



Environment Protection and Biodiversity Conservation (National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)) Instrument 2024

I, Tanya Plibersek, the Minister for the Environment and Water, make the National Recovery Plan for the Southern Right Whale (*Eubalaena australis*) in the following instrument, jointly with Queensland, South Australia, Tasmania, Victoria and Western Australia

Dated 05.07.2024

Tanya Plibersek
Minister for the Environment and Water

1 Name

This instrument is the *Environment Protection and Biodiversity Conservation (National Recovery Plan for the Southern Right Whale (Eubalaena australis)) Instrument 2024*.

2 Commencement

This instrument commences on the day after it is registered.

3 Authority

This instrument is made under subsection 269A(3) of the *Environment Protection and Biodiversity Conservation Act 1999*.

4 Jointly made recovery plan

The National Recovery Plan for the Southern Right Whale (*Eubalaena australis*) in this instrument is jointly made with Queensland, South Australia, Tasmania, Victoria and Western Australia, as agreed by the following State Ministers:

- (a) the Minister for the Environment and the Great Barrier Reef; Minister for Science and Innovation (Queensland);
- (b) the Minister for Climate, Environment and Water; Minister for Defence and Space Industries; Minister for Industry, Innovation and Science (South Australia);
- (a) the Minister for Energy and Renewables; Minister for Parks and Environment (Tasmania);
- (b) the Minister for Environment; Minister for Tourism, Sport and Major Events; Minister for Outdoor Recreation (Victoria).
- (c) the Minister for Energy; Environment; Climate Action (Western Australia).



Australian Government
Department of Climate Change, Energy,
the Environment and Water

National Recovery Plan for the Southern Right Whale

Eubalaena australis



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We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment, and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

Image credits

Cover page: Southern right whales (*Eubalaena australis*) along the southern coast of Australia. Photo © Joshua Smith

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Glossary

Term	Definition
Action	An 'Action' is defined broadly in the EPBC Act and includes: a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. Actions encompass site preparation and construction, operation and maintenance, and closure and completion stages of a project, as well as alterations or modifications to existing infrastructure.
Adaptive management	A systematic process for continually improving management practices through learning from the outcomes of previous management. It includes a monitoring, evaluation, reporting and improvement cycle.
Aggregation	A distinctly clumped or clustered pattern in the distribution of animals.
Auditory impairment	A form of noise induced hearing loss where a temporary or permanent reduction in the hearing sensitivity of an individual due to noise exposure affects the ability to hear and discriminate sounds.
Biologically Important Area (BIA)	Spatially and temporally defined areas of the marine environment used by protected species for carrying out critical life functions. These are areas known, or likely, to be regularly or repeatedly used by individuals or aggregations of a species, stock, or population for reproduction, feeding, migration or resting.
Biologically important behaviour	Behaviour associated with critical life functions (e.g., reproduction, foraging, migration, resting).
Cumulative effects	An incremental effect of an action when added to other past, present, and reasonably foreseeable future actions that results in a greater combined effect.
Cumulative exposure	The combined exposure to one stressor from multiple sources or pathways.
Cumulative risk	The combined risk from exposures to multiple stressors integrated over a defined relevant period (e.g., hours, a day or season).
Demography	The study of the characteristics of populations to assess status and extinction risk by measuring and quantifying standardized metrics common to all populations, such as size, density, fecundity, mortality, sex ratio, and age structure.
Disturbance	Behavioural changes in response to an activity that can result in disruption to biologically important behaviours (i.e., reproduction, foraging, migration, resting).
Effect	Change caused by an exposure to an anthropogenic activity that is a departure from a prior baseline state, condition, or situation.
Habitat critical to the survival (HCTS)	Areas that are necessary to a species: for activities including foraging, breeding, roosting, or dispersal; for the long-term maintenance of the

	species or ecological community; to maintain genetic diversity and long-term evolutionary development; for the reintroduction of populations or recovery of the species or ecological community.
Historic high use area	Areas where intensive and sustained shore-based whaling effort occurred (based on years of operation and number of stations) spanning at least two calving cycles (i.e., 6 years) and southern right whales occupied the area.
Impact	A biologically significant effect that reflects a change whose direction, magnitude and/or duration is sufficient to have consequences for the fitness of individuals or populations. The likelihood of an activity having a significant impact is assessed under the <i>EPBC Act Policy Statement 1.1 Significant Impact Guidelines - Matters of National Environmental Significance 2013</i> .
Injury	Physical harm or damage inflicted on the body of a whale. Evidence of injury could include bleeding, lacerations, loss or inability to use an appendage, and inhibition of sensory (e.g., auditory) capabilities.
Migration area	Areas known or likely to be regularly or repeatedly used by individuals or aggregations of a species for undertaking seasonal or other similar temporal scale movements which contribute to connectivity with other functionally important areas. This can include movement from foraging areas to breeding areas and coastal movement of whales in coastal connecting habitat between reproductive areas.
Occurrence (of a species)	The overall presence of a species in an area.
Offset	A measure that compensates for the residual impacts of an action on the environment, after avoidance and mitigation measures are taken.
Population	An occurrence of the species or community in a particular area. Occurrence includes, but is not limited to, a geographically distinct regional population or collection of local populations, or a population or collection of local populations that occurs within a particular bioregion.
Precautionary principle	The precautionary principle is one of the principles of ecologically sustainable development outlined in subsection 3A(a) and section 391 of the EPBC Act, which states: 'that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent environmental degradation where there are threats of serious or irreversible environmental damage'.
Principles of ecologically sustainable development (ESD)	Defined as five