014). Pygmy blue whales that were satellite tagged off the South Australia – Victoria border, also migrated along the Western Australian coast to Indonesian waters (Möller et al., 2020). Analysis of a passive acoustic array that was located north west of Exmouth found that pygmy blue whales migrated southward at distances up to 400km from shore (Gavrilov et al., 2018). Southward migration back to feeding grounds occurs from November to early January, and female pygmy blue whales with calves have been observed resting in the area of Geographe Bay from September to December (DSEWPaC, 2012h). Peak abundance around Perth Canyon, a known feeding area, is in March and April. The Antarctic blue whale have also been acoustically detected off Cape Leeuwin and the Perth Canyon, predominantly between May and October, and these areas may be part of migratory and /or breeding habitat (COA, 2015b).

There is limited information on the distribution or abundance of killer whales in Western Australian waters, but both tropical and temperate forms are likely to occur. Most killer whales sighted in temperate waters in Australia resemble the Antarctic Type A morphotype, however, killer whales with Type B morphotype have also been recorded off Western Australia (Donnelly et al., 2021). Killer whales aggregate seasonally at Bremer Canyon, which lies approximately 70 km south of Bremer Bay on the southern coast of Western Australia. Over 140 individual whales have been photographed at Bremer Canyon since 2014 (www.projectorca.com.au). In the inshore region of Ningaloo, 26 killer whales have been individually identified. Killer whales in the region of the North West Cape have been observed preying on humpback whale calves, potentially taking dozens each year (Pitman et al., 2015). In addition, the authors observed a successful predation event on a group of spinner dolphins (potentially dwarf spinner dolphins) with one or two individuals taken. A female killer whale that was satellite tagged off the North West Cape travelled an estimated 1,964 km over a 22 day period including moving 400 km south where it spent 3 days close to the shore near Carnarvon before travelling north again near the area where she was tagged (Pitman et al., 2015). A recent study into the population structure of killer whales in Australasia identified killer whales in northwest and southwest Australia as belonging to two separate populations (Reeves et al., 2021).

There is limited information on the distribution of spinner dolphins in Western Australia, but they have been recorded north of Broome and in the Kimberley region (Allen et al., 2012; Bayliss et al., 2015). During three years of surveys of the Browse Basin, spinner dolphins were the most frequently sighted cetacean species, and were predominantly encountered at distances of >10 km from the coast, with groups of up to 100 individuals recorded (RPS, 2012).

There is limited information on the distribution or movements of dwarf minke whales in Western Australia. The species is recorded to occur between March to December.

9.2 Western Australian managed fisheries

Commercial fisheries in Western Australian are managed by the Department of Primary Industries and Regional Development (DPRID) under the *Fish Resources Management Act 1994* (FRM Act), with customary fishing rights protected under the act. Hunting for dugongs by Traditional Owner groups is managed under the *Conservation and Land Management Act 1984*, and where Native Title has been determined Traditional Owners have management responsibility for their Sea Country.

The DPRID manage commercial fisheries in Western Australia using an EBFM approach, and as part of the development of management plans for commercial fisheries, risk assessments are undertaken following the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Fisheries' (Fletcher, 2015; Fletcher et al., 2002). The waters of Western Australia are divided into six aquatic bioregions and cumulative risk is assessed for each ecological resource or asset located within a bioregion. These ecological resources include habitats, captured species and TEP species. Commercial fishers are required to record all interactions with TEP species in monthly statutory returns. The results of fishery risk assessments, and summaries of fishery reported TEP interactions are published annually in 'Status reports of the fisheries and aquatic resources of Western Australia'.

The 2021 status report states that interactions with TEP species were generally assessed as being negligible to low. The exceptions to this were the risk to dolphins from the Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF) which was assessed as low-moderate, and risks to Australian sea lions in the South Coast Bioregion which were assessed as moderate (Gaughan and Santoro, 2021).

A harvest strategy that states the objectives, performance indicators, reference levels and harvest control rules for each 'ecological asset' is developed for each fishery resource. These strategies consider the aggregate effects of commercial, recreational, and customary fishing on the asset being considered. Control rules, or management responses, are specified for set target, threshold, and limit

reference levels for each asset. Impacts of the fishery on TEP species are considered as a single component. There are 30 different commercial fisheries in Western Australia (Gaughan and Santoro, 2021). Two fisheries in Western Australia are managed jointly by the State and Commonwealth government by the Western Australian Fisheries Joint Authority (WAFJA), these are the Southern Demersal Gillnet and Demersal Longline Fishery, and the Northern Shark Fishery (east of Koolan Island).

Several fisheries have specific gear requirements to mitigate interactions with marine mammals. All trawl nets are required to be fitted with BRDs which consist of either a grid and / or a fish exclusion device. Grids are used as the method to mitigate bottlenose dolphin interactions with the PFTIMF. SLEDs have been mandatory in pots when fishing in specified zones in the Western Australia Rock Lobster Fishery since 2006 and in the South Coast Crustacean Fishery since 2015. Changes in how gear is deployed and a reduction in effort are used to mitigate large whale interactions with the Western Australian Rock Lobster Fishery. Further information on these mitigation measures is provided in the relevant fishery sections below.

The DPIRD has undertaken a program to provide all Western Australian commercial fisheries with the opportunity to achieve independent third-party certification, with the MSC chosen as the preferred accreditation scheme. To date seven fisheries have been certified under the program. During fishery assessment for the MSC, specific performance indicators for TEP species are scored by assessors.

A recent assessment of the research priorities for marine mammals in Western Australia using a prioritisation framework identified areas where further information was required in relation to potential impacts from fisheries (Waples and Raudino, 2018). For gillnet gear these were the potential population impacts on Australian sea lions from interactions with the Western Australian Southern Demersal Gillnet and Demersal Longline Fishery, and the sustainability of dolphin bycatch in the Kimberly Gillnet and Barramundi Fishery.

The most recent ERA assessed the risk to Australian sea lions from the gillnet sector of the fishery as being ‘High”(Watt et al., 2021). Bycatch risk to Australian sea lions is currently managed through 33 gillnet exclusions zones along the Western Australian coast that were introduced in 2018. Between 2007 and 2017, DPIRD estimated a bycatch rate of three to adult female sea lions per breeding seasons (TSSC, 2020) However, there is currently no independent monitoring in the fishery to validate fishery-dependent reports of interactions which are low.

The assessment of research priorities also identified a need for further information on the extent and sustainability of dolphin bycatch in the PITIMF, and on marine mammal interactions with the South Coast Purse Seine Fishery was also identified (Waples and Raudino, 2018). The 2018 report on the status of Western Australian fisheries noted that “Low capture rates of dolphins, sea lions and seals have also been recorded [in the South Coast Purse Seine Fishery], which are usually released unharmed” (Gaughan and Santoro, 2018). Information on reported and observed dolphin interactions, and management strategies in the PFTIMF is provided in section 9.2.2.

Improved information on the number of humpback whales that are entangled annually and the effectiveness of mitigation practices in pot fisheries is also required (Waples and Raudino, 2018). Between 2015 and 2020, 34 humpback whale entanglements and 1 southern right whale entanglements were reported in Western Australia in annual national reports to the International Whaling Commission (www.iwc.int). Nineteen entanglements were in pot gear including recreational pots, two were attributed to octopus fishing gear, and fifteen were recorded as miscellaneous or unknown gear. Gear was successfully disentangled or shed from 16 individuals. Information on management strategies to mitigate large whale interactions are provided in the relevant sections below.

The Abalone Managed Fishery, Barramundi and Coral aquaculture fisheries, Gascoyne Demersal Scalefish Managed Fishery, Pearl Oyster Managed Fishery, and the Specimen Shell Managed Fishery have already been classified as 'exempt' under the MMPA. A further ten Western Australian wild-capture fisheries are seeing a comparability finding, the details of each are provided below.

9.2.1 Abrolhos Islands and Mid-West Trawl Fishery

The Abrolhos Islands and Mid-West Trawl Fishery (AIMTF) predominantly operates around the Abrolhos Islands off the coast of Western Australia, with a second fishery area off Port Gregory (Fig. 28). The fishery operates between March and August targeting saucer scallop (*Ylistrum balloti*).and western king prawn (*Melicertus latisulcatus*). Scallops and prawns are targeted using twin-rigged demersal otter trawl nets. Each net is 12.8 m in length with a total headrope of 256 m. Scallop trawl nets have a mesh size of 100 mm, and prawn trawl nets have a mesh size of 61 mm, with a codend mesh size of 45 mm. All trawl nets in Western Australian must have a BRD fitted. Tows are undertaken at around 3 knots and last between 30 minutes to three hours (DPIRD, 2020a). Trawling is prohibited in all Marine Park zones that overlap with the area of the fishery.

There are ten licences in the fishery, with five boats operating each year. As the fishery is dependent on the recruitment of scallops, which is linked to environmental conditions, interannual effort can be highly variable. For example, the fishery was closed between 2012 and 2016 because of low scallop abundance due to a marine heatwave. The fishery is accredited under the EPBC Act until March 2025. The fishery is currently being assessed for MSC accreditation.

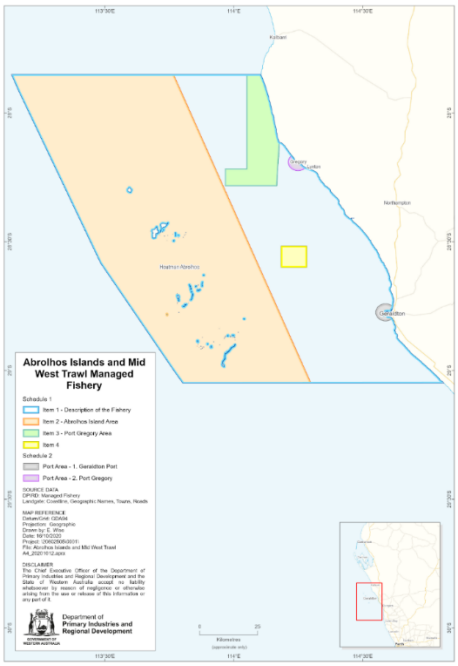


Figure 28: Area of the Western Australian Abrolhos Islands and Mid-West Trawl Fishery The most recent ERA for part of the fishery was undertaken in 2019 (DPIRD, 2020a). The marine mammals considered were "cetaceans" and the Australian sea lion. No interactions have been reported with any marine mammal in the fishery since mandatory reporting was introduced in 2008 (DPIRD, 2020a). The results of the ERA assessed the risk to "cetaceans" of becoming captured in trawl nets as negligible due to the presence of BRDs in trawl nets, and the low opening of the otter trawls. The ERA assessed the risk to Australian sea lions of becoming captured in trawl nets negligible due to the presence of BRD in trawls, and that the species was 'unlikely to forage in trawl nets' (DPIRD, 2020a). The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules for the fishing

'to ensure fishing impacts do not result in serious or irreversible harm' to TEP species populations. The results of periodic risk assessments of the impacts of the fishery on TEP species are used as performance indicators. The reference level set is that impacts on TEP species are assessed as being of a moderate or lower risk (DPIRD, 2020b). If an assessment judges the risk of impact to be high, a review should be undertaken within three months to determine the reasons for the increase in risk, and an appropriate management response should be implemented to reduce risk to an acceptable level as soon as practicable. If the fishing impacts are assessed to generate a severe risk to any TEP species population the control rule is that there should be an immediate management response to reduce the risk to an acceptable level (DPIRD, 2020b). No interactions with marine mammals were reported in fishery logbooks in the AIMTF between 2014 and 2019 (Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2021, 2020, 2018).

A number of marine mammal species occur in the area of the fishery. The Houtman Abrolhos islands are the northern extent of the Australian sea lions which breed on twelve islands, with less than five pups being produced at most of these breeding sites (Goldsworthy et al., 2021). The exact number of breeding colonies is unknown, as at some islands there are only records of large brown or moulted pups which may have been born at other nearby colonies. A species wide assessment of trends in abundance of Australian sea lion, based on time series data from 30 breeding sites, estimated an overall reduction in pup abundance, over three generations, of 64% (Goldsworthy et al., 2021). Time series data were unavailable for many breeding sites in Western Australia, including the Abrolhos Islands, but for the sites where it was available the rate of decline of pup abundance was 0.3% per year. Movement data from juveniles sea lions and an adult female sea lion satellite tagged at the Abrolhos Islands showed individuals foraged in relatively shallow water (<10 km) and had restricted foraging ranges from the colony (<10 km) (Campbell, 2008). There have been no observations or records of Australian sea lions interacting with trawl nets in the fishery.

Both Indo-Pacific and common bottlenose dolphins are likely to occur in the area of the fishery, and both species have been recorded to associate with otter trawl fisheries in Australia. However, there is no information on the abundance or distribution of either species around the Abrolhos Islands and no records of interactions with the fishery.

Humpback whales are seasonally present in the area of the fishery during northward and southward migration to and from breeding and calving grounds in north-west Western Australia. Peak northward migration is in early to mid-July and peak southward migration is in late September. Pygmy blue whales may be present in the area of the fishery during northward migration to potential breeding grounds in Indonesian waters when they migrate within the 100 km of the coast (Double et al., 2014). There have been no observations of interactions between large whales and trawl nets in the fishery.

9.2.2 Pilbara Fish Trawl Interim Managed Fishery

The PFTIMF is a multi-species fishery that targets several scalefish species, primarily snapper (Lutjanidae sp.) and emperor (Lethrinidae) using bottom otter trawls. The fishery operates on shelf waters off the northwest coast of Western Australia, in depths oof 50-100 m in an area covering of 6,900 nm^2. It is divided into six management areas, with two areas (3 and 6) closed to fishing since 1998 (Fig. 29). The fishery operates year-round with some reduction of effort during the cyclone season. Trawl nets are towed at 3-3.5 knots and are limited to 274.32 m in length, including bridles and cables, with a maximum head rope length of 36.58 m and a minimum mesh size of 100m. Two to three trawl vessels operate in the fishery. The fishery is accredited under the EPBC Act until August 2024.

This current EPBC Act accreditation for the fishery includes several conditions that specifically relate to interactions with TEP species. The DPIRD must formalise a policy by August 2024 to support

electronic monitoring in the fishery that must include information to verify bycatch and reported rates of TEP species interactions. An ERA which considers the impacts of the fishery must also be published by DPRID by December 2022.

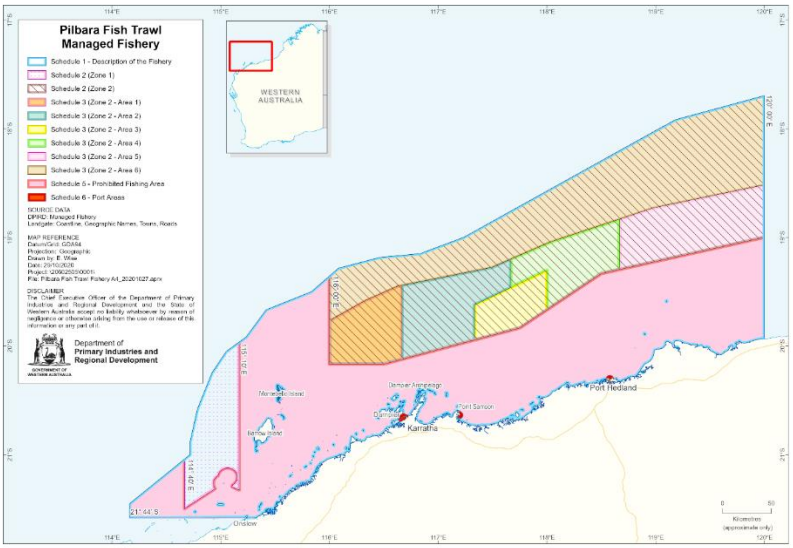


Figure 29: Area of the Pilbara Fish Trawl (Interim) Managed Fishery.

The current harvest strategy for the fishery outlines the performance indicators, reference levels and control rules to meet the objective that 'fishing impacts do not result in serious or irreversible harm' to TEP species populations (DPIRD, 2017). The most recent fishery status report assessed the risk to 'dolphins' from the PFTIMF to be low-moderate (Gaughan and Santoro, 2021).

An inventory of bycatch in the PFTIMF conducted in 2002 showed that several protected species interacted with the fishery. This included the common bottlenose dolphins (*Tursiops truncatus*). Pingers (acoustic devices) were initially trialled to mitigate dolphin interactions but were found to be ineffective. BRDs in the form of exclusion grids were then developed and tested in the fishery in 2004 and 2005, and after they were shown to reduce bycatch rates of a number of species, they became mandatory in the fishery in March 2006. Since this time there have been a number of trials of different grid design and escape hatch configurations, as well as changes in the location where grids are deployed in the net (Allen and Lonergan, 2010; Stephenson and Wells, 2006; Wakefield et al., 2014).

The observed bycatch rate of bottlenose dolphins in the fishery between August 2003 and February 2006, when BRDs were not used, was 18.8 dolphins per 1,000 trawl shots. This rate was reduced to 10.5 dolphins per 1,000 trawl shots between January 2005 and September 2009 with BRDs deployed (Allen et al., 2014). Between 2006 and 2012, the number of dolphin mortalities reported in fishery logbooks ranged from 11 to 24 per year, with an average of 16.7 dolphin mortalities reported annually (Wakefield et al., 2017). The most recent bycatch mitigation trials in the fishery tested three different grid and escape hatch configurations in three vessels. The first was a 'downward BRD' with an escape hole and cover forward of the grid on the bottom surface of the net. The second was an 'upward BRD' with an escape hole and cover forward of the grid on the top surface of the net. The third was and a 'square mesh' BRD with an escape hole and cover forward of the grid on the bottom surface of the net, as well as an escape slit, held together by magnets, on the top surface of the net (Wakefield et al., 2017). The study used underwater cameras positioned 5 m in front and behind of the grids to record interactions between protected species and different grid configurations over a six-month period (Wakefield et al., 2014). In total, 1,320 hours of subsurface daytime footage were

recorded from 774 trawls which accounted for 60% of trawl effort over the study period. Interactions between dolphins and the three grid configurations were too low to determine the relative effectiveness of the three grid configurations at mitigating mortalities However, the high level of video monitoring provided further information on dolphin interactions with the fishery. This information and builds on several previous studies that used video footage recorded inside trawl nets in the PFTIMF to determine the subsurface efficacy of grids at mitigating bycatch and/or the behaviour of marine megafauna interacting with grids and escape holes (Jaiteh et al., 2013; Mackay, 2011; Santana-Garcon et al., 2018; Stephenson et al., 2006; Wakefield et al., 2014).

All sub-surface video has shown that the association rate is very high between dolphins and the fishery, with dolphins actively foraging both inside and outside trawl nets. Where cameras are positioned inside the net affects how much of the trawl net is visible. Studies that analysed video footage where the field of view of the net was restricted likely underestimate dolphin association rates. For example, dolphins were recorded present inside nets inside nets in 81% of 34 videoed trawls in 2008 from cameras placed 3.5m forward of the exclusion grid (Jaiteh et al., 2013), whilst in 2013, when cameras were placed 11 m or 25 m back from the headline facing the opening of the mouth, dolphins were recorded inside of the net in 90% of 50 videoed daytime trawls (Santana-Garcon et al., 2018). Deck cameras that recorded 85% of fishing effort over a six month period in 2012 documented dolphins interacting with trawl nets on the surface during 75.7% of daytime hauls, and in all four management areas of the fishery (Wakefield et al., 2014). Photo-ID taken of dolphins around one trawl vessel identified 136 individuals from 60 trawl shots over a two week period (Allen et al., 2017). Fifty of these individuals were photographed on multiple occasions (3-7 times), producing mark recapture estimates of 226 (S.E. 38.5) dolphins associating with that single vessel over the study period (Allen et al., 2017). Sub-surface video footage documented the same individuals entering nets on different tows separated by days and weeks (Jaiteh et al., 2013). In addition photo-ID and biopsy data matched dolphins that associated with trawlers in both 2008 and 2011, indicating that some individual dolphins show foraging fidelity to the fishery over extended periods (Allen et al., 2017).

While dolphins regularly enter trawl nets in the fishery, the number that 'interact' with the grid (i.e., reach the grid) is lower than the number that freely enter and exit through the mouth of net. Although excluder grids have reduced the number of landed bycaught dolphins in the fishery, it is difficult to determine how much of the reduction is due to dolphins that 'interact' with the grid actively escaping, or through the drop out of mortalities. Videos footage from 446 tows recorded in 2005 and 2006, documented seven dolphins reaching the grid, of which one exited the net through the trawl mouth, two exited alive through the escape opening, two died and fell out of the escape opening and two died forward of the grid (Stephenson et al., 2006). In 2008, two of three dolphin that were videoed interacting with grids during 44 tows were described as motionless prior to being expelled through a bottom opening escape hatch, while the third was retained and landed (Jaiteh et al., 2014). Interactions between seven dolphins and grids were recorded in five of 774 tows videoed in 2012, with all individuals reported as being distressed and/or lethargic when first observed in the vicinity of the grid (Wakefield et al., 2017, 2014). Of these seven dolphins, two were reported to exit through a top opening escape hatch in good condition, four asphyxiated ahead of the grid and were landed, and one died after its tail became lodge in the grid. This individual dropped out of the top opening escape hatch during hauling when the net rotated 180˚ and was therefore not landed or observed on the vessel (Wakefield et al., 2017, 2014). A further six dolphin bycatches were recorded by deck cameras during this study, giving a bycatch rate of 12.9 dolphins in 1000 tows, and an actual bycatch rate of 14.2 dolphins in 1000 tows when the 'drop out' mortality is included. Nearly all dolphins that have been videoed interacting with grids in the fishery have approached the grid tail first, and this orientation has resulted in three individuals being documented to get their tail lodged in the grid bars (Mackay, 2011; Wakefield et al., 2014). Along with trials of different grid configurations, a trial of a louder pinger (Dolphin Dissuasive Device DDD 03H, STM Products SRL) was

conducted in 2012. An assessment of subsurface video recordings of dolphins inside the net showed no different in behaviour inside nets between 17 tows when pingers were deployed and 14 tows without pingers (Santana-Garcon et al., 2018).

The Pilbara Fish Trawl Fishery Code of Practice notes that given the frequency at which dolphins are associated with nets in the fishery, the main method to minimise the risk of bycatch occurring is to ensure nets maintain their shape while being towed. Specifically, the Code of Practice states that otter boards should remain stable during tows and be monitored using acoustic sensor technology, the net opening should be maintained, and speed and direction should be consistent during a tow with no sudden turns. This includes during haul back of the net when tow speed should not be increased.

In 2012-13, EM observer coverage of 85% of fishing effort (2,127 tows) recorded 13 dolphin bycatch events, giving an interaction rate of 6 dolphins per 1,000 tows. In 2016, 20 dolphin mortalities, and three dolphins released alive, were recorded from 78% EM observer coverage (1,729 tows), giving an interaction rate of 12 dolphins per 1,000 tows, which was double the interaction rate observed in 2012-13. A further nine mortalities, and three interactions with dolphins (where the fate of the individual was unknown) were recorded in fishery logbooks in 2016, which was the highest logbook recorded number of dolphin interaction in the last five years (Table 32). The annual number of mortalities reported in fishery logbooks in the fishery between 2015 and 2019 ranged from 11 to 29 dolphins (Table 32).

Table 32: No of dolphin interactions and fate of individuals reported in fishery logbooks in the Pilbara Fish Trawl Interim Managed Fishery between 2014 and 2019.

Year	Total individuals	Total mortalities	Total alive	Unknown
2019	13	11	2	0
2018	23	17	3	3
2017	16	12	2	2
2016	35	29	3	3
2015	20	16	2	2

Wakefield et al. (2018) investigated the relationship between the accuracy of estimating total bycatch of protected species in the fishery and the level of observer coverage. Their results showed that to estimate dolphin interactions within ±50% of the actual number would require 53% observer coverage, and to estimate within ±25% of the actual number of bycatch events, nearly 100% coverage would be required.

A number of questions relating to bottlenose dolphin interactions with the PFTIMF were identified during a recent assessment of information gaps and pressures on marine mammals in Western Australia (Waples and Raudino, 2018). These related to the proportion of the populations of dolphins that is impacted, the biologically sustainable level of bycatch in that fishery and the effectiveness off mitigation strategies.

The only abundance data for bottlenose dolphins in the region are from an aerial survey of 71% of the area of the fishery was conducted in 2011. The results from this fishery, when scaled to the total area of management areas 1-5 of the fishery, produced an abundance estimate of 2,274 (95% CI=1,247–4,214) dolphins (Allen et al., 2017). To estimate the maximum number of individuals that can be removed from a population without causing negative stochastic population growth, Manlik et al. (2022) developed a “sustainable anthropogenic mortality in stochastic environments (SAMSE)” approach. They applied the SAMSE approach to the abundance estimate from Allen et al. (2017), and

estimated a limit of 2.3 – 8.0 dolphin mortalities per year, compared to an estimated PBR of 16.2 individuals per year (Manlik et al., 2022). The current EPBC accreditation of the fishery includes a condition for DPIRD to review the resilience of dolphin populations to the fishery.

9.2.3 Exmouth Gulf Prawn Fishery

The Exmouth Gulf Prawn Managed Fishery (EGPMF) targets brown tiger prawns (*Penaeus esculentus*), western king prawns, endeavour prawns (*Metapenaeus endeavouri*) and banana prawns (*Penaeus merguiensis*) using demersal trawl gear in Exmouth Gulf (Fig. 30). The Gulf is a tropical embayment with waters less than 20 m in depth that covers an area of around 2,200 km^2. The fishing season runs from April to early December each year, with four days of closures around each full moon. Fishing is only allowed between 6pm and 8 am, and more than 60% of the fishery area in Exmouth Gulf is closed to trawling (Kangas et al., 2015b). Vessels in the EGPF use low-opening otter trawl nets, with each vessel towing four nets in quad-rigged formation. Trawls are fitted with primary and secondary BRDs including grids and fish escape devices. Headrope length is either 10.97 m or 14.63 m and tow length ranges from 60 to 200 minutes. The fishery is accredited under the EPBC Act until May 2025 and was certified by the MSC in 2015. Six vessels operate in the fishery.

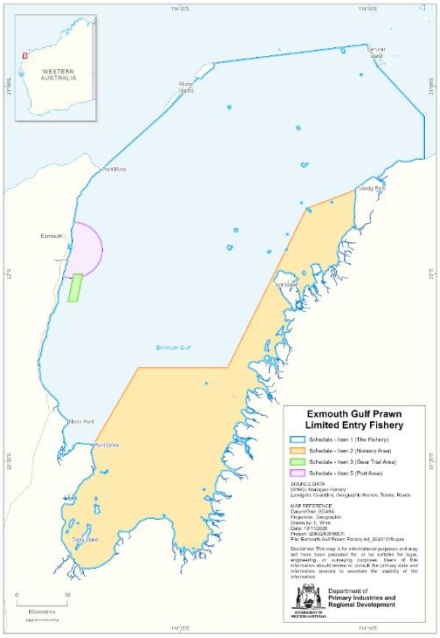


Figure 30: Exmouth Gulf Prawn Fishery.

In 2014 a risk assessment was undertaken in the fishery using a Productivity Susceptibility Analysis (PSA). The results of the PSA identified 'cetaceans' and dugongs at low risk to bycatch and at medium risk to boat strikes (Kangas et al., 2015b). There is no independent observer program in the fishery, however several fishery-independent trawl surveys using commercial fishing boats are undertaken each year (Kangas et al., 2015b). There have been no reports of interactions with marine mammals from these fishery-independent surveys, and no interactions were observed during 246 tows trialling BRDs in the fishery (Kangas and Thomson, 2004). Cameras are now installed on all vessels in the EGPMF to allow monitoring of bycatch and interactions with TEP species (Banks et al., 2020). The EGPMF Bycatch Action Plan (2014-2019) includes actions to improve quantitative information on TEP bycatch through fishery-independent surveys to be conducted every three years (DoF, 2014a). The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules 'to ensure fishing impacts do not result in serious or irreversible harm' to TEP species populations. The performance indicators relate to the percentage of the fishery area that is trawled

and the mandatory use of BRD in the fishery. If the area trawled is greater than 50%, or a potential change in the risk level to TEP species are identified, or a reference level threshold is met, a review of the risk levels must be completed. If the risk level of the fishery is assessed as or above 'high', appropriate management strategies to reduce risk need to be investigated and initiated (DPIRD, 2018a).

Two interactions with dolphins, not identified to species, were reported in the fishery between 2015 and 2019 (Banks et al., 2020; Gaughan and Santoro, 2021)(Table 33). One was reported alive in 2016, while the second, reported in 2017, 'appeared to have been dead prior to capture' (Banks et al., 2020). Dolphins have been reported feeding off discards from prawn trawlers.

Table 33: No of dolphin interactions and fate of individuals reported in fishery logbooks in the Exmouth Gulf Prawn fishery between 2014 and 2019.

Fishing Season	Total	Released Alive	Total Mortalities
2014	0	0	0
2015	0	1	0
2016	1	1	0
2017	1	0	1
2018	0	0	0
2019	0	0	0

Surveys of the North West Cape between 2013 and 2015, which includes the wester waters of Exmouth Gulf, produced an abundance estimate of 129 humpback dolphins (95% CI 117 to 141) (Hunt et al., 2017). The estimated abundance of the resident humpback dolphin population in the survey region was 141 (95% CI: 121–161), with a super-population of 370 (95% CI: 333–407) (Haughey et al., 2020). No other species of dolphins were recorded in the Exmouth Gulf during aerial surveys in 2018 (Irvine and Salgado-Kent, 2019). In 2018, the estimated abundance of dugongs in the Exmouth Gulf and Ningaloo region was 4,831 (±1,965) individuals (Bayliss et al. 2018, cited in Bayliss et al., 2019).

Exmouth Gulf is a known nursing and resting area for humpback whales during their southward migration between August and November. Aerial surveys conducted in 2004-2005 found a maximum of 459 whales were present in the Gulf at any one time (Braithwaite et al., 2012). More recently the ocean side of the North West Cape has been identified as a humpback whale calving ground (Irvine et al., 2018), and neonate calves have also been recorded inside the Gulf (Irvine and Salgado-Kent, 2019). The maximum number of humpback whales recorded from aerial surveys in September 2018 was 754 (Irvine and Salgado-Kent, 2019).

9.2.4 Shark Bay Fisheries

Shark Bay is a shallow subtropical embayment that is listed as a World Heritage Site because of several exceptional natural features, including one of the largest seagrass ecosystems in the world. Dugongs, two pinniped and eighteen cetacean species were listed as potentially occurring the Shark Bay region in a report to the MSC (Kangas et al., 2015a). Of these, the most commonly occurring species are dugongs, Indo-Pacific bottlenose dolphins, humpback whales and southern right whales. Shark Bay is an important area for large resident populations of dugongs (~14,000 in 1999) and Indo-

Pacific bottlenose dolphins (~2000 in 1994) (Gales et al., 2004; Preen et al., 1997). Humpback and southern right whales are seasonally present in the bay during the austral winter. In 2011, a marine heatwave event in Western Australia led to an extensive decline of over 1,000 km^2 in seagrass meadows (Kendrick et al., 2019). The reduction in seagrass had impacts on populations of direct consumers such as dugongs, and non-direct consumers such as Indo-Pacific bottlenose dolphins, with estimated declines in density and abundance of 68% and 39% respectively (Nowicki et al., 2019). Dugongs respond to large-scale die offs of seagrass by temporarily emigrating from the affected area and / or postponing breeding (Marsh, 2018). While bottlenose dolphins may also respond to extreme weather events by temporarily emigrating from an area, declines in the reproductive output of female Indo-Pacific bottlenose dolphins in Shark Bay were also observed after the marine heatwave event (Wild et al., 2019).

9.2.4.1 Shark Bay Prawn Fishery

The Shark Bay Prawn Managed Fishery (SBPMF) targets western king prawns and brown tiger prawns using demersal trawl gear. The fishery operates in an area of around 6,063 km^2 within inner Shark Bay (Fig. 31).The fishing season runs from March to November, with closures monthly closures relating to lunar phase. Vessels in the SBPMF use low-opening otter trawl nets, with each vessel towing four nets in quad-rigged formation, with a net length of 10.1 m. All nets in the fishery must be fitted with a rigid grid and a separate fish exclusion device. Tow length ranges from 50 to 180 minutes. There are 18 vessels operating in the fishery, and fishing effort is undertaken in approximately 40-50% of the fishery area each season (DPIRD, 2020c). The fishery is accredited under the EPBC Act until May 2025 and was accredited by the MSC in 2015.

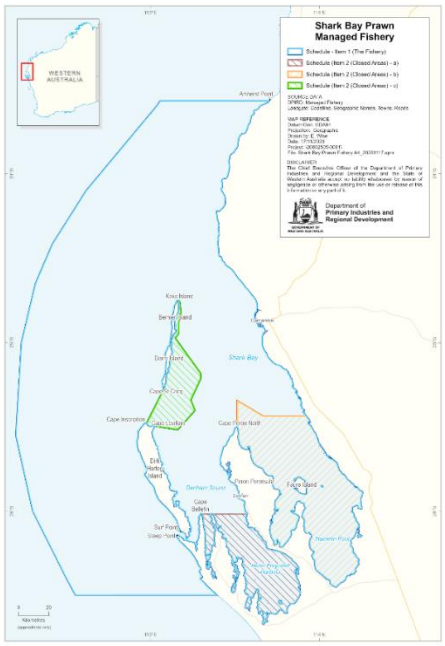


Figure 31 Area of the Western Australian Shark Bay Prawn Fishery.

A total of 1,180 trawl shots were observed in the fishery between 2000 and 2002 as part of trials of BRDs (Kangas and Thomson, 2004). No marine mammals captures were recorded during these trials. The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules so that 'fishing impacts do not result in serious or irreversible harm' to TEP species populations. A review of risk levels in the fishery must be undertaken if the area trawled exceeds 20% of Inner Shark Bay, if a potential change in the risk level to TEP species is identified or a reference level threshold is met, a review of the risk levels must be completed. If the limit reference level is met and

the risk level of the fishery is assessed as ‘high’or above, appropriate management strategies to reduce risk need to be investigated and initiated (DoF, 2014b).

In 2014 the results of a PSA identified ‘dolphins’ at medium risk from the fishery. However, the overall risk to dolphins was considered negligible based on the assumption that dolphins are ‘common’ in inshore and coastal a regions, there were few reports of interactions, and dolphins could avoid vessels as they operate at speeds under four knots (Kangas et al., 2015a). The results of the 2020 ERA for the fishery assessed the risk to dolphins from direct capture or vessel strike as negligible (DPIRD, 2020c). Between 2006 and 2019 there four interactions with dolphins, not reported to species, were reported (DPIRD, 2020c; Gaughan and Santoro, 2021; Kangas et al., 2015a). Two individuals were reported as alive in 2010 and 2018, one individual in 2012 was reported as unknown, and one individual was reported as dead in 2019. The mortality reported in 2019 was the result of a dolphin interacting with a propellor on a vessel in the fishery (Gaughan and Santoro, 2021). The nature of the other three interactions was not reported, but dolphins have been reported to follow vessels in the fishery to feed on discards (Kangas et al., 2015a).

The results of the 2014 PSA assigned a medium risk rating to dugongs, based on the low productivity of the species (Kangas et al., 2015a). There have been no records of interactions with dugongs and the fishery. The results of the 2020 ERA for the fishery assessed the risk to dugongs from direct capture or vessel strike as negligible (DPIRD, 2020c). Over 60% of Shark Bay is permanently closed to trawl fishing, and approximately 8% of fishing effort occurs over seagrass (DPIRD, 2020b. There have been no records of interactions with dugongs and the fishery.

9.2.4.2 Shark Bay Scallop Fishery

The Shark Bay Scallop Managed Fishery (SBSMF) targets saucer scallops in outer Shark Bay using low-opening otter trawl gear with mandatory use of grids as BRD (Fig. 32). The fishery is year-round except during the winter spawning period. There are two types of licence classes in the fishery. A Class boats can only take scallops, while B Class boats can retain scallops when targeting prawns in the prawn fishery. Vessels that only target scallops use low-opening demersal otter trawls that are towed in a twin-rigged formation, for no more than 60 minutes (DPIRD, 2020c). The fishery was closed from 2012 to 2014 due to low scallop recruitment due to a marine heatwave event. The fishery is accredited under the EPBC Act until May 2025.

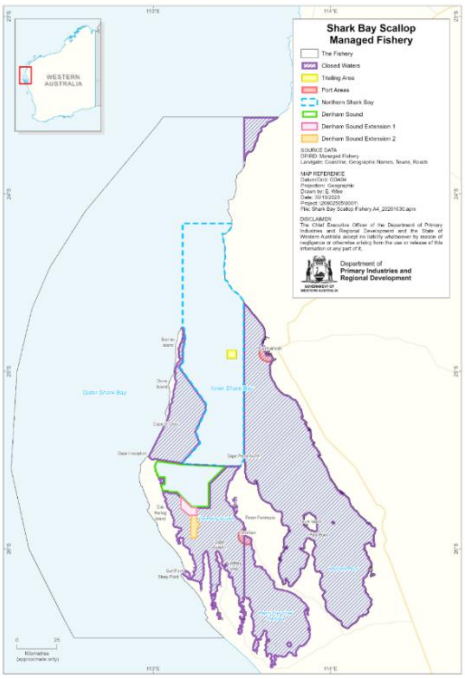


Figure 32: Area of the Western Australian Shark Bay Scallop Fishery. The results of the 2020 ERA for the fishery assessed the risk to dolphins and dugong from direct capture or vessel strike as negligible (DPIRD, 2020c). Over 60% of Shark Bay is permanently closed to trawl fishing, and approximately 8% of fishing effort occurs over seagrass (DPIRD, 2020b). Therefore there are large areas of dugong habitat where trawlers do not operate. The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules so that 'fishing impacts do not result in serious or irreversible harm' to TEP species populations. The target reference level for the fishery is that the risk to TEP species is assessed as 'moderate' or lower' (DPIRD, 2020d). If the risk to a TEP species is judged to be 'high, a review should be undertaken within three months to determine the reasons for the increase in risk, and an appropriate management response should be implemented to reduce risk to an acceptable level as soon as practicable. No interactions with marine mammals were reported in fishery logbooks in the SBSMF between 2014 and 2019 (Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2021, 2020, 2018).

9.2.4.3 Shark Bay Crab Managed Fishery

The Shark Bay Crab Managed Fishery (SBCMF) operates year-round targeting blue swimmer crab using commercial crab traps or trawl nets. Crab traps are joined together in a line using negatively buoyant rope with a vertical line to the surface. Fishers using trawl nets must also hold a licence for the SBPMF or the SBCMF, with crabs retained as part of catch when targeting prawns or scallops. The SBCMF is divided into two zones which relate to the use of trap gear (Fig. 33). There are three licences which allow trap fishing in Zone 1 only, and two that allow trap fishing in both zones (DPIRD, 2020e). Licence holders in the prawn and scallop sectors can fish for crabs using trawl gear in either zone. Trap effort is distributed in less than 1% of the Inner Shark Bay. There are 27 vessels operating in the fishery. The fishery is accredited under the EPBC Act until 2025.

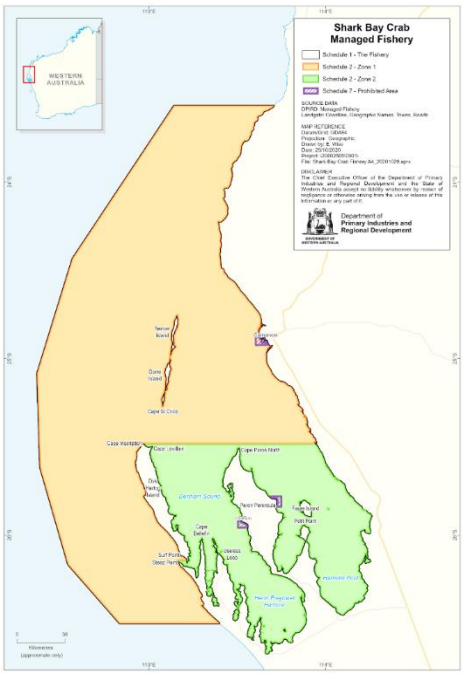


Figure 33: Area of the Western Australian Shark Bay Crab Interim Managed Fishery. There have been no interactions with marine mammals reported in the fishery (DPIRD, 2020c). The risk to both dugongs and cetaceans was assessed as negligible from the most recent ERA (DPIRD, 2020c). Although the use of negatively buoyant rope to join traps reduces the amount of rope in the water column, vertical lines in the water column and surface gear pose an entanglement risk to marine mammals. Both humpback and southern right whales are present in the area of the fishery during the austral winter. The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules so that 'fishing impacts do not result in serious or irreversible harm' to TEP species populations. The target reference level for the fishery is that the risk to TEP species is assessed as 'moderate' or lower'(DPIRD, 2020e). If the risk is assessed as high, a review should be undertaken within three months to determine the reasons for the increase in risk, and an appropriate management response should be implemented to reduce risk to an acceptable level (moderate or lower) as soon as practicable (DPIRD, 2020e).

9.2.5 Western Australia Rock Lobster Fishery

The Western Australian Rock Lobster Fishery (WARFL) targets Australian spiny lobster *(Panulirus cygnus*) using baited batten or beehive style pots. The fishery operates all year round from North-West Cape to Cape Leeuwin, up to 60 km offshore, and is managed in three spatial zones (Fig. 34). There are 295 vessels operating in the fishery. The fishery is accredited under the EPBC Act until 2025 and was accredited by the MSC in 2000.

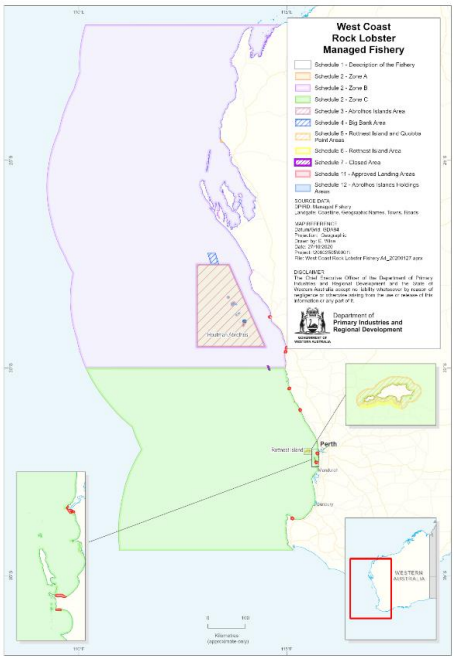


Figure 34: Area of the Western Australia West Coast Rock Lobster Managed Fishery. Several measures are regulated in the fishery to mitigate interactions with Australian sea lion and whale species, with compliance checks undertaken to monitor regulations are being followed. Sea Lion Exclusion Devices (SLED) have been mandatory in pots since 2006, when fishing in areas where there is a potential to interact with Australian sea lions. These areas are defined as waters shallower than 20 m that are within 30 km of Australian sea lion breeding colonies.

Between 1990 and 2017, there were 154 records of entangled whales off Western Australia. The majority (95%) were humpback whales, with the remaining records involving six southern right whales, one Bryde's whale and one minke whale (How et al., 2021). Where it was possible to attribute entanglement material to a specific fishery, most humpback whale entanglements (n=79) involved gear from the WCRLF, with six entanglements involving Aquaculture gear, ten involving octopus gear, and a single entanglement in each of Deep Sea Crabs, Shark and South Coast Crustacean gear (How et al., 2021). Most entanglements were observed during the north bound humpback whale migration which occurs along the coast of Western Australia from May to July and migrate south from September to November (How et al., 2021). Eight humpback whales entanglements in WCRLF were recorded in 2018 and six in 2019 (Daume and Morison, 2020). Table 34 shows the number of humpback whale entanglements attributed to the WCRFL between 2014 and 2019 (Daume and Morison, 2020; Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2020, 2018).

Table 34: No of humpback whale entanglements reported in fishery logbooks in the Western Australia Rock Lobster Fishery between 2014 and 2021.

Year	Number of entanglements
2014	6
2015	2
2016	4
2017	6
2018	8
2019	7

The export approval for the fishery under the EPBC Act was reduced from a five-year exemption to a two-year Wildlife Trade Operation in response to increased interactions with humpback whales in 2013. To reduce entanglement probability a number of gear modifications were introduced in the fishery in 2014. To reduce the amount of slack rope at or near the surface of the water, the following modifications were made. Vertical lines must not be longer than two times the water depth when fishing in water greater than 20 – 25 m in depth, the top two thirds of the rope must be negatively buoyant, and there are specific restrictions on the amount of floatation that can be used depending on the depth of water being fishery. Fishers must also retrieve pots at least every seven days. During the period of whale migrations (May – October), fishers are required to use 50% less pots. There is also an industry Code of Practice for reducing whale entanglements.

How et al. (2021) used a Bayesian modelling approach to investigate the efficacy of gear modification in mitigating humpback whale entanglements in the fishery. The results of the model indicated that gear modifications reduced entanglements with WCRLF gear by at least 25% (median reduction of 64%). Gear modifications were found to have contributed to an 88%, 76% and 65% reduction in reported entanglements in 2015, 2016 and 2017, compared to the peak of 17 entanglements reported in 2013. An increase in reported entanglements in 2018 resulted in a workshop with industry in 2019 to review mitigation and management arrangements and develop further mitigation strategies (How et al., 2020). There were seven reported entanglements in the fishery in 2019.

While it is not possible to accurately determine the number of humpback whale entanglements that occur annually, it is unlikely that these interactions will impact the continued recovery of the Western Australian (Stock D) population which was most recently estimated to be between 17,810 and 26,100 individuals (Hedley et al. 2011, Salgado-Kent et al. 2012). However, these entanglements present clear ethical concerns relating to the welfare and risk of mortality to entangled individuals, as well as the risk posed to personnel who attempt to disentangle them.

9.2.6 West Coast Deep Sea Crustacean Fishery

The West Coast Deep Sea Crustacean Managed Fishery (WCDSCMF) targets crystal crab (*Chaceon albus*), Chaceon spp. and Tasmanian giant crab (*Pseudocarcinus gigas*) using baited traps. The fishery operates in all waters off Western Australia north of 34°24'S, and seaward of the 150 m isobath out to the limit of AFZ (Fig. 35). The fishery operates year-round, but the majority of catch is taken between January and June, and most traps are set in depths between 500 – 800 m. Traps are connected to long-lines with 80 to 150 traps per line and a soak time of three to seven days (How et al., 2015). Two of the five vessels in the fishery are currently operating. The fishery is accredited under the EPBC Act until 2025 and was certified by the MSC in 2016.

No marine mammal interactions were recorded in ~4,700 observed trap lifts between 2010 and 2014 (How et al., 2015). In 2014 a PSA risk assessment was undertaken which rated the risk to humpback whales from the fishery as medium. One humpback whale was entangled in gear attributed to the fishery in 2014, no other entanglements were reported between 2015 and 2019 (Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2021, 2020, 2018).

Under the Bycatch and Discard Plan for the fishery, for any given TEP species, the target level where the risk from fishing impacts is considered acceptable is three or less interactions in a year. If there are more than three interactions in a year, the level of risk is considered undesirable and a review is triggered to investigate the reason for increased interactions, and management action(s) taken to reduce interactions to the target level (DoF, 2015a).

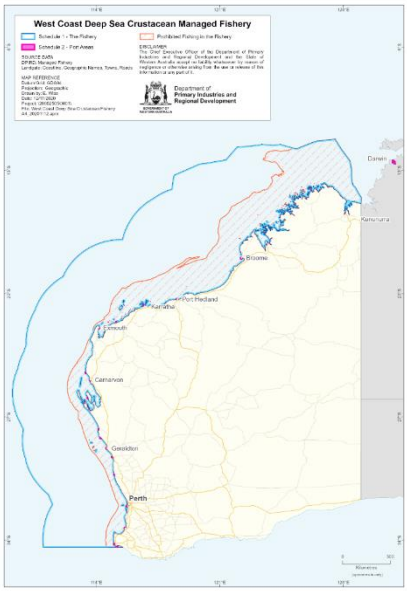


Figure 35: Area of the Western Australian West Coast Deep Sea Crustacean Fishery. The risk of entanglement to whales from pot or trap fisheries is generally from vertical lines. Due to the large number of traps set per longline, the number of vertical rope lines in the water is low in the WCDSF relative to the number of traps. For example the maximum number of vertical rope lines estimated to be deployed in 2015 was 25 (How et al., 2015). There is no information on the abundance or distribution of cetaceans in the area of the fishery, however, large whale species that likely to occur in the region include sperm whales, blue whales, minke whales and Bryde's whale.

9.2.7 Octopus Interim Managed Fishery

The Octopus Interim Managed Fishery (OIMF) targets Western Australian common octopus (*Octopus* aff. *Tetricus*) using active triggered traps and passive shelter traps. Trigger traps are either set as a unit of gear consisting of two or three traps, or are set in a string on a demersal longline with approximately 500 pots per line (Hart et al., 2018). The mean soak time for these traps is 11 days. Shelter pots are generally set in waters less than 20 m in depth with a mean soak time of 25 days. The fishery operates year-round and is managed in three spatial zones, with the majority (82%) of effort occurring in Zone 2 (Hart et al., 2018)(Fig. 36).

The area footprint of the fishery is around 300-500 km^2 (Hart et al., 2018), with vessels operating in most State waters from 27˚S to the border with South Australia. Fishing is not permitted within Cockburn Sound, Princess Royal Harbour, or Oyster Harbour. There are 17 vessels operating in the fishery. The Cockburn Sound Line and Pot Managed Fishery (CSLPMF) targets octopus species using passive traps within Cockburn Sound. There are six vessels operating in the fishery and the footprint of the fishery is approximately 100 km^2. The Western Australian Octopus Fisheries are accredited under the EPBC Act until 2025 and received MSC accreditation in 2019.

Four marine mammal groups were considered during a 2018 ERA of the OIMF and CSLPMF. The risk of entanglement in trap gear in the fisheries was assessed as 'negligible' for 'dolphins', dugongs and Australian sea lions, and assessed as 'low' for 'whales' (Hart et al., 2018). The justification for the assessment of 'low risk' was that between 1994 and 2018 there were 13 reports of whales entangled in Octopus fishing gear (12 humpback whales and 1 southern right whale), of which nine were successfully disentangled or gear was shed. The harvest strategy for the fishery outlines the performance indicators, reference levels and control rules such that 'fishing impacts do not result in serious or irreversible harm' to TEP species populations. The target reference level for the fishery is

that the risk to TEP species is assessed as 'moderate' or lower', and if the risk is assessed as high, an appropriate management response should be implemented to reduce risk to an acceptable level (moderate or lower) as soon as practicable (DPIRD, 2018b).

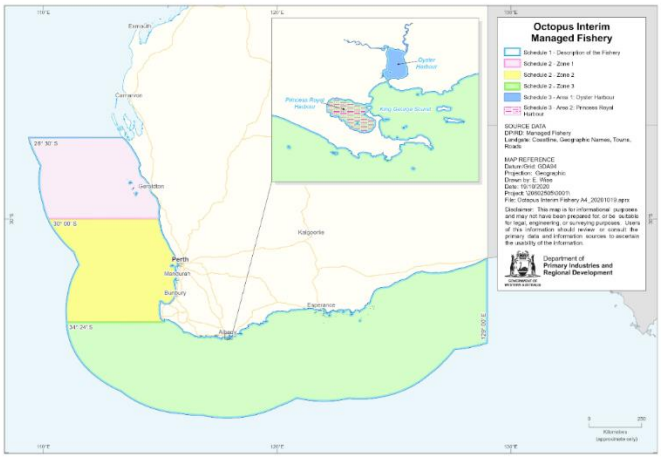


Figure 36: Area of the Western Australian Octopus Interim Managed Fishery. Several measures have been put in place under the Octopus Interim Managed Fishery Management Plan 2015 to reduce the risk of entanglement to whales by reducing the amount of vertical line in the water. Between May and November if multiple traps or cradles are used, they must be set in a longline formation with a minimum of 20 traps or cradles per longline. If traps or cradles are set as a single unit of gear, only rope belonging to the float rig can be at the surface, and at least a third of the line must be held vertically in the water. In the CLSPMF, the minimum number of traps per line is 20 if a series of traps are joined by an underwater line, and only rope belonging to the float rig can be at the surface. A Code of Practice for reducing whale entanglements in the Octopus Fishery was developed in 2014. Six humpback whales were reported to be entangled in octopus trap gear between 2014 and 2019 (Table 34, Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2021, 2020, 2018). There is no observer program in this fishery.

Table 35: No of humpback whale entanglements reported in fishery logbooks in the Western Australian Octopus Interim Managed Fishery between 2014 and 2020.

Year	Number of entanglements
2014	2
2015	0
2016	0
2017	1
2018	1
2019	2

9.2.8 South Coast Crustacean Fishery

The South Coast Crustacean Managed Fishery (SCCMF) targets Southern Rock Lobster (*Jasus edwardsii*), Australian Spiny Lobster *(Panulirus cygnus*) and deep-sea crab species using pots. The fishery operates from latitude 34˚24' S to the to the border with South Australia and out to the limit of the AFZ . The fishery is managed in four spatial zones, with zone specific seasonal and spatial

closures (Fig. 37).Rock Lobster fishing is closed year-round in the Offshore Bight Zone (Zone 4), and from July to mid-November in Zones 1, 2 and 4. All crustacean fishing (Rock Lobster and Deep-Sea Crab) is closed in Zone 3 from July to mid-November. There are approximately 25 vessels and 61 licenses operating in the fishery. The fishery is accredited under the EPBC Act until 2025.

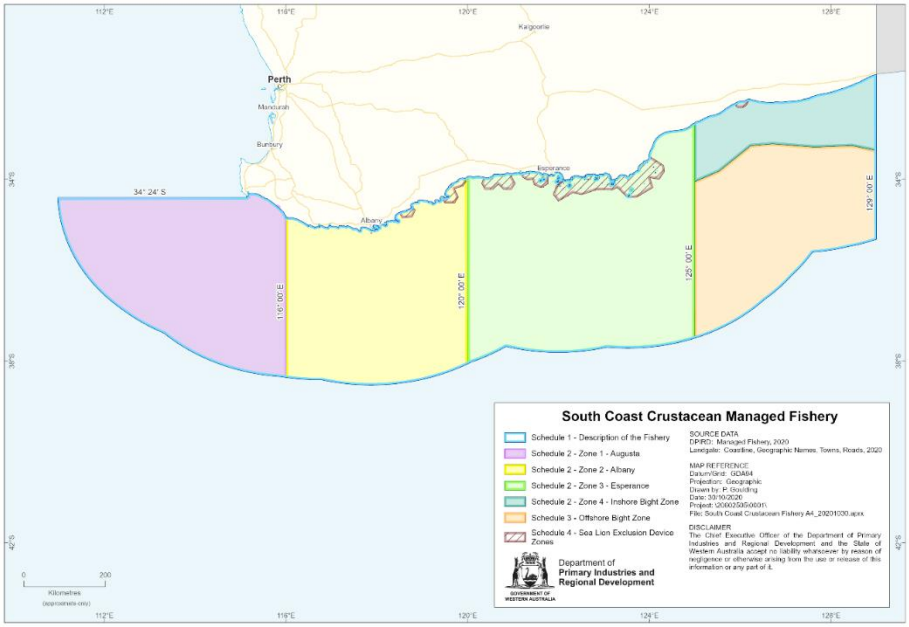


Figure 37 Area of the Western Australian South Coast Crustacean Fishery. The fishery is assessed as being of moderate risk to TEP species (Gaughan and Santoro, 2021). SLEDs must be installed in pots if fishing within Sea Lion Zones (DoF, 2015b), which are all waters to the 80 km depth contour or within 30 km around Australian sea lion colonies (Fig. 37). More than half (66%) of Australian sea lions that breed in Western Australia occur along the southern cost, with the majority of breeding colonies at the Recherché Archipelago near Esperance. There are no data on pup movements from these breeding colonies, but available tracking data showed juveniles foraged within 39 km of sites where they were tagged (Goldsworthy et al., 2014; Hesp et al., 2012). The fishery overlaps with annual migration routes of southern right whale, pygmy blue whales, and humpback whales.

No interactions with Australian sea lions were reported in fishery logbooks between 2014 and 2019 (Fletcher et al., 2017; Fletcher and Santoro, 2015; Gaughan et al., 2019; Gaughan and Santoro, 2021, 2020, 2018). During the same period two humpback whale entanglements, one in 2014/15 and one in 2017/18 , were attributed to gear from the SCCMF (How and Orme, 2019).

10 Discussion

The objective of this report was to synthesise available information on marine mammal interactions with 15 Australian Commonwealth managed fisheries or sub-fisheries, and 29 State or Territory managed fisheries. This information will be used by the Commonwealth Department of Agriculture, Water and the Environment to apply for a comparability finding under the US Marine Mammal Protection Act (MMPA) for each of these fisheries. For each fishery the seeking a comparability finding, the following information were required. The number of observed or reported marine mammal interactions in that fishery in (at least) the last five years and the management strategies in place in the fishery to mitigate marine mammal bycatch. In addition, all information on the abundance and distribution of marine mammals likely to occur in each fishery was compiled. Observer data and fishing effort data were provided by the Australian Fisheries Management Authority (AFMA) for the Commonwealth fisheries considered by the report. A synthesis of available information on the distribution and abundance of 22 marine mammal species is provided in an Appendix to this report.

Marine mammal interactions have been independently observed and / or fishery-reported in nine Commonwealth managed fisheries, and 18 of the State or Northern Territory managed fisheries that are seeking export approval under the US MMPA. There is high variability in the level of independent observer coverage in different Australian commercial fisheries. The type and amount of information that is publicly available about marine mammal interactions, from observer data of fishery logbook reports also varies greatly between jurisdictions.

For most fisheries, observer programs are not specifically undertaken to monitor or estimate marine mammal interactions. In a number of Commonwealth managed fisheries, the target observer coverage is generally set at 10% of fishing effort, or vessels are required to have electronic monitoring (EM) of which a random 10% - 100% of each vessels video footage is audited. Observer coverage in both the Commonwealth Heard Island and McDonald Island Fishery and Macquarie Island Toothfish Fishery is set at 100%. However, in some Commonwealth fisheries where marine mammal interactions have been reported, the average observer coverage has generally been less than 4% of fishing effort. There are only two State managed fisheries that have previously run, or continue to run observer programs specifically aimed at monitoring the success of mitigating interactions with threatened, endangered or protected species. These are the South Australian Sardine Fishery SASF, which has already received a comparability finding under the import provisions of the US MMPA, and the Western Australia Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF). Observer coverage in the SASF is set at 10% and is used to undertake annual assessments of the efficacy of an industry Code of Practice at mitigating interactions with marine mammals in the fishery (e.g., Kirkwood et al. 2020). Observer or EM coverage in the PFTIMF has varied greatly between fishing seasons. Highest monitoring rates have generally occurred during trials to mitigate dolphin interaction rates in the fishery (e.g., Wakefield et al. 2017). Observer or video coverage in the fishery was 85% and 78% of effort in 2012 and 2016 respectively.

Six species of seal have been observed or reported to interact with the fisheries that were reviewed by the project. Four of these species interact with fisheries in waters off the Australian continent, while interactions with southern elephant seals and crab eater seals are only reported in Antarctic fisheries. The majority of pinniped interactions reported in the Commonwealth fisheries seeking export approval were with Australian fur seals (44%), southern elephant seals (33%) or with ‘seals’ not identified to species (16%). Most reported Australian fur seal interactions were with the winter BGTS of the Southern and Eastern Scalefish and Shark Fishery (SESSF), which mandates the use of Seal excluder devices (SEDs) and has 100% of fishing effort is observed. All interactions with southern elephant seals (45 interactions, 40 mortalities) were recorded in the demersal longline sector of the

HIMI, which has 100% observer coverage. Australian and New Zealand fur seals or 'seal' mortalities have also been reported in the Tasmanian and Victorian Rock Lobster Fisheries, the Tasmanian salmon aquaculture industry and with the New South Wales Ocean Trawl fishery.

Overall, the majority of interactions with pinnipeds (93%) and cetaceans (78%) that were reported in Commonwealth managed fisheries between 2010 and 2020, occurred in four fishery sectors that are not seeking export approval under the US MMPA. These are the otter board trawl sector and Danish-seine sector of the Commonwealth Trawl Sector (CTS) of the SESSF, the gillnet sector of the SESSF and the mid-water trawl sector of the Small Pelagic Fishery. Most fishing effort in the SESSF occurs on the continental shelf and shelf-break of south-eastern Australia, and overlaps with the foraging area of Australian sea lions, Australian fur seals and New Zealand fur seals.

Over half of the pinniped interactions in these fishery sectors involved Australian fur seals, while more than a third involved 'seals' that were not reported to species. The majority of interactions (80%) resulted in a mortality. High reported numbers of interactions with fur seals, particularly in sectors with low observer coverage such as the otter board trawl gear sector of the CTS, makes it difficult to assess the cumulative impact of fishery mortalities on either fur seal species. This is further compounded by the high number of reported interactions where the species of seal is not identified. The estimates of N_{min} for Australian fur seals and New Zealand fur seals are 89,262 and 117,101 individuals respectively, based on recent pup abundance estimates (Campbell et al., 2014; McIntosh et al., 2022; Shaughnessy et al., 2015). The total abundance of Australian fur seals is estimated to have declined by 25% between 2007 and 2017 (McIntosh et al., 2022).

The AFMA mitigates pinniped bycatch in the gillnet sector of the SESSF through spatial closures around Australian sea lion colonies, Australian sea lion bycatch limits and observer or EM monitoring. Seal Excluder Devices (SEDs) and are mandatory in mid-water trawl gear in the Small Pelagic Fishery and in the winter Blue Grenadier Fishery sector of the SESSF.

Twelve species of cetaceans were reported to have interacted with the commercial fisheries for which information was collated for this report. Entanglements of an additional three species, the Australian humpback dolphin, Australian snubfin dolphin and the spinner dolphin have been recorded in nets deployed as part of the Queensland Shark Control Program. Interactions with cetaceans were reported in six Commonwealth managed fisheries seeking export approval. The majority of interactions (90%) were reported in the Eastern Tuna and Billfish Fishery (ETBF). This fishery has mandatory EM with at least 10% of all shots reviewed to verify logbook accuracy, and all logbook reports of protected species interactions audited. The majority of cetaceans (88%) that interacted with the fishery were released alive. The second highest number of interactions (n=8) were reported in the Western Tuna and Billfish Fishery (WTBF). This fishery also has mandatory EM with at least 10% of all shots reviewed to verify logbook accuracy, and all logbook reports of protected species interactions audited. All but one cetacean interacting with this fishery was released alive.

More than half of the cetacean interactions that were reported in Commonwealth fisheries between 2010 and 2020 were in sectors that are not seeking export approval. The majority of these interactions involved 'dolphins' not identified to species, 39% were reported as common dolphins, and 83% of interactions resulted in a mortality. There are no abundance estimates for common dolphins or bottlenose dolphins for most of the southeast shelf of Australia including the Bass Strait region where these species interact with several fisheries. The AFMA has introduced management strategies to mitigate dolphin interactions in the gillnet sector of the SESSF and in the mid-water trawl sector of the Small Pelagic Fishery, and EM and / or observer coverage in these fisheries is used to improve the accuracy of fishery logbook reports of protected species interactions. The low level of observer coverage in the otter board trawl gear sector of the CTS makes it difficult to assess the likely level of interactions with cetaceans in this fishery.

Interactions with dolphins were reported in nine State or Territory fisheries comprising nine trawl fisheries, two net fisheries and one pot fishery. The species involved were identified as common bottlenose dolphin (*Tursiops truncatus*) and common dolphins or were just reported as 'dolphins'. For many of these fisheries, information was not available on whether there was any independent monitoring of the fishery, making it difficult to assess whether the reported interaction levels reflect true interaction rates in those fisheries, or the species that are involved. There are no abundance estimates for dolphin species in most of the areas where these State or Territory managed fisheries operate. Reported mortalities in the Western Australian PFTIMF were between 11 and 26 common bottlenose dolphins per year between 2015 and 2020. An aerial survey of 71% of the area of the fishery was conducted in 2011, and produced an abundance estimate of 2,274 (95% CI=1,247–4,214) dolphins (Allen et al., 2017). Using these abundance estimates, and two different modelling approaches, Manlik et al (2022) estimated the limit to dolphin mortalities in the fishery to be between 8-16.2 individuals per year. A condition of the current EPBC accreditation of the fishery is that the Western Australian Department of Primary Industries and Regional Development review the resilience of dolphin populations to the fishery.

The risk of mortality from entangling nets (gill or drift) is likely the highest of all gear types. This is because species may not detect the net, or perceive it as a threat, and once entangled there is a high chance the individual will drown as gear is usually left unattended. For species such as inshore dolphins, that generally occur in small, localised populations, even low levels of fishery caused mortality can have significant impacts on populations. A recent study that applied a semi-quantitative risk assessment to identify which cetacean species were at highest risk of fisheries interactions in Australia, identified the Australian humpback, Australian snubfin, Indo-Pacific bottlenose and short-beaked common dolphin to be at highest risk from 'net' gear (Tulloch et al., 2020). Dugong are also at risk of entanglement in net gear, with nine interactions, including four mortalities reported in 2017 in fishery logbooks in the Northern Territory Barramundi Fishery, and 38 interactions with net gear, including 18 mortalities, reported in fisheries logbooks in Queensland since 2002. Limited monitoring in several coastal net fisheries which overlap with the ranges of inshore dolphin species have led to concerns about the impact even small amounts of bycatch could have on these populations. In addition to entanglements in wild capture fisheries, cetaceans and dugong are also incidentally caught in nets set to protect bathers at swimming beaches from sharks.

As previously discussed, Australian sea lion bycatch in the gillnet sector of the Commonwealth SESSF is managed through spatial closures, bycatch trigger limits and a high level of independent monitoring to validate fishery-dependent logbook reports. In the Western Australian Demersal Gillnet and Demersal Longline Fishery, gillnet exclusion zones were introduced in 2018 to mitigate interactions with Australian sea lion. However, further information on interaction rates is required as currently, there currently no independent monitoring in the to validate fishery logbooks.

Pot and trap gear pose can entanglement risk to marine mammals due to the vertical lines in the water column and loose lines and floats at the surface. Entanglements of humpback whales have been recorded in all of the six State managed crustacean fisheries for which information was synthesised. Obtaining accurate estimates of large whale entanglement in fixed gear is difficult as unless an individual is seen carrying gear, there is no way for a fisher to know if missing gear is as a result of an entanglement, or due to other reasons. Being able to identify which fishery the gear involved in an entanglement originated from is also difficult. While all States have programs to try and disentangle whales, in many cases this is not possible, and long-term entanglement may result in mortality.

Several pot fisheries in Australia have trialled methods to mitigate the risk of entanglement to large whales such as reducing the amount of vertical line in the water, limiting soak time and using acoustic or galvanic releases so that vertical lines and floats can be removed from the water column

(How et al., 2021; OceanWatch Australia, 2019). Whilst there is some evidence that gear modifications have reduced fishery specific entanglement rates (How et al., 2021), the number of reported entanglements is likely to continue to increase, as humpback whale populations recover from commercial whaling. Between 2015 and 2019 entanglements of 319 humpback whale, ten southern right whale, one sei whale and two unidentified large baleen whales were reported in Australian waters to the International Whaling Commission. For humpback whales, these interactions are unlikely to impact the recovery of either the western or eastern Australian stocks which are estimated as 17,810-26,100 and 24,545 individuals respectively. However, there are clear ethical issues regarding the welfare of entangled individuals, the risk to disentanglement teams when removing gear from whales, as well as an increasing issue of social licence in fisheries. For southern right whales from the southeast population, an increase in mortalities due to entanglements could impact the recovery of that subpopulation.

Pot and trap gear can also pose a bycatch risk to pinnipeds that actively try to depredate bait or catch from pots. The use of Sea Lion Excluder Devices (SLEDs) is mandatory in the Western Australian Rock Lobster and South Coast Crustacean Fisheries, and also in the South Australian Northern Zone Rock Lobster Fishery which has already received a comparability finding under the import provisions of the MMPA. No pinniped mortalities have been reported in these fisheries in the last five years. Excluder devices are not mandatory in the Tasmanian or Victorian Rock Lobster Fisheries. Between 2014 and 2018, two seal mortalities and a number of instances of seals depredating bait from pots were reported in the Tasmanian fishery, whilst four Australian fur seal mortalities and two New Zealand fur seal mortalities were recorded between 2014 and 2019 in the Victorian fishery.

The risk of bycatch mortality for marine mammals that actively depredate fishing gear can be high, as these individuals are motivated to undertake risky behaviours. Marine mammals that depredate line gear may become entangled in branchlines, or may ingest hooks which could result in mortality. For species that enter trawl nets to forage such as fur seals in the CTS of the SESSF, or bottlenose dolphins entering trawl nets in the Western Australian PFTIMF, individuals are at risk of mortality if they cannot exit the net. Dolphins that forage in association with prawn trawlers are also at risk of entanglement in the lazy line of the net.

Interactions between marine mammals and purse seine fisheries have a high likelihood of occurring as both the marine mammal and fishery are generally targeting the same prey species. However, as purse seine gear is an active fishing method, in theory these interactions can be mitigated by ensuring marine mammals are not present before setting the net, and by releasing the net to allow individuals to escape in the event they were encircled. A recent study noted the need for further information about the extent and sustainability of dolphin bycatch in the Western Australian South Coast Purse Seine Fishery (Waples and Raudino, 2018).

Given the low level of observer coverage in most of the fisheries for which information were collated, our understanding of whether or not marine mammal interactions occur in a fishery is entirely reliant on the accuracy of exports provided by fishers in logbooks. There are many examples globally of fisher-reported marine mammal interaction rates are being lower than those recorded by independent observers, and for many fishers there is no perceived benefit of reporting such interaction. Without independent observation, or validation of fishery logbooks through EM, it is just not possible to determine if a fishery interacts with TEP species, and if it does, at what frequency these interactions occur. The level of observer coverage needed to have sufficient statistical confidence to estimate marine mammal bycatch in a fishery is relative to the frequency of interactions. For fisheries where interactions are incredibly rare, a high level of independent monitoring would be required, whereas a much lower level is needed if interactions occurred relatively frequently.

While there was little or no independent monitoring in many of the fisheries reviewed in this report, all fisheries have undergone some form of qualitative risk assessment to assess the potential impact of they might have on marine mammals and other TEP species. An Ecological Risk Assessment for the Effects of Fishing (ERAEF) framework (Hobday et al., 2011) is undertaken in all Commonwealth managed fisheries. Each assessment uses a Level 2 Productivity Susceptibility Analysis (PSA) to scores the fishery risk to a given species in relation to their productivity, and their susceptibility to the fishing activity (Hobday et al. 2011). The results of the PSA are used to prioritise management actions for species identified as being at medium or high risk from the fishery. For the Sate and Territory fisheries reviewed by the project, the level of detail used in fishery risk assessments varied greatly, with many assessing risks at a taxonomic group level such as 'cetaceans' or 'pinnipeds'.

The identification of TEP species assessed as being of high or medium residual risk is used to prioritise management actions under fishery-specific bycatch and discarding workplans. However, there is limited Information on the distribution or abundance of marine mammal species that occur in the areas where most Commonwealth managed fisheries operate. In addition, for many fisheries, information on interactions with TEP species are reliant on self-reporting by fishers. The introduction of EM in several Commonwealth managed fisheries has resulted in an increase in logbook reported interaction rates by fishers. An analysis of the level of congruence between two years of fishery logbook data and EM analyst data found that a greater number of interactions with protected species were reported in logbooks in the ETBF, while logbook and EM interactions were equivalent in the GHAT sector of the SESSF (Emery et al., 2019b). Although all protected species interactions in Commonwealth fisheries that have EM are audited by an analyst, data on the number of individuals identified or verified to species by analysts is not publicly reported. Of the 2,976 individual marine mammals reported in Commonwealth fishery logbooks between 2010 and 2020, 41% were not recorded to species. Most were recorded as unidentified seals (75%) and unidentified dolphins (24%). Of these, 133 unidentified dolphins and 148 unidentified seals have been reported in logbooks in fisheries with EM. Annual updates of TEP species identification by EM audit would increase the utility of logbook data when used in fishery risk assessments, and improve the accuracy of publicly available records.

It is important to emphasise that neither the Commonwealth nor State or Northern Territory risk assessment frameworks consider the cumulative risk to TEP species from multiple fisheries. Data synthesised under the current project show that fur seals and dolphin species are subject to bycatch mortality from multiple fisheries in south-eastern Australia (both Commonwealth and State managed). Quantitative data on bycatch rates by fishery sector, and correct species identification are required in order to assess the cumulative impacts of fishery interactions on these populations. Abundance data for dolphin species interacting with these fisheries is also required.

The difficulty in robustly assessing the extent or trends in interactions between Australian commercial fisheries and TEP species has been shown by several studies (Kennelly, 2020; Tuck et al., 2013; Tulloch et al., 2020). Tuck et al. (2013) noted that an assessment of fishery specific trends in bycatch rates for TEP species in Commonwealth fisheries was confounded by different levels of observer coverage, and potential increased reporting of TEP interactions during bycatch mitigation trials. A recent study concluded that it was not possible to produce annual estimates of TEP species in most Australian fisheries due to the 'rare and sporadic' nature of such interactions and that the willingness of fishers to self-report interactions may be influenced by the 'controversy that such interactions may incur' (Kennelly, 2020). Tulloch et al. (2020) conducted an analysis of spatial and temporal trends of cetacean interactions with fisheries gear in the AFZ using systematic and incidental entanglement records collected between 1887 and 2016 (Tulloch et al., 2020). Systematic records were those recorded in fisheries or in nets used in State managed shark control programs, while incidental records included data sightings of entangled whales or strandings that were attributed to fishing mortality. Incidental or systematic entanglements were reported for 27 cetacean

species and involved 1,300 records of cetaceans that could be identified to species. However, eight of these species were only recorded once, and a further six species had five or fewer records recorded over the time period (Tulloch et al. 2020). The study noted that the lack of spatial fishing effort data made it difficult to assess spatial trends in cetacean entanglements in Australia, although an increasing trend in cetacean entanglements was observed.

Having data on interaction rates provides the necessary information to quickly assess if these rates are increasing or decreasing. This data is also required to determine the efficacy of bycatch management strategies in a fishery. Where observer coverage is sufficient, these rates can also be used to estimate total levels of bycatch, and, when obtained for all fisheries that operate in the same spatial area, can provide a means of quantitatively assessing the cumulative impacts that fisheries interactions may have on a given species. Interaction rates also provide a means of comparing fisheries across jurisdictions, which vary greatly in the size, geographic area, and fishing intensity.

The information synthesised in this report provides an overview of the level of observed and or reported marine mammal interactions with those Australian Commonwealth, States and Northern Territory managed fisheries that are seeking a comparability finding under the new import provisions of the US MMPA. While most of these fishery's report little to no marine mammal bycatch, the high variability in the amount of independent fishery data and / or level of information provided in fishery logbook reports, makes it difficult to make to assess what the true level of interactions may be. Uncertainty around the potential impacts of fisheries on TEP species if further confounded by limited information on the distribution or abundance of these species.

Under the EPBC Act all interactions between commercial fisheries and TEP species must be reported to the DAWE. However, the way in which interactions are reported are not standardised. Where reports are made publicly available by jurisdictions, many do not contain relevant information such as the species involved, fishing effort, or the level of independent monitoring in the fishery. Without this information it is not possible to assess interaction rates or determine whether these rates may have population consequences to the species involved.

A simple first step that would allow cross jurisdictional comparisons of marine mammal (and other TEP species) in Australian fisheries, is to introduce a mandatory form for reporting TEP interactions in commercial fisheries. For each fishery, the annual report to DAWE should contain the following information: total fishing effort, number of operators, and the level of fishery-independent monitoring. Fishery-independent-monitoring could include periods when fishery scientists or observers are aboard collecting data in the fishery under normal fishing practices. This would greatly improve the utility of these reports, and would provide managers, fishers, and stakeholders a means of better assessing the level of TEP fishery interactions occurring in Australia.

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13 Appendix A: Summary Tables

Table A1: Reported interactions with marine mammals, by species between 2016 and 2020 in Commonwealth managed fisheries seeking a comparability finding under the import provisions of the United States Marine Mammal Protection Act

Fishery	Year	Observer / EM* coverage	Dugong		Unidentified dolphins		Bottlenose dolphin sp.		Common dolphin		Unidentified whale		Short-finned Pilot whale		Long-finned pilot whale		Killer whale		False killer whale		Melon-headed whale		Cuvier's beaked whale		Humpback whale		Minke whale		Unidentified seals		Australian sea lion		Australian fur seal		New Zealand fur seal		Southern elephant seal		Crabeater seal	
			Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality
Northern Prawn Fishery	2016	1.5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	2.4%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	1.9%	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	3.4%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	1.8%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Torres Strait Prawn Fishery	2016	2.8%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	3.7%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	1.9%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	1.9%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	5.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coral Sea Fishery -set demersal longline	2016	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	2018	32.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	51.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	26.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Tuna and Billfish Fishery	2016	8.8%*	0	0	3	0	0	0	0	0	3	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	2017	10.1%*	1	0	9	0	1	1	0	0	5	0	6	1	4	0	0	0	1	0	4	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
	2018	11.3%*	0	0	4	1	0	0	0	0	0	0	7	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
	2019	11.6%*	0	0	7	2	1	0	3	1	1	0	3	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	2020	10.1*	0	0	4	0	1	0	3	1	2	0	1	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Western Tuna and Billfish Fishery	2016	10%*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0
	2017	10%*	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
	2018	10%*	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	10%*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	10%*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Southern Bluefin Tuna Fishery	2016	13.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	23.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	13.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	7.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	10.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Purse seine sector, Small Pelagic Fishery	2016	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	4.4%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	5.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue Grenadier Fishery, SESSF	2016	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2017	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2018	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2019	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	4	2	0	0	0	0
	2020	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	0	0	0	0
Orange Roughy Fishery, SESSF	2016	16%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	33%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	30%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	2019	43%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	64%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cascade Management Zone, SESSF	2016	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2017	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2018	no effort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2019	96%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	80%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Pedra Branca, SESSF	2016	46%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	55%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	58%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	55%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	53%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Autolongline sector, SESSF	2016	7.8%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	17.9%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
	2018	12.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	2	1	0	0	0	0	0	0
	2019	8.3%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	2020	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Manually baited hook sector, SESSF	2016	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
	2017	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	0.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	2019	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Coast Deepwater Trawl Sector, SESSF	2015	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2016	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Australian Bight Trawl Sector, SESSF	2016	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIMI demersal longline fishery	2016	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	8	8	2	2		
	2017	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	4	0	0		
	2018	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	8	0	0		
	2019	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0		
	2020*	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0		
HIMI demersal trawl fishery	2016	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2017	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2018	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2019	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2020	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Macquarie Island Toothfish Fishery	2016	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2017	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2018	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2019	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals			1	0	27	3	3	1	6	2	12	0	25	3	7	2	4	1	9	0	6	1	1	0	2	0	0	0	21	9	5	0	6	2	12	5	29	26	2	2

Table A2: Reported interactions with marine mammals, by species, between 2016 and 2020 in Commonwealth managed fisheries that are not seeking a comparability finding under the import provisions of the United States Marine Mammal Protection Act

			Dugong		Unidentified dolphins		Bottlenose dolphin sp.		Common dolphin		Unidentified whale		Short-finned Pilot whale		Long-finned pilot whale		Killer whale		False killer whale		Melon-headed whale		Cuvier's beaked whale		Humpback whale		Minke whale		Unidentified seals		Australian sea lion		Australian fur seal		New Zealand fur seal		Southern elephant seal		Crabeater seal	
Fishery	Year	Observer / EM* coverage	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality
Commonwealth Trawl Sector, SESSF	2016	2.1%	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	8	0	0	78	67	1	1	0	0	0	0
	2017	3.1%	0	0	4	4	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	3	0	0	114	93	1	1	0	0	0	0
	2018	2.2%	0	0	2	2	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	18	0	0	147	115	18	16	0	0	0	0
	2019	3.0%	0	0	3	3	0	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	16	0	0	122	104	4	1	0	0	0	0
	2020	0.7%	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	12	0	0	99	82	7	7	0	0	0	0
Danish Seine sector, SESSF	2016	1.2%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0	0	5	4	0	0	0	0	0	0
	2017	90.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	6	0	0	15	11	0	0	0	0	0	0
	2018	80.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	7	0	0	23	16	1	1	0	0	0	0
	2019	1.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	13	0	0	8	5	0	0	0	0	0	0
	2020	0.5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	13	0	0	20	14	0	0	0	0	0	0
Gillnet Sector, SESSF	2016	9%*	0	0	15	15	0	0	22	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	17	2	1	10	10	5	5	0	0	0	0
	2017	10%*	0	0	43	43	4	4	20	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	26	0	0	7	6	1	1	0	0	0	0
	2018	11%*	0	0	26	26	7	7	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	26	2	2	16	16	6	6	0	0	0	0
	2019	10%*	0	0	17	17	4	4	12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	19	1	1	23	15	22	22	0	0	0	0
	2020	10%*	0	0	25	1	22	22	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	18	0	0	10	10	5	5	0	0	0	0
Mid-water trawl sector, SPF	2016	100%	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	50	45	8	8	0	0	0	0
	2017	100%	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
	2018	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	5	5	17	15	0	0	0	0
	2019	11%	0	0	0	0	1	1	15	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	15	0	0	0	0
	2020	4%	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	71	67	19	0	0	0	0	0
		Totals	0	0	136	112	44	44	132	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	282	210	5	4	825	687	127	104	0	0	0	0

Table A3: Cumulative reported interactions with marine mammals, by species, between 2016 and 2020 in Commonwealth managed fisheries

		Dugong		Unidentified dolphins		Bottlenose dolphin sp.		Common dolphin		Unidentified whale		Short-finned Pilot whale		Long-finned pilot whale		Killer whale		False killer whale		Melon-headed whale		Cuvier's beaked whale		Humpback whale		Minke whale		Unidentified seals		Australian sea lion		Australian fur seal		New Zealand fur seal		Southern elephant seal		Crabeater seal	
Seeking comparability finding	Commonwealth Fishery	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality	Interaction	Mortality
Y	Northern Prawn Fishery	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Torres Strait Prawn Fishery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Coral Sea Fishery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Eastern Tuna and Billfish Fishery	1	0	27	3	3	1	6	2	11	0	22	3	6	0	0	0	8	0	6	1	0	0	2	0	0	0	9	0	0	0	1	0	1	1	0	0	0	0
Y	Western Tuna and Billfish Fishery	0	0	0	0	0	0	0	0	1	0	3	0	1	2	0	0	1	0	0	0	1	0	0	0	0	0	1	0	4	0	0	0	2	0	0	0	0	0
Y	Southern Bluefin Tuna Fishery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Purse seine sector, SPF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Blue Grenadier Fishery, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	1	1	7	3	0	0	0	0
Y	Orange Rough Fishery, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Y	Cascade Managed Zone, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Eastern Pedra Branca, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Autolongline sector, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	5	3	0	0	3	1	1	0	0	0	0	0
Y	Manually baited line sector, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
Y	East Coast Deepwater Trawl Sector, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Great Australian Bight Trawl Sector, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	McDonald Island demersal longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	29	26	2	2
Y	McDonald Island demersal trawl fishery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Macquarie Island Toothfish Fishery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	Commonwealth Trawl Sector, SESSF	0	0	10	10	2	2	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89	57	0	0	560	461	31	26	0	0	0	0
N	Danish Seine Sector, SESSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	44	0	0	71	50	1	1	0	0	0	0
N	Gillnet Sector, SESSF	0	0	126	102	37	37	91	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	106	5	4	66	57	39	39	0	0	0	0
N	Mid-water Trawl Sector SESSF	0	0	0	0	5	5	28	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	128	119	56	38	0	0	0	0
	Totals	1	0	164	115	47	45	138	130	12	0	25	3	7	2	4	1	9	0	6	1	1	0	2	0	1	0	303	219	10	4	831	689	139	109	29	26	2	2

14 Appendix B

Appendix B: Compilation of information on the abundance of marine mammal species in Australian territorial waters to support the Australian application under the US Marine Mammal Protection Act Comparability Finding process

FRDC Project No. 2019-212

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Summary

This report synthesises available data on the abundance, distribution, population structure and growth rates for 20 marine mammal species that occur within Australian territorial waters including external territories. This synthesis forms part of the information that the Australian Department of Agriculture, Water and Environment (DAWE) will use to support an application for a 'comparability finding' under recent changes to the United States (US) *Marine Mammal Protection Act* 1972 (MMPA) for Australian fisheries that want to export product to the US.

The 20 marine mammal species for which data were synthesised are those that have previously been recorded as bycatch in Australian Commonwealth or State commercial fisheries. The most comprehensive data available on abundance and population trends were for the seven pinniped species and two baleen whale species considered by the project. Abundance data for small cetaceans was generally only available from discrete survey areas, and no abundance data were available for five of the cetacean species considered.

Introduction

Recent changes to legislation in the United States (US) requires that nations importing seafood must demonstrate that they have a regulatory program for reducing marine mammal bycatch that is comparable in effectiveness to the US standards under 'Fish and Fish Product Import Provisions' of the *Marine Mammal Protection Act 1972* (MMPA). A comparability finding means the marine mammal protection provisions in the relevant fishery are recognised to be equivalent to that of the United States. The provisions come into effect 1 January 2022 once an initial exemption period is over.

To date the US National Oceanographic Atmospheric Association (NOAA) has classified Australian fisheries as 'exempt' or 'export'. Exempt fisheries are those which NOAA have determined have a remote likelihood, or no known incidental mortality of marine mammals. Export fisheries are those determined to have more than a likelihood of incidental mortality to marine mammals.

For each Australian fishery that the US has currently classified as 'export', further information is required to determine if a 'comparability finding' under the new provisions of the MMPA can be obtained. The criteria to receive a comparability finding include

- conditions related to the prohibition of intentional killing or injury of marine mammals
- and the requirement to develop and maintain regulatory programs comparable in effectiveness to the US regulatory program for reducing incidental marine mammal bycatch

A key component of the US regulatory program for reducing incidental marine mammal bycatch is the calculation of Potential Biological Removal (PBR) levels for marine mammal populations, termed 'stocks'. The PBR is, conceptually, the maximum number of anthropogenic mortalities a marine mammal population can sustain and still reach or maintain its optimum sustainable population (OSP) (Wade, 1998). Determining the PBR for a population relies on having robust data on minimum population size, termed N_{min}, and information on the maximum population growth, termed R_{max}. The calculated PBR level can then be used to identify if a 'stock' is at risk of decline by comparing it to the estimated cumulative annual mortalities in the population from anthropogenic activities, e.g. fisheries mortality.

All cetaceans in Australian waters are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and it is an offence to kill, injure or interfere with a cetacean. Under the EPBC Act all pinnipeds within Australian waters are listed as Marine species and it is an offence to kill, injure, take, trade, keep, or move any member of a listed marine species without a permit. All pinnipeds located south of 60°S are protected under the *Antarctic Treaty (Environment Protection) Act 1980* specifically through the Convention for the Conservation of Antarctic Seals 1972 (CCAS).

In Australia, PBR is not used as a tool to estimate limits of cumulative fisheries mortality to marine mammals. Instead, several management strategies are followed to mitigate interactions between marine mammals and fisheries. In Australian Commonwealth managed fisheries these can include area closures, mandated bycatch mitigation devices or limits on bycatch mortality at a vessel level that trigger a management response (AFMA, 2019a, 2019b, 2015). As part of the application for a 'comparability finding' for Australian fisheries that want to export product to the US., the Australian Department of Agriculture, Water and Environment (DAWE) is required to provide information on the minimum abundance and population trend of marine mammals in Australian jurisdictional waters that have been recorded to interact with commercial fisheries.

Under the MMPA, the minimum population size, N_{min}, is calculated as the 20th percentile of a log-normal distribution, and as such provides the lower 60% confidence interval of the population estimate. If a direct count of population size is available, such as for some pinniped populations, this count can be used as N_{min}. Correction factors may be applied to direct counts of pinnipeds at haul out sites to account for those individuals that were at sea when the survey was conducted. Estimates of pup abundance are also used to calculate population size for some pinniped species by applying a multiplier, based on species specific life-history tables, to the estimated number of pups. The precision of pup abundance estimates will be affected by the survey method used, the timing of surveys relative to the breeding season, pup sightability and pup mortality rates. In the current project, available abundance estimates for each species are presented and the N_{min} is calculated where possible.

Under the MMPA, the annual maximum growth rate of a population because of additions due to reproduction, and losses due to natural mortality is defined as R_{max}. Where specific information on the population growth rate is missing, the default values applied under the MMPA are R_{max} = 0.04 for cetaceans and R_{max} = 0.12 for pinnipeds. Where available, information on population growth rates for each species is presented.

Available data on species distribution, population structure and abundance are presented, for each of the 20 species considered by the current project. The list of species was provided by the Department of Agriculture Water and the Environment. The Australian Fishing Zone includes the waters adjacent to Australia out to the 200 nm boundary of the Exclusive Economic Zone, including waters adjacent to each external territory, and covers a geographic area of 8,000,000 km^2. There are seven external Australian territories. Ashmore Reef, Cartier Island, Christmas Island and Cocos (Keeling) islands in the Indian Ocean, the Coral Sea Islands in the Coral Sea, and Norfolk Island in the Pacific Ocean. The external territories in the Southern Ocean are the subantarctic islands of Heard, McDonald and Macquarie Islands, and the Australian Antarctic Territory. The Australian Antarctic Territory consists of all islands and territories south of 60°S, and between 45°E and 160°E, excluding the French territory Terre Adélie.

Antarctic fur seal (*Arctocephalus gazella*)

Antarctic fur seals are widely distributed in the Southern Ocean (Figure 1). The global abundance estimate is ~5,000,000 individuals (Lowther, 2018), and the majority of the species (95%) breeds at South Georgia where the population estimate in 1991 was 2,700,000 (Forcada and Staniland, 2018). At South Georgia a 30% reduction in the number of female fur seals was recorded between 2003 and 2012. This decline has been linked to climate driven changes in prey availability (Forcada and Hoffman, 2014). Smaller breeding colonies occur at eleven other sub-Antarctic Island, three of which, Heard Island, McDonald Island and Macquarie Island are Australian External Territories. Records of vagrants in Australia are infrequent (Shaughnessy et al., 2014). While there is evidence of low levels of population substructure, there are no distinct subpopulations (Hofmeyr, 2016). Antarctic fur seals are listed as a Marine species under the EPBC Act, as Least Concern under the IUCN Red List of Threatened Species (Hofmeyr, 2016), and are protected under the CCAS south of 60˚S.

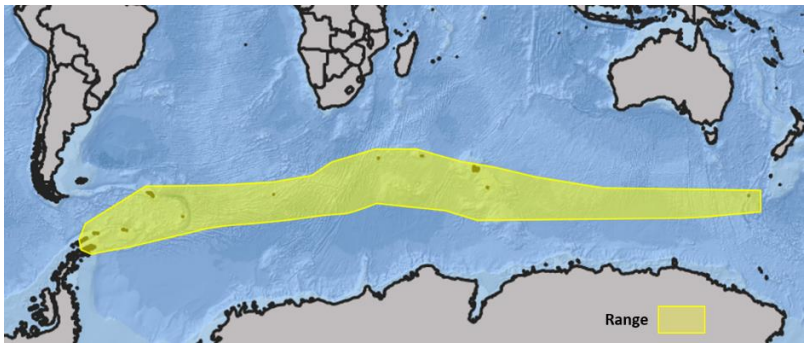

Figure 38: Global range of Antarctic fur seals The Heard Island Antarctic fur seal colony was estimated to be between 4,048-4,149 individuals in 2000/2001 based on a pup count of 1,012 and using a pup multiplier of 4 or 4.1 (Page et al., 2003). On Macquarie Island, Antarctic fur seals co-occur with Sub-Antarctic fur seals and New Zealand fur seals, and hybridisation between the three species occurs. Phenotype (physical characteristics) can be used to classify pups to species, and this method was accurate 96.6% of the time for identifying pure Antarctic fur seals (Goldsworthy et al., 2009). Pup production has increased by 8.8% per year between 1986-2007 (Goldsworthy et al., 2009), and pup abundance at Macquarie Island was estimated to be 100 in 2003 using mark-recapture methods (Lancaster et al., 2006). Applying a pup multiplier of 4 or 4.1 to this pup abundance gives a population estimate of 400-410 at Macquarie Island. The N_{min} for Antarctic fur seals in the Australian Antarctic Territory is 4,448 individuals, which was calculated by applying a pup multiplier or 4 to the sum of the most recent pup counts from Heard and Macquarie Islands (Table 1). Variability in annual pup mortality will affect the accuracy of N_{min} for the species. Pup mortality rates (for all fur seal species combined) at Macquarie Island average 13% but can be as high as 64%, with the most common cause of death predation by New Zealand sea lions (*Phocarctos hookeri*)(Goldsworthy et al., 2009). The impacts of predation on pups on intrinsic population growth rates of Subantarctic fur seals at Macquarie Island is unknown.

Table 36: Estimates of minimum population size (N_{min}) of Antarctic fur seals within the Australian Antarctic Territories of Heard and Macquarie Islands.

Stock	Year	Source	Minimum pup estimate	N_{min}
Heard Island	2001	Page et al. 2003,	1,012	4,048
Macquarie Island	2003	Lancaster et al. 2006.	100	400

Subantarctic fur seal (*Arctophoca tropicalis*)

Subantarctic fur seals (*Arctophoca tropicalis*) are widely distributed throughout the southern hemisphere, breeding on subantarctic and sub-temperate islands (Figure 2). Records of vagrants in South Australia have mostly been of juveniles (Shaughnessy et al., 2014). The species is listed as Endangered and Marine under the EPBC Act, Endangered in South Australia under the *National Parks and Wildlife Act 1972*, Endangered in Tasmania under the *Threatened Species Protection Act 1995*, Vulnerable in Queensland under the *Nature Conservation (Animals) Regulation 2020* and Vulnerable in Western Australia under the *Biodiversity Conservation Act 2016*. The species is listed as Endangered under the EPBC Act, as the total number of mature individuals in Australia is estimated to be fewer than 200, with fewer than 50 mature females estimated in the population in 2007 (Goldsworthy et al., 2009). However, the global population estimate was 400,000 in the early 2000's and the species is classified as Least Concern under the IUCN Red List of Threatened Species (Hofmeyr, 2015a).

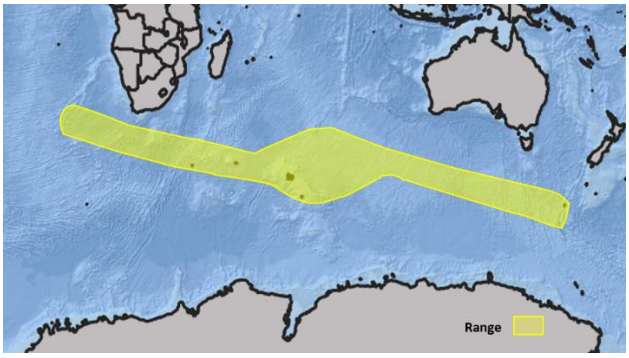

Figure 39: Global range of Subantarctic fur seals. Within the Australian external territory, the species breeds sympatrically and hybridises with Antarctic fur seals (*Arctocephalus gazella*) and New Zealand fur seals (*Arctocephalus forsteri*) at Macquarie Island. Between 1987 and 2001, three Subantarctic fur seal pups were recorded at Heard Island (Page et al., 2003). fur seals were extirpated from Macquarie Island during commercial sealing in the early 1800's, and subantarctic females were not observed until 1981 (Goldsworthy et al., 2009). The Macquarie island colony is estimated to be increasing at 6.8% per annum and low levels of immigration of individuals from Île Amsterdam and Marion Islands in the Southern Indian Ocean (Goldsworthy et al., 2009).

Based on the number of pups produced in the 2011/12 breeding season (n=45), and applying a pup multiplier of 4.5, N_{min} for the Subantarctic fur seal population at Macquarie Island is estimated to be 202 individuals (Table 2). On Macquarie Island the species has been recorded to hybridise with Antarctic and New Zealand fur seals (Goldsworthy et al., 2008), but hybridisation rates have decreased over time, and is not thought to be a threat to the genetic integrity of the species (Lancaster et al., 2010).

Table 37: Estimates of minimum population size (N_{min}) of Subantarctic fur seals at Macquarie Island.

Stock	Year	Source	Minimum pup estimate	N_{min}
Macquarie Island	2011/12	Threatened Species Scientific Committee (2016)	45	202

The accuracy of N_{min}, when calculated from pup counts, will be affected by the level of pup mortality. Pup mortality rates (for all fur seal species combined) at Macquarie Island average 13% but can be as high as 64%, with the most common cause of death predation by New Zealand sea lions (*Phocarctos hookeri*)(Goldsworthy et al., 2009). The impacts of predation on pups on intrinsic population growth rates of Subantarctic fur seals at Macquarie Island is unknown. Pup abundance data used to calculate N_{min} is now over eight years old and there is no ongoing monitoring of the population. Subantarctic fur seals within the Australian Antarctic Territories represent ~1% of the global population.

Crabeater seal (*Lobodon carcinophagus*)

Crabeater seals (*Lobodon carcinophagus*) have a circumpolar Antarctic distribution within the pack ice zone, and are considered a single panmictic population (Davis et al., 2008)(Figure 3). They move over large distances with the seasonal advance and retreat of pack ice, and pup annually on ice floes with peak pupping occurring in the latter part of October. The most recent global population estimate for the species is approximately 8,000,000 individuals for a proportion of their Antarctic Pack Ice distribution (Southwell et al. 2012). Crabeater seals are listed as a Marine species under the EPBC Act, listed as Least Concern under the IUCN Red List of Threatened Species (Hückstädt, 2015), and are protected under the CCAS south of 60˚S.

A minimum population estimate for the species within the Australian Antarctic Territory (45°E and 160°E) is not available. However, the most recent abundance estimate for crabeater seals for a longitudinal sector from 64°E to 150°E was 946,000 (95% CI = 726,000–1,397,000) (Southwell et al., 2008). These estimates were obtained from shipboard and aerial surveys and were corrected using information on diving behaviour to estimate the probability that seals were hauled out on the ice at the time of surveys (Southwell et al. 2008). The current population trend is unknown (Hückstädt, 2015).

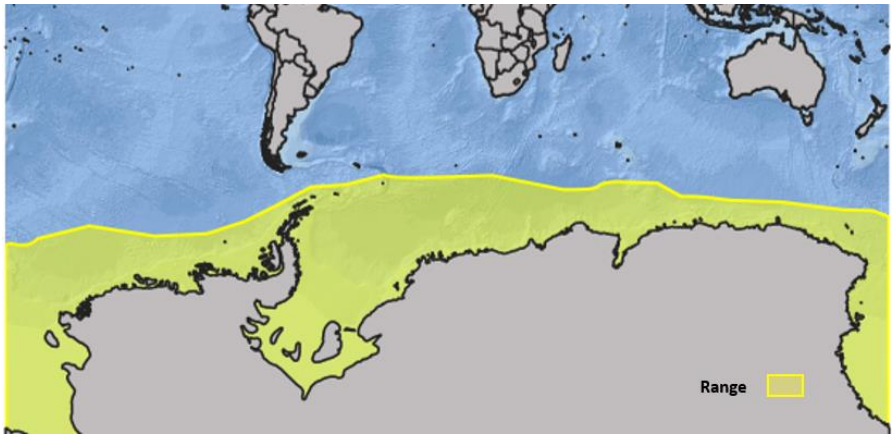

Figure 40: Global range of crabeater seals.

The calculated N_{min} for crabeater seals for an area of Antarctic Pack Ice (between 64°E and 150°E) in the Australian Antarctic Territory is 813,942 individuals (Table 3). This N_{min} only represents an abundance estimate for a portion of the distribution of this species, which is considered panmictic throughout its range.

Table 38: Estimates of abundance (N) and minimum population size (Nmin) for crabeater seals within the Australian Antarctic Territory based on the most recent estimate of abundance for the area of Antarctic Pack Ice between 64°E and 150°E

Stock	Source	Year of estimate	N	N_{min}
Antarctic Pack Ice (64°E to 150°E)	Southwell et al. (2008)	1999/ 2000	946,000	813,942

Southern elephant seals (*Mirounga leonina*)

The southern elephant seal has a circumpolar distribution in the Southern Ocean, breeding on subantarctic islands and around the Antarctic Peninsula (Figure 4). The most recent global estimate of total population size was ~750,000 in 2000 (Hindell et al., 2016). The species is listed as Vulnerable and a Marine species under the EPBC Act, Rare In South Australia under the *National Parks and Wildlife Act 1972,* Endangered in Tasmania under the *Threatened Species Protection Act 1995*, globally as Least Concern under the IUCN Red List of Threatened Species (Hofmeyr, 2015b), and are protected under the CCAS south of 60˚S.

Southern elephant seals were extirpated by sealers from mainland breeding sites in Tasmania and the islands in the western Bass Strait. Since the 1980's, several elephant seal births have been recorded in Tasmania, three been recorded in Western Australia and two in Southern Australia (Caddy, 2015; McMahon et al., 2017; Shaughnessy et al., 2012). Within the Australian external territory, the species breeds at the sub-Antarctic islands of Macquarie Island and Heard Island.

Southern elephant seals are grouped in four regional populations or stocks: the Peninsula Valdes stock in Argentina, South Georgia stock in the southern Atlantic ocean, Kerguelen stock in the southern Indian Ocean and the Macquarie Island stock in the southern Pacific Ocean (Corrigan et al., 2016; McMahon et al., 2005). Hindell et al (2016) estimated that the total population size of southern elephant seals in 2000 was ~750,000. The Macquarie Island stock has been decreasing for several decades (van den Hoff et al., 2014). In contrast, the other three stocks show stable or slightly increasing population growth (Hindell et al., 2016). Food availability is considered the biggest driver of population growth (McMahon et al., 2005), and has been suggested as a cause of the ongoing decline at Macquarie Island.

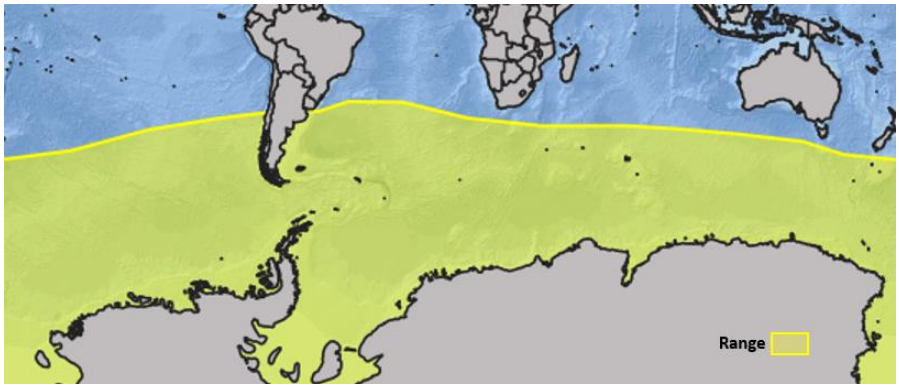

Figure 41: Global range of southern elephant seals. Adapted from Hofmeyr (2015). *Mirounga leonina*. The IUCN Red List of Threatened Species 2015.

Southern elephant seal population size is estimated by counting all breeding females that are ashore on a single day during peak breeding and then adding the total number of weaned and dead pups, with each pup assumed to represent a breeding female that has already departed the colony. The total elephant seal population, excluding pups of the year, is then estimated by applying a multiplier to the number of breeding females. Multipliers of 3.15 (Van der Hoff 2007) and 3.5 (McMahon 2015) have been used to estimate population size at Macquarie Island.

The most recent published estimates of population size at Macquarie Island was 60,298 in the 2010s (van den Hoff et al., 2014), which represents 99.6% of the total abundance of the Macquarie stock (n=60,561). The most recent abundance at Heard Island was 61,933 (Slip and Burton 1999, cited in Hindell et al. 2016), which represents 28% of the total abundance of the entire Kerguelen stock (n=219,957). The most recent published estimates of abundance for the Macquarie and Kerguelen stocks are 219,957 and 60, 561 individuals respectively (Table 4). As standard errors and / or CVs are not available with these estimates N_{min} could not be calculated.

Table 39: Most recent published estimates of abundance (N) of southern elephant seals for two stocks, Kerguelen and Macquarie Stocks, and two breeding colonies, Heard Island and Macquarie Island, within the Australian Antarctic Territory.

Stock	Source	Year of estimate	N
Kerguelen Stock	Hindell et al. (2016)	2010'S	219,957
Heard Island	Slip and Burton (1999) cited in Hindell et al. (2016)	1990'S	61,933
Macquarie Stock	Hindell et al. (2016)	2010'S	60,561
Macquarie Island	Van den Hoff et al. (2014) cited in Hindell et al. (2016).	2010's	60,298

Australian sea lion (*Neophoca cinerea*)

The Australian sea lion is the only pinniped species that is endemic to Australia. It is listed as Endangered and Marine under the EPBC Act, listed as Vulnerable in South Australia under the *National Parks and Wildlife Act 1972*, Vulnerable in Western Australia under the *Wildlife Conservation Act 1950* and as Endangered under the IUCN Red List of Threatened Species (Goldsworthy, 2015). The Australian National Recovery Plan for the Australian sea lion was published in 2013 (DSEWPaC, 2013). The objective of the plan is to halt the decline of Australian sea lion throughout its range, assist in the recovery of the species, and ensure that anthropogenic activities do not hinder this recovery, with the overall aim being the future removal of Australian sea lions from the threatened species list of the EPBC Act.

The Australian sea lion breeds between the Houtman Abrolhos Islands on the west coast of Western Australia and The Pages Islands in South Australia (Shaughnessy et al., 2011), with a total of 32 breeding colonies in Western Australia and 48 in South Australia (Goldsworthy et al., 2021, 2015; Goldsworthy, 2020; Shaughnessy et al., 2011)(Figure 5). Most (81%) of breeding sites produce fewer than 50 pups in a breeding season and only four sites, all in South Australia, produce more than 100 pups (Goldsworthy 2020). Consequently, most (82%) of the species occurs in South Australia (Goldsworthy et al., 2021).

Unique to pinnipeds, Australian sea lions have an 18-month breeding cycle (Ling and Walker 1978) and the timing of breeding is asynchronous across the range. Female Australian sea lions typically breed at the colony where they were born, resulting in population sub-structuring at small spatial scales (~20km) (Campbell et al., 2008; Lowther et al., 2012). Although male dispersal is greater, it can be limited to approximately 110 km (Ahonen et al., 2016). This pattern of female natal-site fidelity and male dispersal results in each breeding colony effectively being a closed population, and regional meta-population divisions that are a result of geographic distance between colonies. These meta-populations are South Australia, the southern coast of Western Australia, and the west coast of Western Australia.

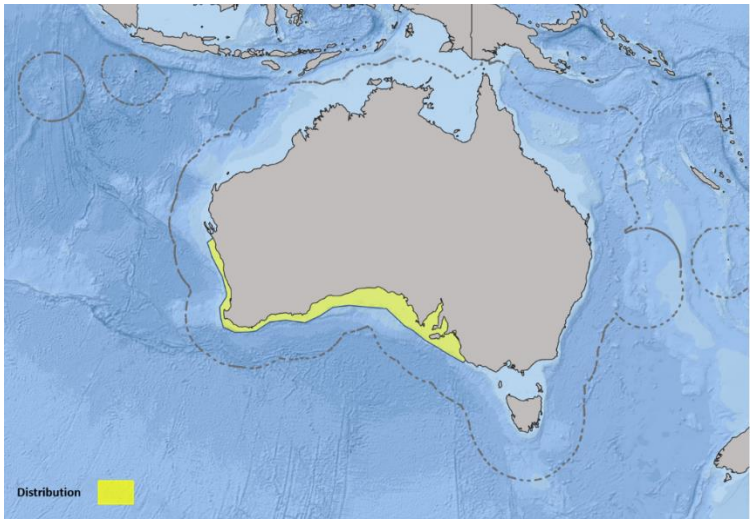

Figure 42: Australian sea lion distribution. Pup production estimates are obtained using a range of survey methods; direct counts, mark-recapture, and cumulative pup production estimates. The precision of each of these methods will vary depending on the time within the breeding season the survey was conducted, the size of the colony, the ability to sight all pups and whether assumptions of mark- recapture methods are upheld. Pup multipliers used to calculate total population size have ranged between 3.8 and 4.8 (Gales et al., 1994; Goldsworthy et al., 2015, 2010; Goldsworthy and Page, 2007).

Total pup abundance in Australia, based on the most recent and/or best survey data is 2,716, with 82% of pups occurring in South Australia (Goldsworthy, 2020). Applying a multiplier of 3.83 produces a total population estimate for the species of 10,402. This pup multiplier assumes a stable population, however, a recent analysis of 30 Australian sea lion breeding colonies estimated a decline of 64% in total pup abundance over a three generation period (Goldsworthy et al., 2021; Goldsworthy, 2020). These 30 colonies account for 75% of the total pup production of the species, and likely reflect a species wide decline. The unique 18-month breeding cycle of the Australian sea lion (Walker and Ling, 1981), and evidence that females may not produce a pup each breeding season, means population growth in this species will be slower than for other pinniped species that breed annually.

N_{min} was calculated for each colony by applying a pup multiplier of 3.83 to the colony pup abundance data presented in Goldsworthy (2020)(Table 5). Estimates of N_{min} varied greatly between colonies and ranged from 4 to 1,364 individuals.

Over a quarter (26%) of Australian sea lion colonies have not been surveyed within the last eight years. It is unknown how estimates of pup abundance relate to population size, or whether the pup multiplier used is suitable given the declining population trend.

Table 40: Estimates of minimum population size (N_{min}) for individual Australian sea lion colonies.

State	Breeding site	Source	Year	Minimum pup estimate	N_{min}
SA	The Pages Islands	Goldsworthy et al. 2015	2014	313	1189
SA	Seal Slide (Kangaroo Is.)	Goldsworthy et al. 2019	2018	14	53
SA	Seal Bay (Kangaroo Is.)	Goldsworthy 2020	2019	222	844
SA	Cape Bouguer (Kangaroo Is.)	Goldsworthy et al. 2015	2014	9	34
SA	North Casuarina Is. (Kangaroo Is.)	Goldsworthy et al. 2015	2014	11	42
SA	Peaked Rocks	Goldsworthy et al. 2012	2011	59	224
SA	Western Isles	Goldsworthy et al. 2012	2011	10	38

SA	Dangerous Reef	DEW unpublished data	2019	359	1364
SA	English Is.	Goldsworthy et al. 2012	2011	34	129
SA	Albatross Is.	Goldsworthy et al. 2012	2011	69	262
SA	South Neptune Islands	Goldsworthy et al. 2015	2014	4	15
SA	North Neptune Islands	Goldsworthy et al. 2015	2014	9	34
SA	Lewis Is.	Goldsworthy et al. 2015	2014	83	315
SA	Williams Is.	Goldsworthy et al. 2020	2019	2	8
SA	Curta Rocks	Goldsworthy et al. 2020	2019	5	19
SA	Liguanea Is.	Goldsworthy et al. 2020	2019	27	103
SA	Price Is.	Goldsworthy et al. 2015	2014	32	122
SA	Four Hummocks Is.	Goldsworthy et al. 2020	2019	10	38
SA	Rocky (South) Is.	Goldsworthy et al. 2020	2019	6	23
SA	Rocky (North) Is.	Goldsworthy et al. 2015	2014	36	137
SA	Cap Island	Goldsworthy et al. 2015	2014	31	118
SA	West Waldegrave Is.	Goldsworthy et al. 2015	2015	89	338
SA	Jones Is.	Goldsworthy et al. 2015	2014	19	72
SA	Point Labatt	Goldsworthy et al. 2013	2013	2	8
SA	Pearson Is.	Goldsworthy et al. 2015	2015	32	122
SA	Ward Is.	Goldsworthy et al. 2020	2019	42	160
SA	Nicolas Baudin Is.	Goldsworthy et al. 2020	2019	70	266
SA	Olive Is.	Goldsworthy et al. 2020	2019	86	327
SA	Lilliput	Goldsworthy et al. 2020	2019	63	239
SA	Blefuscu	Goldsworthy et al. 2020	2019	50	190
SA	Breakwater / Gliddon Is	Goldsworthy et al. 2015	2015	27	103
SA	Lounds Is.	Goldsworthy et al. 2020	2019	30	114
SA	Fenelon Is.	Goldsworthy et al. 2020	2019	31	118
SA	West Is.	Goldsworthy et al. 2020	2019	36	137
SA	Purdie Is.	Goldsworthy et al. 2020	2019	74	281
SA	Nuyts Reef	Goldsworthy et al. 2020	2019	122	464
SA	Bunda 01	Goldsworthy et al. 2020	2018	2	8
SA	Bunda 06	Goldsworthy et al. 2020	2019	8	30
SA	Bunda 07	Goldsworthy et al. 2020	2019	4	15
SA	Bunda 09	Goldsworthy et al. 2020	2019	15	57

Table 5 continued

State	Breeding site	Source	Year	Minimum pup estimate	N_{min}
SA	Bunda 11	Goldsworthy et al. 2020	2017	1	4
SA	Bunda 12	Goldsworthy et al. 2020	2017	7	27
SA	Bunda 18	Goldsworthy et al. 2020	2019	1	4
SA	Bunda 19	Goldsworthy et al. 2020	2017	14	53
SA	Bunda 20	Goldsworthy et al. 2020	2017	1	4
SA	Bunda 22	Goldsworthy et al. 2020	2017	13	49
SA	152	Goldsworthy et al. 2020	2017	11	42
SA	155	Goldsworthy et al. 2020	2017	28	106
WA	Twilight Cove	Dennis & Shahghnessy 1999	1996	4	15

WA	Spindle Is.	Gales (1990); Gales et al. (1994)	1990	53	201
WA	Ford (Halfway) Is.	Gales (1990); Gales et al. (1994)	1990	17	65
WA	Six Mile Is.	Goldsworthy 2020	2017	45	171
WA	Round Is.	Goldsworthy et al. 2020	2017	13	49
WA	Salisbury Is.	Goldsworthy et al. 2020	2014	10	38
WA	Wickham (Stanley) Is.	Goldsworthy et al. 2020	2014	5	19
WA	George Is.	Goldsworthy et al. 2020	2011	13	49
WA	Glennie Is.	Goldsworthy et al. 2020	1999	21	80
WA	Taylor Is.	Goldsworthy et al. 2020	2013	4	15
WA	Kimberley Is.	Goldsworthy et al. 2020	2014	32	122
WA	Cooper Is.	Goldsworthy et al. 2020	2014	8	30
WA	Investigator (Rocky Is.)	Gales et al. (1994)	1989	17	65
WA	West Is.	Gales et al. (1994)	1991	20	76
WA	Red Islet	Goldsworthy et al. 2020	2017	25	95
WA	Middle Doubtful Is.	Goldsworthy et al. 2020	2012	1	4
WA	Haul Off Rock	Goldsworthy et al. 2020	2016	24	91
WA	Butler Is.	Goldsworthy et al. 2020	2019	44	167
WA	Beagle Is.	Goldsworthy et al. 2020	2019	57	217
WA	North Fisherman Is.	Goldsworthy et al. 2020	2019	40	152
WA	Morley Is.	Goldsworthy et al. 2020	2006	1	4
WA	Soumi Is.	Goldsworthy et al. 2020	2006	4	15
WA	Rat Is.	Goldsworthy et al. 2020	2014	1	4
WA	Campbell Is.	Goldsworthy et al. 2020	2004	1	4
WA	Leo Is.	Goldsworthy et al. 2020	2006	2	8
WA	Gibson Is.	Goldsworthy et al. 2020	2006	6	23
WA	Serventy Is.	Goldsworthy et al. 2020	2006	3	11
WA	Stokes Is.	Goldsworthy et al. 2020	2013	2	8
WA	Alexander Is.	Goldsworthy et al. 2020	2006	3	11
WA	Gilbert Is.	Goldsworthy et al. 2020	2006	9	34
WA	Long Is.	Goldsworthy et al. 2020	2006	2	8
WA	Eastern Is.	Goldsworthy et al. 2020	2006	6	23

Australian fur seal (*Arctocephalus pusillus doriferus*)

Australian fur seals are distributed in south-eastern Australia, with most breeding colonies located on Victorian and Tasmanian islands in Bass Strait (Kirkwood et al. 2010) (Figure 6). The species is listed as a Marine species under the EPBC Act, Vulnerable in New South Wales under the *Biodiversity Conservation Act 2016*, Rare In South Australia under the *National Parks and Wildlife Act 1972* and globally as Least Concern under the IUCN Red List of Threatened Species (Hofmeyr, 2015c). The Australian fur seal population is considered a single genetic population with high gene flow between colonies maintained by both sexes (Lancaster et al. 2010).

Pup production estimates have been obtained using aerial surveys, direct counts, and mark-recapture surveys (Kirkwood et al. 2010, McIntosh et al. 2014). To produce a total population estimate, a pup multiplier, currently estimated at 4.5 (Gibbons and Arnould, 2009) is applied to pup production estimates. Surveys of breeding sites in Victoria and New South Wales have been

undertaken at approximately five-yearly intervals since 2002-03 (Kirkwood et al. 2005, 2010, McIntosh et al. 2018, McIntosh et al., 2022). To account for pup mortality, an estimate of 15% mortality has previously been applied to pup counts when estimating abundance (Kirkwood et al. 2010).

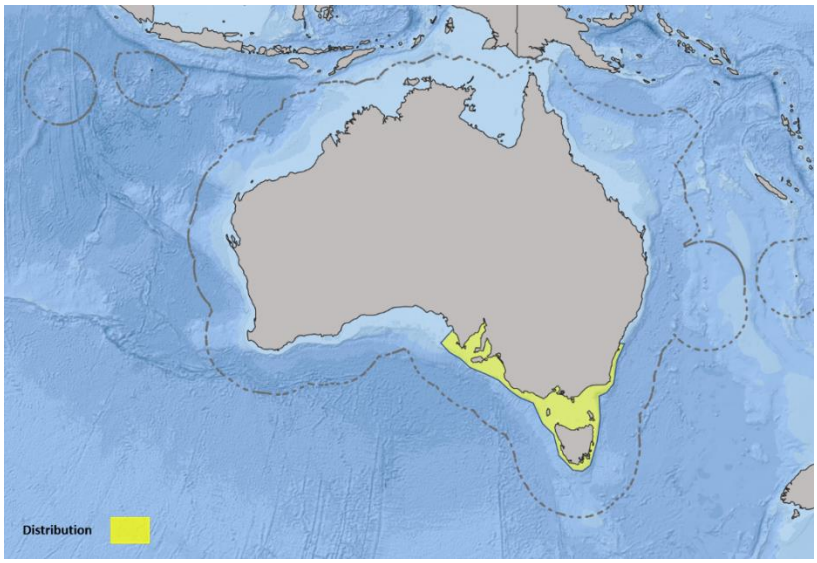

Figure 43: Australian fur seal distribution. In 2017, the estimated pup abundance, after accounting for 15% mortality was 19,836 (McIntosh et al., 2022). Pup production therefore continued to decline from an estimated 17,503 in 2013 and 21,589 pups in 2007. The total abundance of Australian fur seals is estimated to have declined by 25% between 2007 and 2017 (McIntosh et al., 2022). As previously observed, declines in pup production were not consistent across breeding sites (McIntosh et al., 2018). Trends in pup abundance between seasons varied between sites, with some colonies declining and others increasing. Sites with decreased pup production were generally north of Tasmania (McIntosh et al., 2022). Potential drivers for the continued decline in Australian fur seal pup production include reduced reproductive success, increased adult mortality, or lower pup survival. Contributing factors could include climate driven ecosystem changes leading to reduced food resources, the impacts of heat waves and storm surges on pup survival, the impacts of chemical pollution on fecundity, and juvenile and adult mortality as a result of entanglements in debris or fisheries bycatch (McIntosh et al., 2022).

An N_{min} for Australian fur seals was estimated as 89,262 individuals, by applying pup multiplier of 4.5 to the most recent pup production estimate (Table 6). Pup production estimates were obtained using a range of survey methods (e.g. direct counts, mark-recapture, aerial surveys), and the precision of each of these methods, and therefore the accuracy of N_{min}, will be dependent on the size of the colony and the ability to sight all pups. As early pup mortality can vary both between colonies and between years, applying a 15% mortality rate across all pup counts will also affect the accuracy of N_{min}.

Table 41: Estimates of minimum population size (N_{min}) of Australian fur seals.

Stock	Source	Year of estimate	Minimum pup estimate	N_{min}
Australia	(McIntosh et al. 2022)	2017	19,386	89,262

New Zealand fur seal (*Arctocephalus forsteri*)

The New Zealand fur seal, also known as the Long-nosed fur seal, is primarily distributed around the South and North Islands of New Zealand, and along the coast and offshore islands of southern Australia, with established and expanding populations at several sub-Antarctic Islands. In Australia, the species breeds on offshore islands from southwest Australia through to east of Kangaroo Island in South Australia, and southern Tasmania (Figure 7). Small breeding colonies are establishing in Bass Strait and in southern New South Wales coastal waters. The New Zealand fur seal is listed as a Marine species under the EPBC Act, Vulnerable in New South Wales under the *Biodiversity Conservation Act 2016*, Rare in Tasmania under the *Threatened Species Protection Act 1995*, Listed as Other Specially Protected fauna in Western Australia under the *Wildlife Conservation Act 1950*, and globally as Least Concern under the IUCN Red List of Threatened Species (Chilvers and Goldsworthy, 2015).

Within mainland Australia, New Zealand fur seals breed at 65 sites. Most breeding sites are in South Australia and West Australia (36 and 20 respectively), with four breeding sites in both Tasmania and Victoria, and one in New South Wales. There is some evidence of population structuring across the breeding range, but little variation observed between individuals from Western and South Australia (Berry et al., 2012). Juveniles, including females, tagged as pups have been shown to disperse widely around the southern coast, and such dispersal could possibly result in genetic interchange between breeding colonies (Shaughnessy and Goldsworthy, 2020). Movement of a small number of marked individuals between New Zealand and southern Australia has also been recorded (Shaughnessy et al. 2001). Male New Zealand fur seals also occur at the Australian external territory of Macquarie Island, where they have mated and produced hybrid pups with Antarctic and Sub-Antarctic fur seals (Lancaster et al., 2006). However, due to the absence of reproductively mature females the species has not established a breeding colony on the island (Goldsworthy et al., 2009).

Pup production estimates are obtained using direct counts and mark-recapture methods. To produce a total population estimate, Shaughnessy et al. (2015) used a multiplier of 4.76 developed by Goldsworthy and Page (2007). This multiplier is based on life-tables generated from population demographic studies of New Zealand fur seals at Cape Gantheaume, South Australia (McKenzie, 2006), while Campbell et al. (2014) used multipliers of 4.76 - 4.9 based on two structured population models for New Zealand fur seals (Goldsworthy and Page, 2007; Shaughnessy et al., 1994). Pup mortality in 2013-14 at six large breeding colonies in South Australia, varied between 2.5% and 7.8%.

The most recent pup production estimate for the species is 24,601 pups. This figure is the sum of estimates of pup counts from different breeding areas in different seasons. These are 3,518 pups in Western Australia during the 2010/11 breeding season (Campbell et al., 2014), 20,431 pups (range 20,312-20,549) in South Australia during the 2013/14 breeding season (Shaughnessy et al., 2015), 198 pups (185-211) from four breeding sites within Victoria, Tasmanian Bass Strait and New South Wales during the 2013/14 breeding season (McIntosh et al., 2014), and 399 pups in Tasmania in 2012/13 (S. Thalmann cited in Shaughnessy et al. 2015). Applying a 4.76 pup multiplier to the sum of these pup production estimates produces a total population estimate of 117,101.

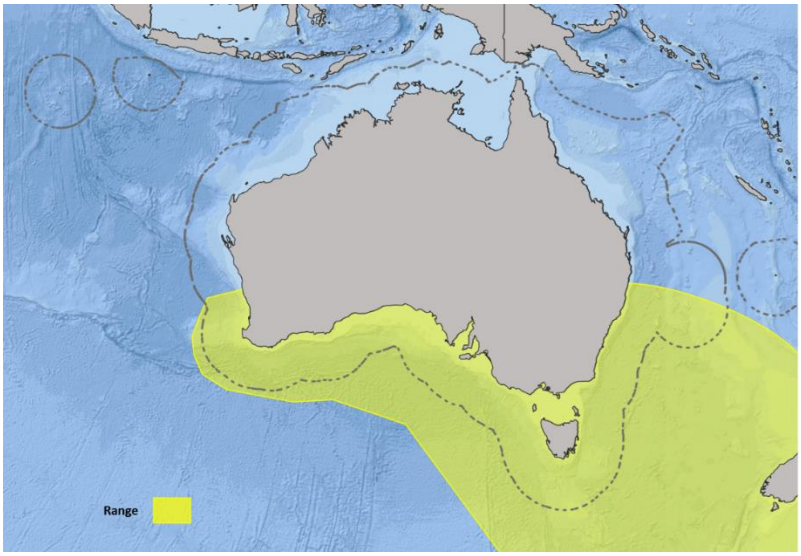

Figure 44: Range of New Zealand fur seals around mainland Australia.

While the overall trend for New Zealand fur seals is continued population recovery, some breeding colonies appear to have reached carrying capacity (Goldsworthy et al. 2019). These include two colonies that account for 47.5% of pup production in South Australia (Shaughnessy et al. 2014), and colonies in Western Australia that grew at a rate of 1% per annum over a 12-year period (Campbell et al. 2014). The most recent estimate of pup production for breeding colonies within the Cape Gantheaume Wilderness Protection Area, South Australia, in the 2017/18 breeding season was 5,820 (95% CI = 5,776 –5,865), an increase of 20.6% on the previous breeding season (Goldsworthy et al., 2019). The N_{min} for New Zealand fur seals in mainland Australia was calculated at 116,751 individuals (Table 7). This N_{min} was calculated as the 20th percentile of the lognormal distribution for the two pup abundance estimates that a CV could be calculated for (South Australia and Victoria), then added to the summed point estimates of pup production from Western Australia, New South Wales and Tasmania. Pup production estimates were obtained using a range of survey methods (e.g. direct counts or) mark-recapture, and the precision of each of these methods, and therefore the accuracy of N_{min}, will be dependent on the size of the colony and the ability to sight all pups.

Table 42: Minimum pup estimate and estimates of minimum population size (N_{min}) for New Zealand fur seals in mainland Australia.

Stock	Source	Year of estimate	Minimum pup	N_{min}
Australia	Campbell et al. 2014, Shaughnessy et al. 2015, McIntosh et al. 2018	2011-2014	24,528	116,751

Humpback whale (*Megaptera novaeangliae*)

The humpback whale has a global distribution and is found in all major ocean basins. Most humpback whales in the southern hemisphere migrate to the Antarctic region each Austral summer, feeding as far south as the ice edge (Cooke, 2018). The species was heavily exploited throughout its range and it is estimated that over 215,000 individuals were killed in the southern hemisphere in the 20th century (Clapham and Baker, 2018). The most recent global population estimate is 135,000 individuals (Cooke, 2018), with a southern hemisphere population estimate in 2015 of 97,000 (95% CI = 78,000-118,000)(IWC, 2016). The species is listed as Migratory and a Cetacean under the EPBC Act, listed as Vulnerable in New South Wales under *the Biodiversity Conservation Act 2016*, Vulnerable in Queensland under the *Nature Conservation (Animals) Regulation 2020*, Vulnerable in South Australia under the *National Parks and Wildlife Act 1972*, Endangered in Tasmania under the *Threatened Species Protection Act 1995*, Threatened in Victoria under the *Flora and Fauna*

Guarantee Act 1998, Conservation Dependent in Western Australia under the *Wildlife Conservation Act 1950*, and of Least Concern under the IUCN Red List of Threatened Species (Cooke, 2018).

The International Whaling Commission (IWC) Scientific Committee recognises seven breeding stocks of humpback whales in the Southern Ocean (stocks A-G), of which two stocks migrate annually to breed in Australian coastal waters during the Austral winter (Figure 8). Stock D migrates annually from Antarctica along the coast of Western Australia, and stock E1 migrates annually from Antarctica along the eastern coast of Australia. Key calving and aggregation sites for Stock D along the Western Australian coast include the southern Kimberly region, Exmouth Gulf and Shark Bay (Figure 8). Key calving grounds for Stock E1 are within the Great Barrier Reef region off the Queensland coast (Figure 8). During the austral summer whales from Stock D are thought to be distributed on feeding grounds between 70˚E-130˚W, while whales from Stock E1 are distributed between 130˚ E-170˚W. There is low but significant genetic differentiation between the two populations (Schmitt et al., 2014), with a low level of interchange between the western and eastern Australian subpopulations (Kaufman et al., 2011). Movement of individuals between the eastern Australian E1 stock and the Oceania E2 stock have also been recorded (Garrigue et al., 2007).

Both stocks are increasing in abundance, and estimated rates of population growth are 9.7%-13% per annum for Stock D (Hedley et al. 2011, Salgado-Kent et al. 2012), and 10.6%-11% for Stock E1 (Noad et al.,2011, 2019). The most recent estimates of abundance for Stock D are between 17,810 (95% CI = 14,210–27,720) and 28,830 (95% CI = 23,710-40,100) individuals (Hedley et al. 2011, Salgado-Kent et al. 2012). The most recent estimate of abundance in 2015 for stock E1 is 24,545 individuals (95% CI = 21,631–27,851) (Noad et al., 2019). Obtaining accurate abundance data for Stock D is difficult as whales travel along a broad migration corridor along the coast of Western Australia, and there is inter-annual variation in the distances that whales migrate from the shore. As a result, the estimates for this stock are considered preliminary by the IWC (IWC, 2016). In contrast, 90% of whales were found to pass within 5km of the shore-based survey site used to collect data on abundance of Stock E (Noad et al. 2019).

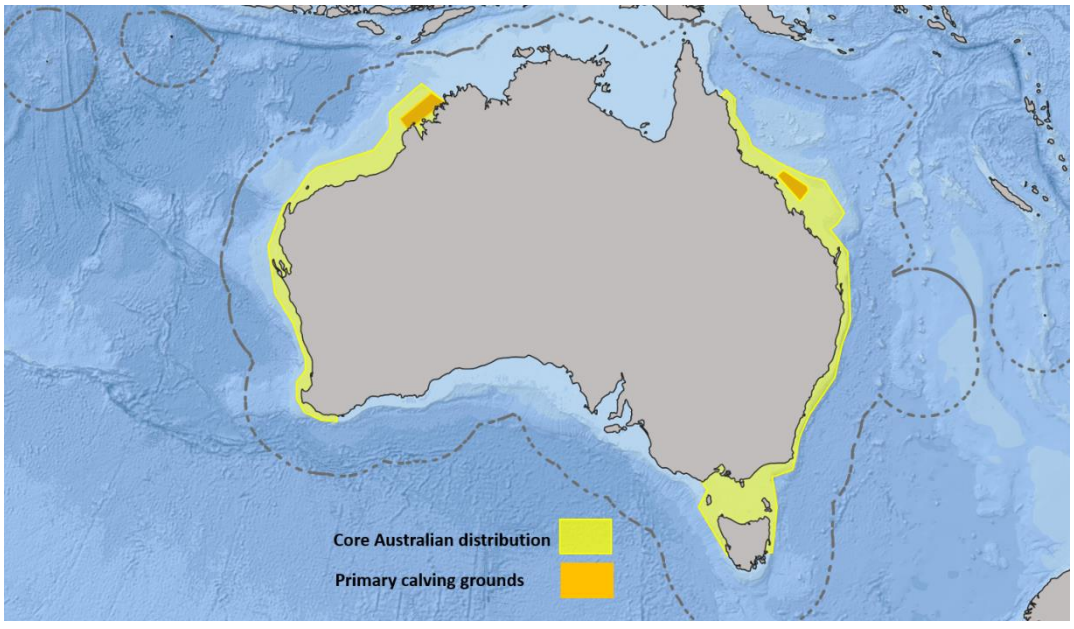

Figure 45: Core distribution of humpback whales in Australian waters during the Austral winter The estimate of N_{min} for Stock D was calculated as 16,933 and 25,427 individuals based on the abundance estimates in Hedley et al. (2011) and Salgado Kent et al. (2012) respectively (Table 8). The estimate of N_{min} for Stock E1 was 23,337 individuals based on the abundance estimate presented in Noad et al. (2019)(Table 8). The estimated annual growth rates for Stock D and E1 range between 9.7%-13%

(Hedley et al. 2011, Salgado-Kent et al. 2012, Noad et al. 2019). Zerbini et al. (2010) estimated an annual growth rate of 11.8% was the maximum plausible growth rate for the species, and it has been proposed that the high rate of growth observed in Stock D may partially be due to temporary immigration of whales from other populations in Oceania (Clapham and Zerbini, 2015).

Table 43: Estimates of abundance (N) and minimum population size

Stock	Source	Year	N	N_{min}
D	Hedley et al. 2011	2008	17,810	16,933
D	Salgado Kent et al. 2012	2008	26,100	25,427
E1	Noad et al. 2019	2015	24,545	23,337

Southern right whale (*Eubalaena australis*)

Southern right whales have a circumpolar distribution between latitude 16°S and 65°S, and migrate between mid- to high latitude feeding grounds and Austral-winter calving grounds. Southern right whales were heavily exploited throughout their range and around 150,000 whales were killed between 1770 and 1900. The species was already considered rare when modern whaling began (Cooke and Zerbini, 2018). It is estimated that over 4,452 southern right whales were killed in the southern hemisphere in the 20th century (Clapham and Baker, 2018). The global population was estimated to have reached 13,600 animals by 2009. The species is listed as Endangered, Migratory and a Cetacean under the EPBC Act, listed as Endangered in New South Wales under the *Biodiversity Conservation Act 2016*, Vulnerable in South Australia under the *National Parks and Wildlife Act 1972*, Endangered in Tasmania under the *Threatened Species Protection Act 1995*, Threatened in Victoria under the *Flora and Fauna Guarantee Act 1988*, Vulnerable in Western Australia under the *Wildlife Conservation Act 1950*, and Least Concern under the IUCN Red List of Threatened Species (Cooke and Zerbini, 2018). A Recovery Plan for the species has been in effect under the EPBC Act since 2013 (DSEWPaC, 2012). The long-term objective of the plan is 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" (DSEWPaC, 2012).

In Australia, southern right whales are seasonally present during the Austral winter at coastal calving and aggregation areas that occur from Western Australia to New South Wales, including Tasmania (Figure 9). Reproductive females return to calving grounds on average every three years to give birth to a single calf. Two subpopulations are considered to occur in Australian waters based on genetic analyses (Carroll et al., 2011), and different rates of population growth. These are the southwest Australian population (SWA), which is distributed from Western Australia into South Australia, and the southeast Australia population (SEA) from Victoria to New South Wales including Tasmania. The boundary between the two sub-populations is at approximately 140˚E. A more recent genetic analyses did not find differentiation between whales sampled for SEA and New Zealand calving grounds (Carroll et al., 2015), and there is some evidence of limited interchange between the SWA and New Zealand populations (Mackay et al., 2020; Pirzl et al., 2009), and of the two populations potentially sharing a feeding ground (Mackay et al. 2020). These findings may indicate that whales from the two subpopulations mix along migratory corridors, or whales from the New Zealand population may migrate to SEA calving grounds. In addition, a recent comparison of Photo-ID matches between catalogues found 7% of individuals photographed in Victoria were also recorded in southwestern Australian calving and aggregation areas, showing there is some degree of movement between the two calving areas in Australia (Watson et al., 2021).

Aerial surveys have been conducted annually since 1976 to collect data on the abundance of southern right whales in southwestern Australia. The most recent abundance for the SWA subpopulation is 3,164 individuals (Smith et al., 2020). As reproductive females do not calve every year, a multiplier of 3.94 is applied to total counts of cow-calf pairs to calculate total population abundance. The estimated rate of increase for the SWA population is approximately 6% per annum. The most recent abundance estimate for the SEA population using a superpopulation mark-recapture model was 268 individuals in 2017, with an estimated rate of increase of reproductive females of 4.7% (Stamation et al., 2020). An ongoing project funded by the National Environmental Science Program will provide an abundance estimate of the total population of southern right whales in Australia using photo-ID in the Australasian Right Whale Photo-identification Catalogue (ARWPIC). The project will also investigate the spatial connectivity of whales utilising different calving and aggregation areas and assess the degree of connectedness between the SWA and SEA populations. As the Recovery Plan currently recognises two subpopulations in Australia, that have different rates of population growth, N_{min} was calculated for the SWA and SEA populations separately (Table 9).

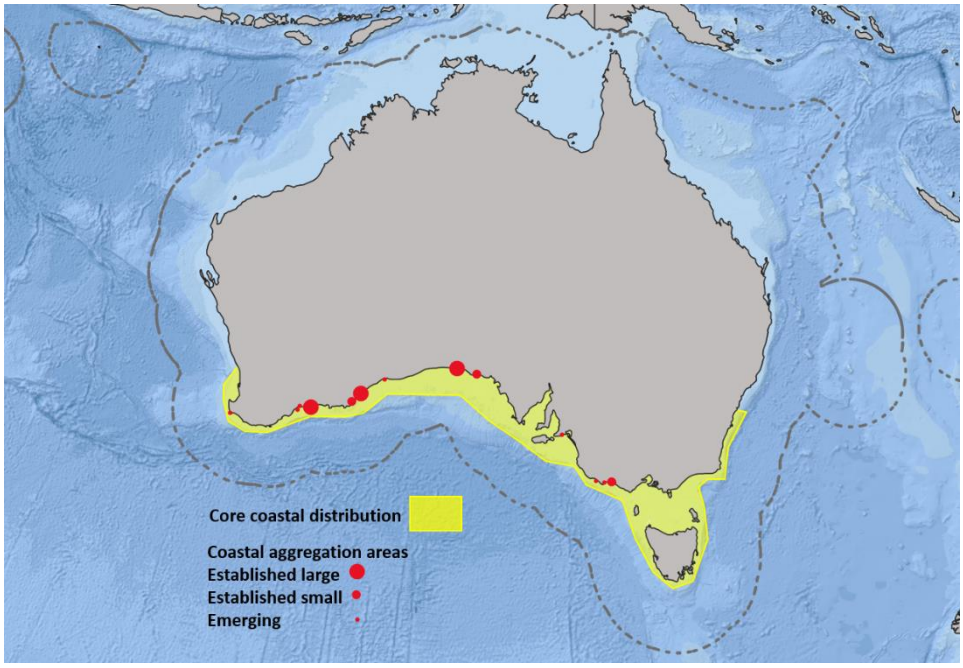

Figure 46: Coastal distribution and aggregation areas of southern right whales in Australia. Table 44: Estimates of abundance (N) and minimum population size (N_{min}) for southern right whales in Australia.

Stock	Source	Year	N	N_{min}
SWA	Smith et al. 2019	2018	3,191	2,553
SEA	Stamation et al. 2020	2017	268	183

Bottlenose dolphin species

At least two species of bottlenose dolphins occur in Australian waters, the Common bottlenose dolphin (*Tursiops t. truncatus*) and the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). Determining the distribution of each species is complicated by the fact that these species can occur sympatrically, and species identification in the field is difficult. Species assignment in the field usually identifies smaller inshore forms of coastal bottlenose dolphins as *T. aduncus*, and larger, primarily offshore forms as *T. truncatus*. However, genetic data are required to confirm species identity and determine the distribution of the two species. In the southern Australian region, an assessment of the abundance of *Tursiops* spp. is further complicated by the unresolved taxonomy of the genus, with a third species, the Burrunan dolphin or Southern Australian dolphin (*T. australis*) described from inshore waters in Victoria and South Australia (Charlton- Robb et al. 2011). The taxonomic status of this proposed species is not currently accepted (Committee on Taxonomy, 2020).

Common bottlenose dolphin (*Tursiops truncatus*)

Common bottlenose dolphins, hereafter referred to as bottlenose dolphins, are widely distributed worldwide in temperate and tropical coastal, shelf, and oceanic waters. In some regions inshore and offshore ecotypes are recorded, with inshore forms tending to form smaller resident populations in bays and estuaries, and offshore forms showing less restricted range. The bottlenose dolphin is listed as a Cetacean under the EPBC Act, and globally of Least Concern under the IUCN Red List of

Threatened Species (Wells et al., 2019). Current global population estimates are in excess of 750,000 individuals, as this estimate was based on abundance data for only part of the species range.

The distribution of bottlenose dolphins in Australian waters is not well understood, but the species has been recorded in all States with the exception of the Northern Territory, and also at the offshore islands of Lord Howe and Cocos (Keeling) Islands (Woinarski et al., 2014)(Figure 10). The lack of information on the distribution of the species is compounded by the difficulty in distinguishing between it and T. *aduncus* in the field, in areas where the two species are sympatric.

The only published abundance estimate for bottlenose dolphins in Australian waters is for an area of 25,888 km^2 in Western Australia, which covers four managements areas of the Western Australian Pilbara Trawl Fishery that has ongoing interactions with bottlenose dolphins (Allen et al., 2017). An aerial survey conducted in April 2011 estimated an abundance of 1,551 dolphins (95% CI = 822–2,929) for the surveyed area, and an extrapolated estimate of 2,185 (95% CI = 158–4,125) for the entire area of the Pilbara Trawl Fishery. The authors note this abundance estimate is likely an underestimate as they were not able to correct for availability bias (Allen et al., 2017). Tursiops *spp*. that were biopsy sampled in the area of the fishery were genetically confirmed as T. *truncatus* (Allen et al., 2016). However, it is unknown whether bottlenose dolphins in the surveyed area could be considered a single stock, or if they are part of a larger pelagic population.

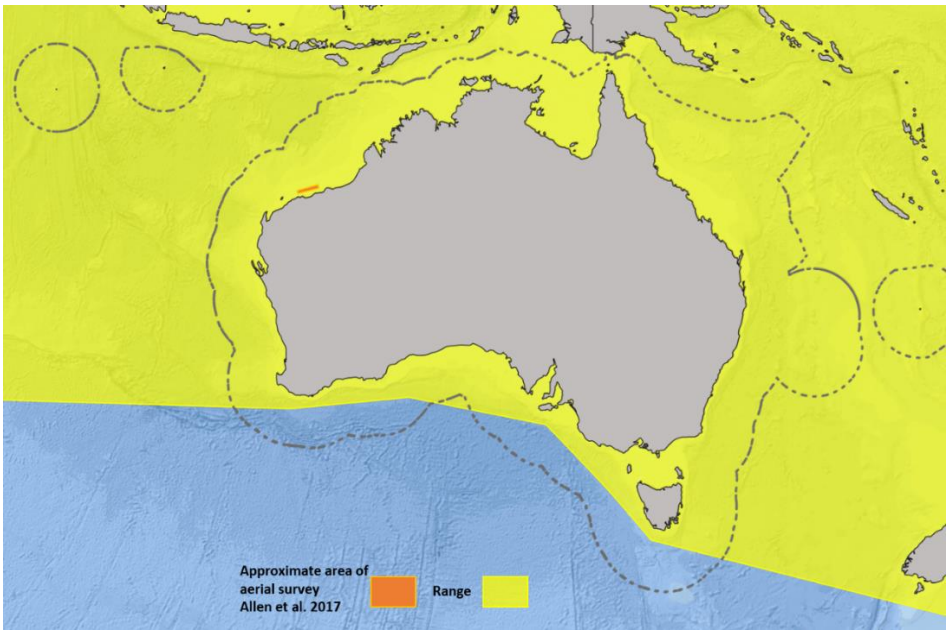

Figure 47: Range of bottlenose dolphins in Australian waters. Adapted from Wells et al. (2019).

Table 45: Abundance (N) and minimum population size (N_{min}) of common bottlenose dolphins for a surveyed region in Western Australia

State	Area surveyed	Source	Year	N	N_{min}
WA	Pilbara	Allen et al. 2017	2011	1,551	1,168
WA	Extrapolated to entire area of the fishery	Allen et al. 2017	2011	2,774	1,731

Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)

Indo-Pacific bottlenose dolphins have an extensive distribution in tropical and temperate waters of coastal Australia (Figure 11). The species is listed as a cetacean species under the EPBC Act, and globally as Near Threatened under the IUCN Red List of Threatened Species (Braulik et al., 2019). The global population is estimated to be in excess of 40,000 individuals (Braulik et al., 2019). The species was assessed as being Data Deficient in Australian waters (Woinarski et al., 2014) and there is no information on total population size or trends. Where robust abundance data are available, these tend to be for small, restricted areas, such as bays, where dolphins exhibit some degree of residency, and are therefore referred to in this report as communities unless there is clear evidence that they are separate populations or 'stocks'. Available published estimates of abundance for Indo-Pacific bottlenose dolphins are presented in Table 11.

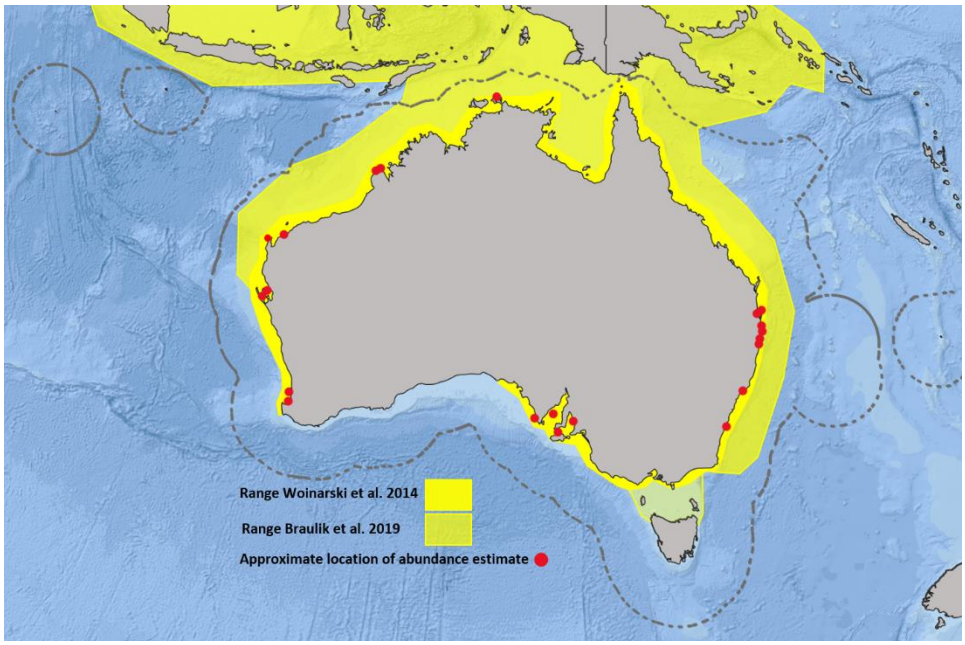

Figure 48: Range of Indo-Pacific bottlenose dolphins in Australian waters. It should be noted that while recent abundance estimates from Victoria and South Australia report the species of Bottlenose occurring there to be, or likely to be, the Burrunan (*T.* cf. *australis)* or Southern Australian dolphin, morphological studies of inshore *Tursiops* in the same area identify the species as *T. aduncus* (Kemper et al., 2019). In addition, a recent analysis of 264 bottlenose dolphin skulls collected in Australia allocated all specimens as either *T. truncatus* or *T. aduncus*, and those skulls previously identified as *T.* cf *australis* were morphologically clustered with *T. truncatus* specimens (Jedensjö et al., 2020). The study also found that all specimens from Bass Strait were *T. truncatus*, whilst almost all samples from the northern coast of Australia were *T. aduncus* (Jedensjö et al., 2020). Abundance estimates for Indo-Pacific bottlenose dolphin communities range from the low tens to the hundreds (Table 11), with many locations recording seasonal changes in abundance and residency patterns. There is evidence of fine-scale population structure among Indo-Pacific bottlenose dolphins within regions (e.g. Ansmann et al., 2012). Six genetic subpopulations have been proposed for *T.* cf. *australis* dolphins between Esperance in Western Australia, and Tasmania (Charlton-Robb et al., 2015; Pratt et al., 2018). It is not conclusive that these proposed subpopulations represent demographically independent populations (Pratt et al., 2018). Minimum 'population' sizes (N_{min}) calculated from available abundance estimates are presented in Table 12.

Table 46: Published estimates of *Tursiops aduncus* populations in Australian waters.

State	Location	Source	Method	Year of estimate	Estimate
QLD	Keppel Bay	Woinarski et al. 2014	Unknown	Unknown	50
QLD	Great Sandy Strait &Hervey Bay	Woinarski et al. 2014	Unknown	Unknown	70
QLD	Offshore North Stradbroke Island	Chilvers and Corkeron, 2003	Mark-recapture	1998	895 (± SE 74)
QLD	North Moreton Bay	Ansmann et al. 2013	Mark-recapture	2008-2010	446 (95% CI = 336–556)
QLD	South Moreton Bay	Ansmann et al., 2013	Mark-recapture	2008-2010	193 (95% CI = 181–207)
NSW	Tweed Heads	Woinarski et al. 2014	Mark-recapture	Unknown	51 (95% CI = 49–54)
NSW	Byron and Ballina coast	Hawkins 2007	Mark-recapture	2003-2005	865 (95% CI = 861–869)
NSW	Richmond River	Fury and Harrison, 2008	Mark-recapture	2003-2006	34 (95% CI = 19–49)
NSW	Clarence River	Fury and Harrison, 2008	Mark-recapture	2003-2006	71 (95% CI = 62–81)
NSW	Port Stephens	Möller et al., 2002	Mark-recapture	1999–2000	143 (95% CI = 132–165)
NSW	Jervis Bay	Möller et al., 2002	Mark-recapture	1998–1999	61 (95% CI = 58–72)
WA	Bunbury	Smith et al., 2013	Mark-recapture	2007-2009	63 (95% CI = 59 to 73) to 139 (95% CI = 134–148)
WA	Swan River	Chabanne et al., 2012	Mark-recapture	2003	55 (17-18 resident individuals)
WA	Shark Bay	(Preen et al., 1997)	Aerial survey	1994	2064 (SE ± 267)
WA	Useless Loop, Shark Bay	(Nicholson et al., 2012)	Mark-recapture	2010	208 (95% CI = 177–245)
WA	Onslow, Pilbara	(Raudino et al., 2018a)	Mark-recapture	2015	79 (95% CI = 43-148) for Onslow

State	Location	Source	Method	Year of estimate	Estimate
WA	North West Cape	(Haughey et al., 2020)	Mark-recapture	2013-2015	141 (95% CI: 121–161) to 370 (95% CI: 333–407)
NT	Port Essington Harbour	(Palmer et al., 2014)	Unknown	2008-2010	75 (95% CI = 39–145)
NT	Beagle Bay, Kimberly Region	(Brown et al., 2016)	Mark-recapture	2012-2014	Min 156 (95% CI = 115-211), Max 184 (95% CI = 113-300)
NT	Cygnet Bay, Kimberly Region	(Brown et al., 2016)	Mark-recapture	2012-2014	Min 35 (95% CI = 27-48), Max 60 (95% CI = 42-87)
Vic	Port Phillip Bay*	(Charlton-Robb et al., 2015)	Unknown	Unknown	80-100
Vic.	Gippsland Lakes*	(Charlton-Robb et al., 2015)	Unknown	Unknown	50-150
SA	Adelaide metropolitan waters*	(Zanardo et al., 2016)	Mark-recapture	2012-2014	95 (SE ± 45.20) in winter 2013 to 239 (SE ± 54.91) in summer 2014
SA	Central South Australian waters*	(Bilgmann et al., 2019)	Mark-recapture distance sampling	2011	3,493 (95% CI = 2,327-5,244) summer/autumn, and 3,213 (95% CI = 2,151-4,801) in winter/spring
SA	Coffin Bay*	(Passadore et al., 2017)	Mark-recapture	2013-2015	306 (95% CI = 291–323)
SA	Western Eyre peninsula coast*	(Bilgmann et al., 2018)	Count from aerial survey	2013	107

Table 47: Estimates of abundance (N) and minimum population size (N_{min}) of Indo-Pacific bottlenose dolphins from surveyed areas in Australia

State	Survey location	Source	Year	N	N_{min}
NT	Port Essington Harbour	(Palmer et al., 2014)	2008-2010	75	56
NT	Beagle Bay, Kimberly Region	(Brown et al., 2016)	2012-2014	156	148
NT	Cygnet Bay, Kimberly Region	(Brown et al., 2016)	2012-2014	35	31
QLD	North Stradbroke Island	(Chilvers and Corkeron, 2003)	1998	895	879
QLD	North Moreton Bay	(Ansmann et al., 2013)	2008-2010	446	401
QLD	South Moreton Bay	(Ansmann et al., 2013)	2008-2010	193	187
NSW	Tweed Heads	Woinarski et al. 2014		51	50
NSW	Byron and Ballina coast	Hawkins 2007	2003-2005	865	863
NSW	Richmond River	(Fury and Harrison, 2008)	2003-2006	34	28
NSW	Clarence River	(Fury and Harrison, 2008)	2003-2006	71	67
NSW	Port Stephens	(Möller et al., 2002)	1999–2000	143	136
NSW	Jervis Bay	(Möller et al., 2002)	1998–1999	61	58
SA	Adelaide metropolitan waters	(Zanardo et al., 2016)	2012-2014	95	65
SA	Central South Australian waters	(Bilgmann et al., 2019)	2011	3213	2,697
SA	Coffin Bay	(Passadore et al., 2017)	2013-2015	306	299
WA	Bunbury	(Smith et al., 2013)	2003	63	60
WA	Shark Bay	(Preen et al., 1997)	1994	2064	2,007
WA	Useless Loop, Shark Bay	(Nicholson et al., 2012)	2010	208	194
WA	Onslow, Pilbara	(Raudino et al., 2018)	2015	79	60
WA	North West Cape	(Haughey et al., 2020)	2013-2015	370	354

Common dolphin (*Delphinus delphis*)

Common dolphins have an extensive range and are distributed in temperate and subtropical waters. Three subspecies are recognised including the Indian Ocean long-beaked common dolphin (*D. d. tropicalis*). There is no estimate of global population size, but minimum global abundance based on abundance estimates from areas that have been surveyed likely amount to several million (Braulik et al., 2021). Common dolphins are widely distributed in Australian waters and have been recorded in all States. While listed as occurring in the Northern Territory (Bannister et al., 1996), the current project was unable to find any records of strandings (Chatto and Warneke, 2000) or sightings in Territory waters, and the species was not among dolphin species observed as bycatch in the Taiwanese gillnet fishery that operated in northern Commonwealth Australian waters (Harwood and Hembree, 1987). Common dolphins, identified as the Indian Ocean long-beaked common dolphins have been recorded at the external Australian territories of Cocos (Keeling) and Christmas Islands (Woinarski et al., 2014)(Figure 13). Records from all other States are of the short-beaked common dolphin. Common dolphins are listed as a cetacean under the EPBC Act, and globally as Least Concern under the IUCN Red List of Threatened Species (Braulik et al., 2021).

There have been very few systematic surveys throughout the Australian range of the species, and most occurrence data are from strandings (Evans et al., 2005; Foord et al., 2019; Groom and Coughran, 2012; Lloyd and Ross, 2015; Segawa and Kemper, 2015). The extent of their distribution in the southwest Pacific and Indian Ocean is poorly understood. In contrast to other regions where common dolphins are considered to be single panmictic populations (Moura et al., 2013), population sub-structuring has been identified in common dolphins sampled in coastal waters (or less than 100m) between Albany in Western Australia and Ballina in northern New South Wales (Bilgmann et al., 2014; Möller et al., 2011).

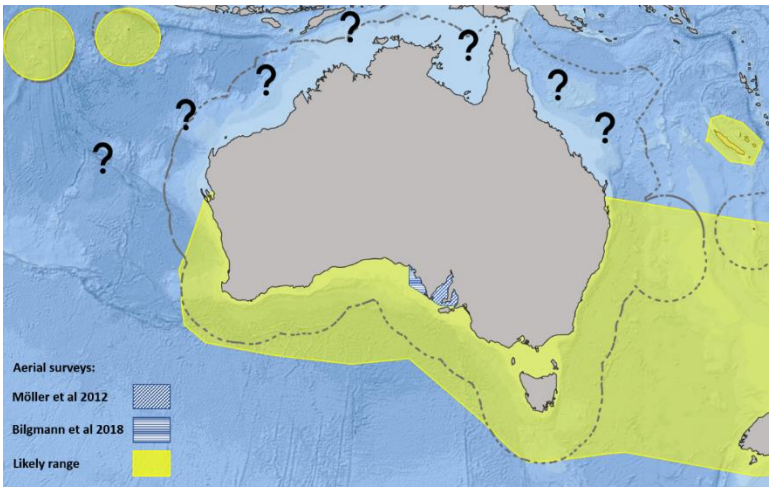

Figure 49: Likely range of common dolphins. A recent study looking at the genetic structure in common dolphins across Australasia found three distinct regional populations; the southern coast of Australia, the eastern coast of Australia, and a New Zealand and Tasmania population (Barceló et al., 2021). Within Australia several Management Units (MU) have been proposed for common dolphins based on genetic analyses. A minimum of eight MUs have been proposed between Albany in Western Australia and Ballina in New South Wales (Bilgmann et al. 2014, Möller et al. 2011). Five are identified as Indian Ocean MUs; two in Western Australia, two in South Australia and one from the Eyre Peninsula in South Australia to Wilson's Promontory in Victoria (Bilgmann et al., 2014). Of the three proposed Pacific Ocean MUs one encompasses south-eastern Australia, Tasmania, and New South Wales, whilst the remaining two encompass central and northern New South Wales, respectively (Bilgmann et al. 2014, Möller et al. 2011). It is not clear whether the proposed MUs in southern Australia can be considered as individual 'stocks', as no population substructure was detected in

Indian Ocean samples, when sample location was not used as a prior (Bilgmann et al., 2014; Suppl.material). In addition, mixed schools of Pacific Ocean and Indian Ocean MUs were recorded (Bilgmann et al. 2014). The authors suggest these mixed schools were because of dolphins from the Pacific Ocean migrating into the region in association with seasonal upwelling, and oceanographic features that affect the distribution of prey species are suggested as a driver behind the genetic substructure found in southern Australian and New South Wales waters (Bilgmann et al. 2014, Möller et al. 2011).

Seasonal differences in the abundance of common dolphins in shelf waters of South Australia have been recorded (Filby et al., 2010; Möller et al., 2012). Such seasonal changes in abundance or densities have been reported for the species in the North and West Atlantic and Eastern Pacific oceans (Campbell et al., 2015; Murphy et al., 2013; Perrin, 2018). In New Zealand, seasonal offshore movements of common dolphins were associated with changes in sea surface temperature (SST) (Neumann, 2001). The diet of common dolphins in South Australia is dominated (*Sardinops sagax*), while prey items in the diet of common dolphins in New Zealand included both neritic and pelagic species suggesting diel movement between coastal and oceanic waters (Meynier et al., 2008).

There are limited abundance data for common dolphins in Australian waters, with all estimates off South Australia restricted to coastal or shelf waters less than 100m in depth (Bilgmann et al., 2018; Filby et al., 2010; Parra et al., 2021). Filby et al. (2010) conducted systematic boat-based surveys for common dolphins in an area of 2,592 km^2 between 2005 and 2008 in Gulf St Vincent, South Australia, and derived an overall estimate of 1,957 individuals in the study area. Parra et al. (2021) conducted two line transect aerial surveys of Spencer Gulf, Gulf St Vincent and Investigator Strait out to the 100m depth contour. The survey design used a double observer platform method (mark-recapture distance sampling (MRDS)) with one survey conducted in austral summer and one in winter 2011. The estimated abundance of common dolphins was 21,733 (95% CI = 13,809–34,203) in austral summer and 26,504 in winter (95% CI = 19,488–36,046). Bilgmann et al. (2018) conducted a single observer platform systematic line transect aerial survey between Ceduna and Coffin Bay, South Australia from the coast out to the 100m depth contour in winter 2013. The abundance of common dolphins was estimated to be 20,000–22,000 individuals with densities of 0.67–0.73 dolphin/km^2 (Bilgmann et al., 2018). Atypical continued residency of 10 adult common dolphins has been recorded within a small area of Port Philip Bay, Victoria, with a total group estimated to be around 30 dolphins (Mason et al., 2016). There are no estimates of abundance for the species throughout the rest of its range in Australian waters.

Table 48: Estimates of abundance (N) and minimum population size (N_{min}) of common dolphin for surveyed areas in South Australia.

Location	Source	Year	N	N_{min}
Spencer Gulf, Gulf St Vincent and Investigator Strait, South Australia	Parra et al. (2022)	2011 Summer	21,733	17,696
Spencer Gulf, Gulf St Vincent and Investigator Strait, South Australia	Parra et al. (2012)	2011 Winter	26,504	22,618
Ceduna to Coffin Bay, South Australia	Bilgmann et al. 2014	2013 Winter	19,735	15,060

Humpback dolphin (*Sousa sahulensis*)

The Australian humpback dolphin (*Sousa sahulensis*) is distributed in coastal tropical and subtropical waters from Shark Bay in Western Australia, east across the Northern Territory, to the southern

coastal waters of Queensland, and across the Sahul Shelf to New Guinea (Beasley et al., 2016; Jefferson and Rosenbaum, 2014). It was recently described as a separate species to the Indo-Pacific humpback dolphin (*Sousa chinensis*) based on molecular and morphological data (Jefferson and Rosenbaum, 2014). Australian humpback dolphins occur in coastal waters and associate with habitat such as estuaries and offshore islands with fringing reefs (Allen et al., 2012; Brown et al., 2016; Palmer et al., 2014; Parra and Cagnazzi, 2016; Raudino et al., 2018b) (Figure 13). The Australian humpback dolphin is listed as Cetacean and Migratory under the EPBC Act, Vulnerable in Queensland under the *Nature Conservation (Animals) Regulation 2020*, P4 (rare, near threatened or in need or monitoring) under the Western Australian *Wildlife Conservation Act 1950* and globally as Vulnerable under the IUCN Red List of Threatened Species (Parra et al., 2017b).

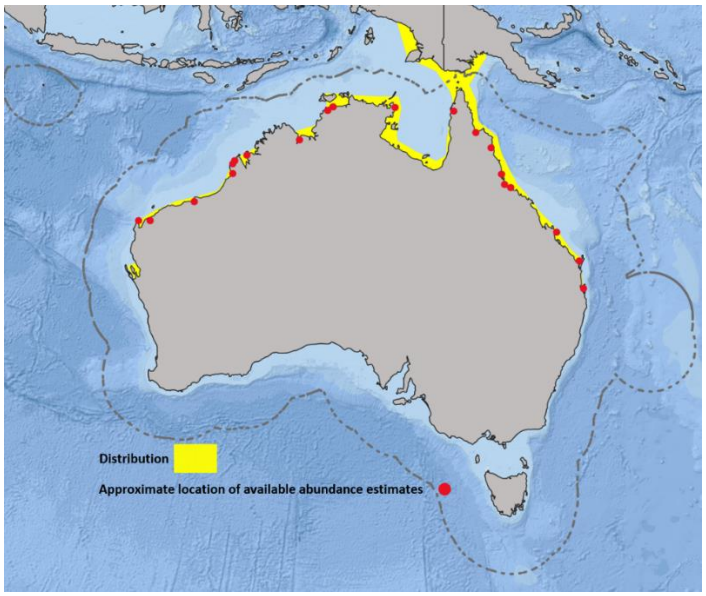

Figure 50: Potential distribution of Australian humpback dolphins and locations where abundance estimates are available.

There is no total abundance estimate for Australian humpback dolphins across their range and abundance data are only available from discrete areas with localised populations (Brooks et al., 2019, 2017; Brown et al., 2016; Cagnazzi et al., 2013; Hunt et al., 2017; Palmer et al., 2014; Raudino et al., 2018b). Parra and Cagnazzi (2016) who provide a comprehensive summary of available information on the range, distribution, and abundance of the species estimated the total abundance of mature Australian humpback dolphins to be fewer than 10,000 individuals. Within their range there is evidence of metapopulation structuring with limited gene flow between populations (Brown et al., 2014; Parra et al., 2018).

There is no information on the overall population trend for the species. Where abundance data are available estimates of population size range from the tens to a maximum of 150 individuals.

Table 49: Estimates of abundance (N) and minimum population size (N_{min}) of humpback dolphins in surveyed areas of Australia.

State	Location	Source	Method	Year of	Estimate	Nmin

WA	Montebello Islands	Raudino et al. 2018b	Photo ID	2017	28	28*
WA	Cygnet Bay	Brown et al. 2016	Mark-recapture	2012-2014	15-20	13-19
WA	North West Cape	Hunt et al. 2017	Mark-recapture	2013-2015	129	124
NT	Port Essington	Palmer et al. 2014	Mark-recapture	2008-2010	17-65	13-50
NT	Darwin Harbour	Brooks et al. 2017	Mark-recapture	2011-2015	90	81
QLD	Cleveland Bay	Parra et al. 2006	Mark-recapture	1999-2002	34-54	29-46
QLD	Cleveland Bay	Brooks et al. 2019	Unknown	Unknown	86	79
QLD	Great Sandy Strait	Cagnazzi et al. 2011	Mark-recapture	2004-2007	150	143
QLD	Capricorn Coast	Cagnazzi et al 2013	Mark-recapture	2006-2011	105	103
QLD	Rods Bay to Port	Brooks et al. 2019	Unknown	Unknown	154	146

Snubfin dolphin (*Orcaella heinsohni*)

The Australian snubfin dolphin (*Orcaella heinsohni)* is distributed in shallow (<20m) coastal tropical waters from Exmouth in Western Australia, east across the Northern Territory to central Queensland, with most sightings occurring in areas close to freshwater inputs (Allen et al., 2012; Beasley and Brown, 2018; Bouchet et al., 2021; Palmer et al., 2014; Parra et al., 2017a)(Figure 14). The Australian snubfin dolphin is listed as Cetacean and Migratory under the EPBC Act, Vulnerable in Queensland under the *Nature Conservation (Animals) Regulation 2020*, P4 (rare, near threatened or in need or monitoring) under the Western Australian *Wildlife Conservation Act 1950,* and globally as Vulnerable under the IUCN Red List of Threatened Species (Parra et al., 2017a).

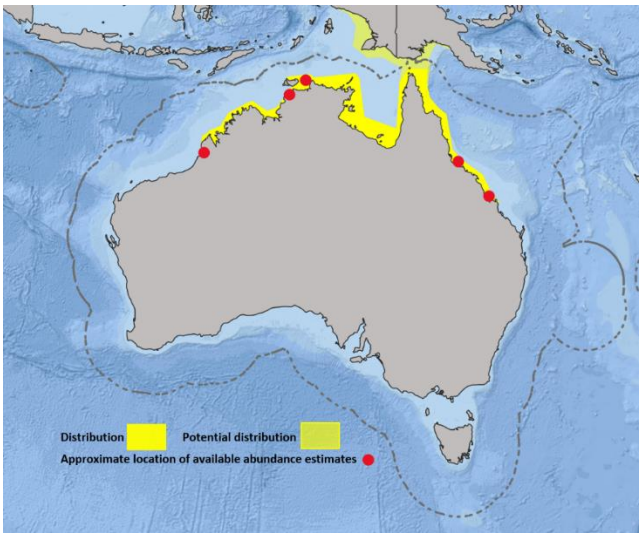

Figure 51: Recorded and potential distribution of Australian snubfin dolphins and locations where abundance estimates are available.

There is no total abundance estimate for the Australian snubfin dolphin across its range and abundance data are only available from discrete areas with localised populations. Where abundance data are available population estimates are generally fewer than 100 individuals, and corresponding estimates of N_{min} for those populations range from 44-106 individuals (Table 15).

Table 50: Estimates of abundance (N) and minimum population size (N_{min}) of snubfin dolphins in surveyed areas of Australia.

State	Location	Source	Method	Year of	N	N_{min}
WA	Cygnet Bay	Brown et al. 2016	Mark-recapture	2012-2014	54 (95% CI = 51-60)	52
WA	Roebuck Bay	Brown et al. 2016	Mark-recapture	2012-2014	48 (95% CI = 41-58)	44
NT	Port Essington	Palmer et al. 2014	Mark-recapture	2008-2010	136 (95% CI = 58-317) to 222 (95% CI = 146-336)	92
NT	Darwin	Brookes et al.	Mark-	2011-2015	41 (SD 20)	-
QLD	Cleveland Bay	Parra et al. 2006	Mark-recapture	199-2002	64 (95% CI = 51-80) to 76 (95% CI = 65-88)	59
QLD	Keppel Bay	Cagnazzi et al 2013	Mark-recapture	2006-2011	71 (95% CI = 61-80) to 80 (95% CI = 68-93)	67
QLD	Rodds Bay to Port Alma	Brooks et al., 2019	Unknown	Unknown	122 (CV 0.17)	106
QLD	Repulse Bay	Brooks et al., 2019	Unknown	Unknown	111 (CV 0.21)	93

False killer whale (*Pseudorca crassidens*)

False killer whales are widely distributed in the Atlantic, Pacific and Indian Oceans from warm temperate to tropical waters, with highest densities in tropical waters (Baird, 2018a) (Figure 15). The species is listed as a Cetacean under the EPBC Act, Rare in South Australia under the *National Parks and Wildlife Act 1972* and Near Threatened under the IUCN Red List of Threatened Species (Baird, 2018a). The global estimate for false killer whales is around 60,000 individuals, but most available abundance data is more than 25 years old, and there are no estimates for most of the species' distribution, so the actual abundance is likely much higher (Baird, 2018).

The distribution of false killer whales in Australian waters is not well known, but the species has been recorded in strandings from all states and the Northern Territory, and has been reported from Cocos (Keeling) Islands and Scott Reef (Woinarski et al., 2014). Although generally considered oceanic, there are locations where distinct subpopulations utilise both shallow and deep waters either seasonally, or throughout the year (Baird, 2018b; Zaeschmar et al., 2014).

Four individual false killer whales that were satellite tagged in Couburg Northern Territory in March and April of 2014 were found to use both coastal and pelagic waters of the southwestern Arafura and eastern Timor seas during the period of seven to twelve weeks that the tags transmitted (Palmer et al., 2017). Satellite locations were received from a minimum of 0.1 km to a maximum of 188 km from the shoreline, and the four individuals spent most time in water depths of 33-40 m. The species has previously been sighted in coastal estuarine waters in the Northern Territory during the wet season (October to April) (Groom et al., 2015; Palmer et al., 2009). The utilisation of shallow continental shelf habitats by false killer whales has also been reported in north-eastern New Zealand, where resight rates of individual false killer whales along a 650km stretch of coastline over a 17 year period may indicate the occurrence of a subpopulation in the area (Zaeschmar et al., 2014). Based on genetic and ecological data it is likely that subpopulation structure occurs throughout the range of the species (Baird, 2018a). Around the Hawaiian archipelago three distinct populations, with partially overlapping ranges are recognised; two are insular around the main Hawaiian Islands and north-western Hawaiian Islands respectively, whilst the third is a pelagic population (Baird, 2018b). There is no information on population size or trends of false killer whales in Australian territorial waters.

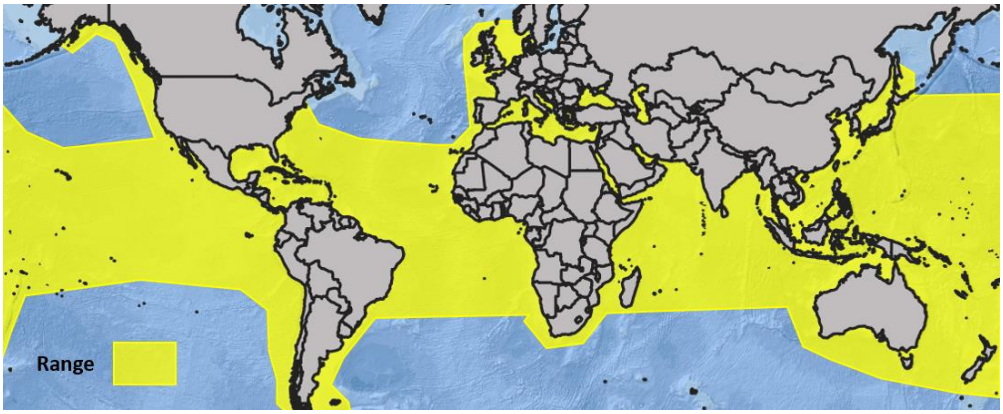

Figure 52: Global range of false killer whales.

Killer whale (*Orcinus orca*)

Killer whales have a global distribution, although densities appear to be greater in higher latitude waters compared to the tropics (Figure 16). The species is listed as a Cetacean and Migratory under the EPBC Act and Data Deficient under the IUCN Red List of Threatened Species (Reeves et al., 2017). The global estimate for killer whales in 2006 was 50,000 individuals, but is considered an underestimate as no abundance data were available for large areas of the distribution range of the species (Reeves et al., 2017). There is no information on population size or trends of killer whales in Australian waters, and the species was assessed as Data Deficient under the 'Action Plan for Australian Mammals 2012' (Woinarski et al., 2014). Killer whales have been recorded in all State and Territorial waters in Australia, at the sub-Antarctic islands of Heard Island and Macquarie Island, and in Australian Antarctic Territory waters (Kent et al., 2020; Morrice, 2004; Palmer and Chatto, 2013; Woinarski et al., 2014). Killer whales are seasonally present in the inshore waters of northwestern Australia and the waters of the Bremer basin off southwestern Australia. Records of killer whales predominantly come from strandings and incidental sightings, and limited information on spatial or temporal movements in coastal and continental shelf waters come from resights of individual whales.

Killer whales are currently considered a single species, but are grouped into ecotypes based on morphology, colour patterns, diet, and behaviour. Five killer whale morphotypes have been described in Antarctic waters, Type A, B1 and B2, C and sub-Antarctic type D (Durban et al., 2017; Pitman et al., 2011; Pitman and Ensor, 2003). Killer whale Types A, B and C have been recorded in Australian Antarctic Territory (Woinarski et al., 2014). Most killer whales sighted in temperate Australian coastal waters resemble the Type A morphotype, the Type B morphotype has been recorded off Western Australia, and the Type B and C morphotypes have been recorded off Tasmania (Donnelly et al., 2021). There is no information on population size or trends of killer whales in Australian territorial waters, however over 140 individuals have been photographed at Bremmer Canyon off the southern coast of Western Australia since 2014 (Project Orca https://www.projectorca.com.au) and 26 individuals have been identified in the northwest region. A recent genetic population structure study identified the southwest and northwest Australian killer whale groups as two separate populations (Reeves et al., 2021).

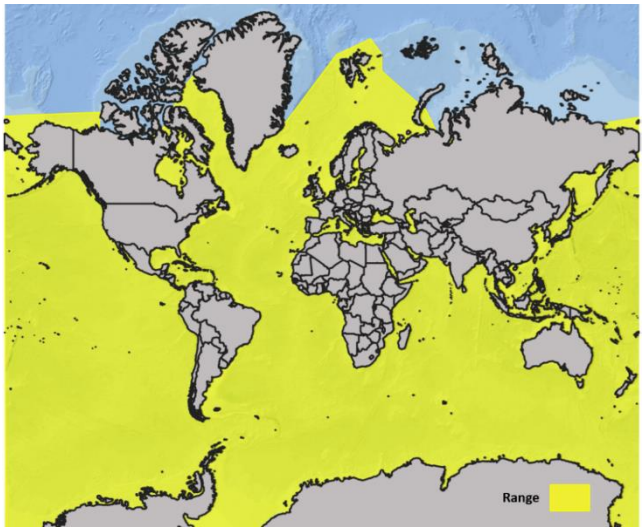

Figure 53 Global range of Killer Whales.

Long-finned pilot whale (*Globicephala melas*)

Long-finned pilot whales (*Globicephala melas*) are widely distributed in cold temperate waters of the North Atlantic and Southern Ocean (Olson, 2018). The northern and southern populations are geographically disjunct, and in the southern hemisphere, the species is distributed between around 65°-30°S (Minton et al., 2018a)(Figure 17). While abundance data are available for some areas of the species in the northern hemisphere, none exists for the southern hemisphere population. The species is listed as a Cetacean under the EPBC Act and as Least Concern under the IUCN Red List of Threatened Species (Minton et al., 2018b).

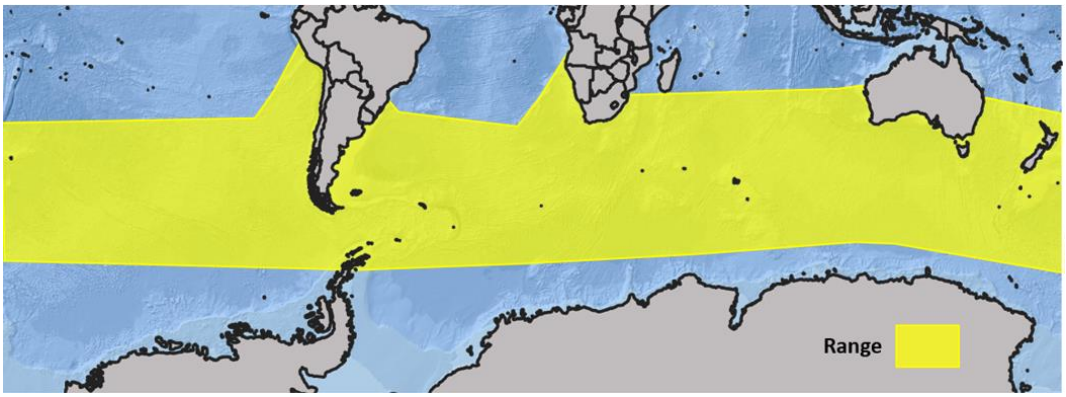

Figure 54: Global range of long-finned pilot whales.

Long-finned pilot whale distribution is associated with continental shelf and slope waters, in areas with complex bathymetry and in deep oceanic waters. They are considered nomadic, moving in response to distribution of preferred prey species (Olson 2018). Genetic differentiation in long-finned pilot whales has been found between ocean basins, and also between individuals sampled in Tasmania and New Zealand (Oremus et al., 2009). It is not clear if this differentiation reflects a separation in distribution, or population structure that is a result of maternal fidelity or habitat specialization. A recent study which correlated tooth growth chronologies and sea surface temperatures found that pilot whales that stranded in Australia had foraged in association with the subtropical and subantarctic fronts south of Tasmania, while individuals stranded in New Zealand associated with areas of seasonal enhanced productivity close to New Zealand (Hamilton et al., 2019). Published sightings of the species in Australian waters include from the Bremer Canyon region in Western Australia (Kent et al., 2020) and the slope and shelf-break off south Australia (Gill et al.,

2015; Mackay et al., 2018; MCRI, 2013). Five individuals that stranded on the north coast of Tasmania and were subsequently satellite tagged and released were found to stay within the Bass Strait region for the duration that the tags transmitted (12-32 days) (Gales et al., 2012). On the east coast of Australia, at sea identification of the species is difficult as it overlaps in range with the short-finned pilot whale.

Most information on the occurrence of the species in Australian waters is predominantly from stranding records in southern Australian waters (Foord et al., 2019; Groom and Coughran, 2012; Lloyd and Ross, 2015; Segawa and Kemper, 2015). The species regularly live-strands in Tasmania, with individual mass-stranding events involving over 200 individuals (Gales et al., 2012). There is no information on population size or trends of long-finned pilot whales in Australian territorial waters.

Short-finned pilot whale (*Globicephala macrorhynchus*)

The short-finned pilot whale has an extensive global distribution, in tropical, subtropical and temperate waters (Olson, 2018)(Figure 18). The global estimate of short-finned pilot whales is approximately 700,000, but is likely an underestimate as large parts of the species range have not been surveyed (Minton et al., 2018b). The species is a listed cetacean under the EPBC Act, listed as Rare in South Australia under the *National Parks and Wildlife Act 1972*, and as Least Concern under the IUCN Red List of Threatened Species (Minton et al., 2018a). In Australia, the species has been recorded from strandings in all States and the Northern Territory (Chatto and Warneke, 2000; Foord et al., 2019; Groom and Coughran, 2012; Lloyd and Ross, 2015; Segawa and Kemper, 2015). The southern range of the species in eastern Australian waters overlaps with the northern range of the long-finned pilot whale, and it can be difficult to distinguish between the two species in the field. There is no information on population size or trends of short-finned pilot whales in Australian territorial waters.

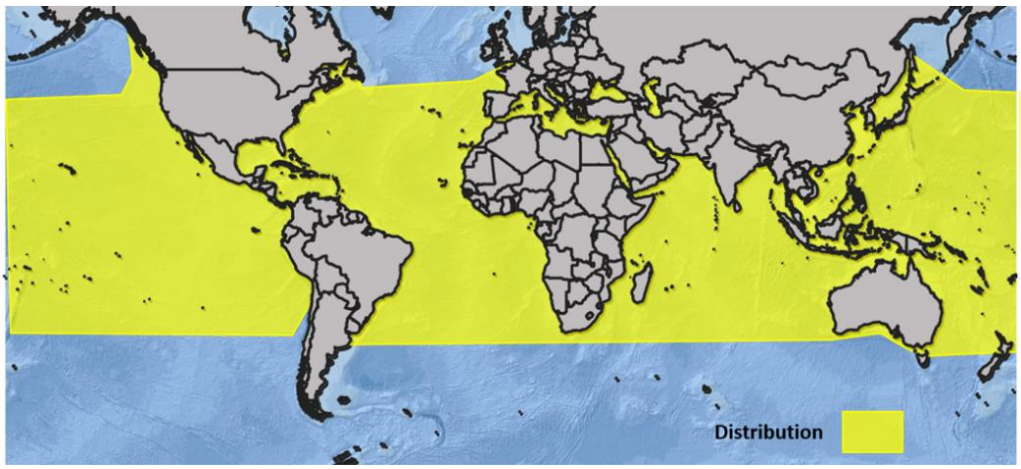

Figure 55: Global range of short-finned pilot whales.

Melon-headed whale (*Peponocephala electra*)

The melon-headed whale is distributed in tropical and sub-tropical oceanic waters (Figure 19). The species occurs in deep oceanic waters, and sightings are generally of large aggregations of hundreds of individuals (Brownell et al., 2009; Kiszka and Brownell, 2019; Perryman and Danil, 2018). Melon-headed whales can also form resident populations around oceanic islands (e.g Aschettino et al., 2012). There is a relatively high level of genetic connectivity of melon-headed whales across the three main ocean basins (Martien et al., 2017), and the global population based on available abundance estimates is around 180,000 individuals (Kiszka and Brownell, 2019). This will be an underestimate as large areas of the species range which have not been surveyed. Melon-headed

whales are listed as a Cetacean under the EPBC Act, and of Least Concern under the IUCN Red List of Threatened Species (Kiszka and Brownell, 2019).

There Is little information of the at sea distribution of the species in Australia waters, but stranding records, including mass strandings, have been recorded in Western Australia, the Northern Territory, Queensland and New South Wales (Chatto and Warneke, 2000; Groom and Coughran, 2012; Kiszka and Brownell, 2019; Lloyd and Ross, 2015; Meager and Sumpton, 2016). There is no information on population size or trends of melon-headed whales in Australian territorial waters.

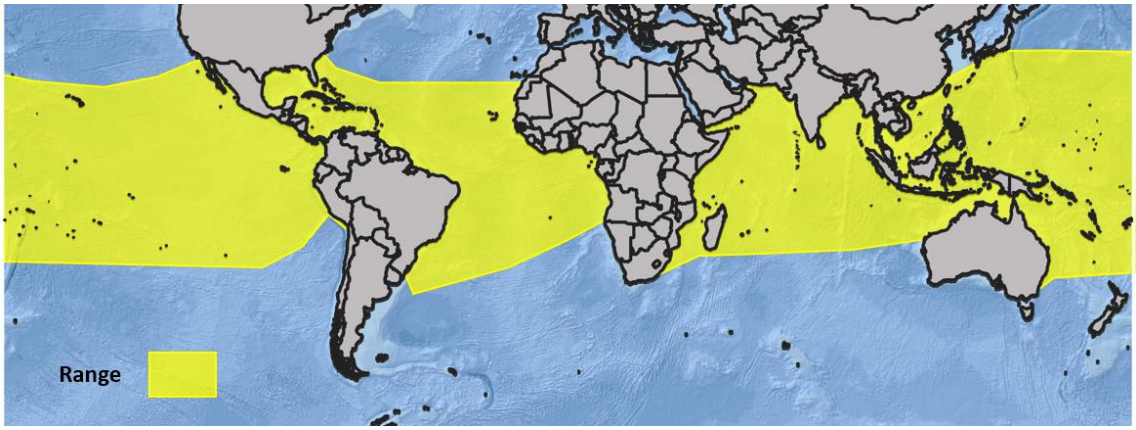

Figure 56: Global range of melon-headed whales.

Sperm whale (Physeter macrocephalus)

Sperm whales are widely distributed throughout the ocean from the tropics to high latitude waters and are generally associated with deep water or along continental slopes (Figure 20). They have been recorded in all Australian Commonwealth waters and in Australian Antarctic Territory waters (Carroll et al., 2014; Gedamke and Robinson, 2010; Gill et al., 2015; Johnson et al., 2016; Kent et al., 2020; Lloyd and Ross, 2015; Mackay et al., 2018). Sperm whales were heavily exploited by global whaling operations, and an estimated 406,535 were killed in the Southern Hemisphere in the 1900s during the 'modern' whaling period (Clapham and Baker, 2018). By 2002, global sperm whale populations were estimated to be only 32% of their pre-whaling levels (Whitehead, 2002). The most recent global estimate from 2002 was around 360,000 individuals (CV=0.36) (Whitehead, 2002). The species is listed as a Cetacean and Migratory under the EPBC Act, Vulnerable in New South Wales under the *Biodiversity Conservation Act 2016*, Rare in South Australia under the *National Parks and Wildlife Act 1972*, Vulnerable in Western Australia under the *Biodiversity Conservation Act 2016*, and is listed as Vulnerable under the IUCN Red List of Threatened Species (Taylor et al., 2019). There is little evidence of population recovery of the species since the cessation of whaling.

In Australian waters, sperm whales were hunted during two distinct whaling periods: open boat whaling (1761-1920) and "modern" mechanised industrial whaling (1936-1979). By the 1970's declines in large males were recorded from aerial surveys off Albany, Western Australia, that were conducted to direct whaling boats to whales. A recent aerial survey off Albany, compared sperm whale bull sighting rates to those recorded by commercial whaling aerial spotting rates before whaling ceased, and found no evidence of population recovery (Carroll et al. 2014).

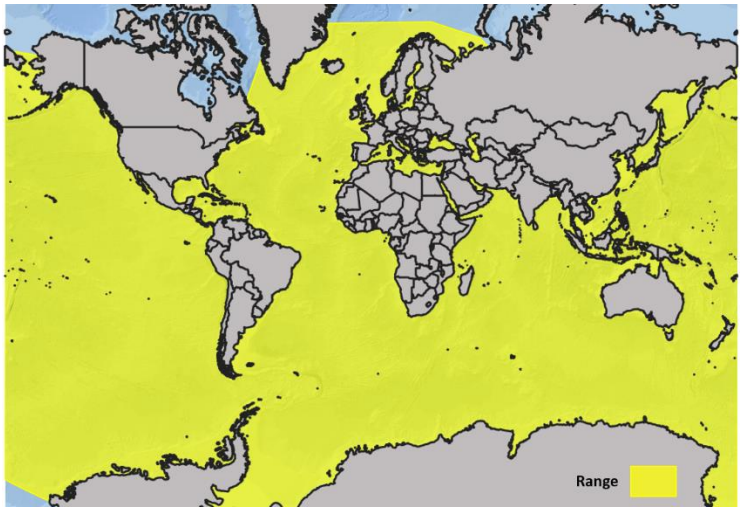

Figure 57: Global range of sperm whales. Limited density data have been obtained for the area off Albany, Western Australia (Johnson et al., 2016), and for the central Great Australian Bight along the shelf and shelf-break to the Bonney Coast (Gill et al., 2015; Mackay et al., 2018; MCRI, 2013). The acoustic density of sperm whales from surveys in the eastern Australian Bight shelf break ranged from 0.21 individuals per 1,000 km^2 (Mackay et al. 2018) to 0.35 individuals per 1,000 km^2, (MCRI, 2013). Aerial survey sighting rates of 0.31 to 0.62 individuals per 1,000 km were recorded along the Bonney Upwelling Coast during upwelling seasons between 2002 and 2013 (Gill et al., 2015). Acoustic densities of sperm whales in other locations where the species appears to be present throughout the year include 0.16 individuals per 1,000 km^2 in the Tongue of the Ocean, Bahamas (Ward et al., 2012), and 0.6-12.1 individuals per 1,000 km^2 in the northern Gulf of Mexico (Hildebrand et al., 2012). There is no information on the abundance of population trends of sperm whales in Australian territorial waters.

Dugong (*Dugong dugon*)

Dugong (*Dugong dugon*) are distributed between around 27˚N and 27˚S of the equator in warm shallow to medium depth coastal waters that support seagrass beds (Marsh, 2018; Marsh and Sobtzick, 2019). Within Australian waters, the species is distributed from Shark Bay in Western Australia, east across the Northern Territory, to Moreton Bay in southern Queensland (Figure 21). The dugong population in Australian waters represents a significant portion of the global population, and while there is no total population estimate, abundance estimates are available from key areas of the species distribution in Australia.

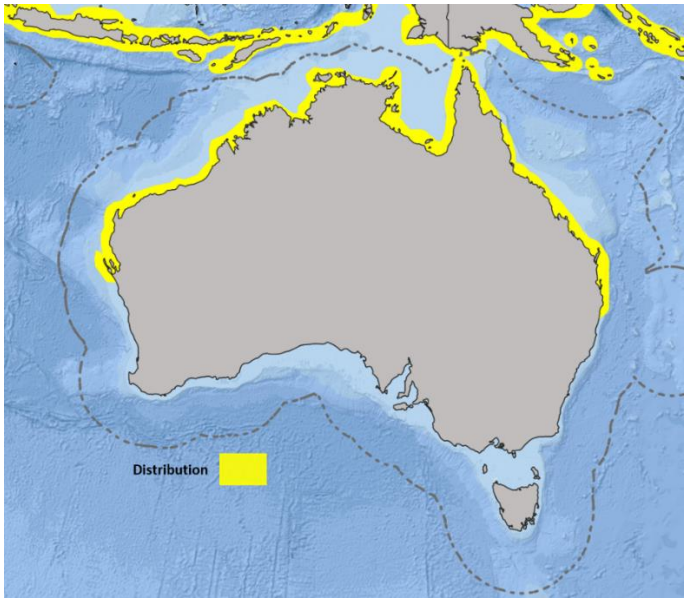

Figure 58: Distribution of dugong. The sum of most recent abundance estimates for dugong in Australian waters and the Torres Strait produces a population size of >150,000 individuals (Table 16). The density of dugong in the waters of the Torres Strait, where a traditional harvest occurs, has been stable over the last 30 years (Marsh et al., 2015), with the most recent abundance, estimated to be 102,519 (SE ± 20,146) dugong in 2013 (Hagihara et al., 2016). Estimated abundance of dugong in the Northern Territory's Gulf of Carpentaria region was 5,877 (±768) in 2014 (R.A. Groom et al., 2015). Recent genetic evidence suggests there are at least two stocks of dugong on the east coast of Queensland with a genetic break around the region of the Whitsunday Islands (Marsh et al., 2019). The most recent abundance estimates for these two regions are 2,822 (SE ± 600) dugong in the southern Great Barrier Reef and 6,558 (SE ± 1141) dugong in the northern Great Barrier Reef (Marsh et al., 2019). The abundance of dugong in the southern Great Barrier reef was estimated to have declined by 1.46% per annum between 2005 and 2016 and by 3.14% per annum between 2006 and 2013 in the northern Great Barrier Reef, with these declines thought to be due to seagrass habitat loss as a result of severe weather events (Marsh et al., 2019). The most recent abundance estimate for dugong from aerial surveys undertaken in June 2018 in Shark Bay and the Exmouth Gulf and Ningaloo regions were 18,555 (±3,396) individuals and 4,831 (±1,965) individuals respectively (Bayliss et al. 2018, cited in Bayliss et al., 2019). Provisional estimates of dugong abundance in the Kimberley region from surveys undertaken over an area of ~33,000 km^2 in 2015 are 11,839 individuals (±1,391) (Bayliss et al., 2015).

Table 51: Abundance (N) and minimum population size (N_{min}) of dugong for surveyed areas in Australia and the Torres Strait.

Area /	Area surveyed	Source	Year	N	N_{min}
Torres	Torres Strait	Hagihara et al., 2016	2013	102,519	86773
NT	Gulf of Carpentaria	Groom et al. 2015	2014	5,877	5270
QLD	Northern Great Barrier Reef	Marsh et al. 2019	2019	6,558	5689
QLD	Southern Great Barrier Reef	Marsh et al. 2019	2019	2,822	2369
WA	Shark Bay	Bayliss et al. 2019	2018	18,555	15965
WA	Exmouth Gulf	Bayliss et al. 2019	2018	4,831	3467
WA	Kimberly	Bayliss et al. 2015	2015	11,839	10705

Summary

The objective of the first stage of the project was to determine what abundance data are available for 20 marine mammal species that occur in Australian Territorial Waters. The list of marine mammal species assessed for the project was provided by the Australian Department of Agriculture, Water and Environment (DAWE). This information is required by the Department of Agriculture, Water and Environment (DAWE) as part of the application for a 'comparability finding' by Australian fisheries that want to export product to the United States (US) under the US Marine Mammal Protection Act (MMPA).

Abundance data are required to estimate limits to marine mammal bycatch using Potential Biological Removal (PBR), which is part of a formalised legal framework under the US MMPA. This legal framework requires that abundance estimates used to calculate minimum population size (N_{min}) are less than eight years old (National Marine Fisheries Service, 2016). The Australian Government does not use PBR as a means of estimating limits to marine mammal bycatch, and there is no legislative requirement to estimate abundance of marine mammals in Australia or its external territories. As a result, the amount and quality of abundance data varied greatly for the 20 species considered by the project.

The most comprehensive data available on abundance, growth rates and populations trends were for the seven pinniped species and two baleen whale species considered by the project. Abundance data for small cetaceans were generally only available from discrete survey areas, and no abundance data were available for five of the cetacean species considered.

For the three pinniped species that breed at colonies off the coast of Australia (Australian sea lion, New Zealand fur seal and Australian fur seal), recent abundance data were available to calculate minimum populations size. For these three pinniped species N_{min} is calculated by applying a multiplier to estimates of pup production and can include a correction factor to account for pup mortality. Precision in estimates of pup abundance will be affected by survey method, colony size and pup availability for sighting. Using a single correction factor for pup mortality means that variability in mortality rates both between colonies and breeding seasons is not accounted for, and multipliers from pups to total population size are reliant of life history tables reflect the population trend (e.g. stable, increasing or decreasing). Ongoing declines have been recorded across Australian sea lion colonies, with an estimated 64% decline in pup production over three generations (42.3 years) (Goldsworthy et al., 2021). The unique 18-month breeding cycle of the species and evidence that mature females do not produce pups every breeding season means inherent maximum population growth rates in the species will be lower than default values used for pinniped species that breed annually.

The abundance data used to calculate minimum population size for Crabeater and Antarctic fur seals are 20 and 17 years old respectively, and eight years old for both Subantarctic fur seals and Southern Elephant Seals. Given the age of these abundance estimates, the N_{min} for these four species would be considered unknown under the US MMPA. Within the Australian External Territories, 'populations' of Antarctic and Subantarctic fur seals represent ~0.1% to 1% of the global population, respectively. Crabeater Seals represent 12% of the global population, and Southern Elephant Seals at Heard Island represent 28% of the Kerguelen Stock, while those breeding at Macquarie Island represent 99.8% of the Macquarie Stock. There is no ongoing monitoring of the abundance or population trends of any of these four species in Australian waters.

A minimum population estimate was calculated for the two humpback whale stocks that are seasonally present in Australian coastal waters: Stock D which migrates along the coast of Western

Australia, and Stock E1 which migrates along the east coast. The N_{min} for Stock D was based on an abundance estimate that is 12 years old, and one that is considered to have low precision, as this stock is difficult to survey accurately due to the wide migratory corridor individuals use when travelling north and south along the coast of Western Australia. The estimated annual population growth rate for the stock is between 9.7% and 13%. Currently there is no program to collect a robust abundance estimate for Stock D. The minimum population estimate calculated for Stock E1 was based on an abundance estimate from 2015. Annual population growth rate for this stock has been estimated to be between 10.6% and 11%. It has been proposed that the high rate of growth observed in Stock D may partially be due to temporary immigration of whales from other populations in Oceania (Clapham and Zerbini, 2015).

Southern right whales that calve and aggregate in Australian coastal waters are considered as two subpopulations under the Conservation Management plan for the species (DSEWPaC, 2012). The minimum population estimate for the southeast Australia (SEA) subpopulation, which is increasing at ~4% per annum was 183 individuals, while for the southwest Australia (SWA) subpopulation which is increasing at ~6% per annum, is 2,553 individuals. An ongoing project funded by the National Environmental Science Program will provide an abundance estimate of the total population of southern right whales in Australia using photo-ID in the Australasian Right Whale Photo-identification Catalogue (ARWPIC). The project will also investigate the spatial connectivity of whales utilising different calving and aggregation areas and assess the degree of connectedness between the SWA and SEA populations.

Abundance data were only available for five of the odontocete species considered, and only then for discrete areas of the species' ranges. No abundance data were available for the remaining five odontocete species.

Two species of bottlenose dolphin (common bottlenose dolphins and Indo-Pacific bottlenose dolphins) occur in Australian waters. Determining the distribution of each species is complicated by the fact that they can occur sympatrically, and identification in the field is difficult, with genetic data needed to correctly identify species.

A single abundance estimate is available for common bottlenose dolphins from an aerial survey conducted to calculate the abundance of bottlenose dolphin in the area of the Pilbara Trawl Fishery, which operates in shelf waters of Western Australia (Allen et al. 2017). The minimum population estimate calculated using this data represents a small spatial area of the potential distribution of common bottlenose dolphins in Australian waters, and it is not possible to determine if the abundance estimate represents a 'stock' or if the area surveyed is a small proportion of a more widely distributed pelagic population.

Most available robust abundance data for Indo-Pacific bottlenose dolphins were from spatially restricted areas where dolphins exhibit some degree of residency. Many estimates were greater than eight years old. Abundance estimates ranged from the tens to the hundreds, or thousands. Seasonal variation in dolphin abundance in a number of locations indicate survey areas did not cover the range of the species. There is evidence of fine-scale population structure among Indo-Pacific bottlenose dolphins within regions. In the southern Australian region, there is unresolved taxonomy of the genus, with a third species, the Burrunan dolphin or Southern Australian dolphin described species from inshore waters in Victoria and South Australia (Charlton- Robb et al. 2011). The taxonomic status of this proposed species has not been accepted (Committee on Taxonomy, 2020).

Common dolphins are widely distributed in Australian waters and have been recorded in all States. Indian Ocean long-beaked common dolphins have been recorded at the external Australian territories of Cocos (Keeling) and Christmas Islands, but are no longer considered a separate species and are now a subspecies of *D. delphis*. Although widely distributed in shelf and pelagic Australian

waters, abundance data are only available for a small portion of the species' likely range, and only for waters out to the 100m contour. A recent study that investigated genetic structure in common dolphins across Australasia found three distinct regional populations; the southern coast of Australia, the eastern coast of Australia, and New Zealand and Tasmania (Barceló et al., 2021). Within Australian waters a minimum of eight Management Units (MUs) of common dolphin have been proposed along the southern and eastern Australian coasts, between Albany in Western Australia and Ballina in New South Wales based on genetic analyses (Bilgmann et al. 2014, Möller et al. 2011). However, it is unclear how much spatial or genetic mixing occurs between common dolphin in southern Australia, or if the population sub-structuring described would lead these MUs to be considered separate 'stocks' under the MMPA. Abundance data from the Gulfs and Investigator Strait in South Australia is now more than eight years old, although another aerial survey in a similar region is planned for 2021.

Abundance data for the humpback dolphin and snubfin dolphin are only available for discrete areas where surveys have occurred. Parra and Cagnazzi (2016) estimated the total abundance of mature Australian humpback dolphins to be fewer than 10,000 individuals, and estimated N_{min} for those locations where abundance data were available ranged from tens to low hundred individuals. There is no information on the overall population trend for the species. For the snubfin dolphin, where abundance data are available population estimates are fewer than 150 individuals, and corresponding estimates of N_{min} for those populations range from 44-92 individuals.

There is no information on the status, population trends or abundance of killer Whales, long-finned pilot Whales, short-finned pilot whales, melon-headed whales or sperm whales in Australian Territorial waters.

The sum of most recent abundance estimates for dugong in Australian waters and the Torres Strait produces a population size of >150,000 individuals (Table 16). The density of dugong in the waters of the Torres Strait, where a traditional harvest occurs, has been stable over the last 30 years (Marsh et al., 2015), whilst declines in abundance have been recorded in the southern and northern Great Barrier Reef. The drivers of these declines are thought to be due to seagrass habitat loss as a result of severe weather events (Marsh et al., 2019).

The results of this data synthesis confirm the paucity of recent abundance data for most of the 20 marine mammal species considered by the project. Where abundance data are available, most estimates are now greater than eight years old and there is no future monitoring planned. Robust abundance data are costly to collect, but where species have formally been identified as at high risk, e.g. Australian sea lion, such data are needed to ensure performance criteria and management goals are met.

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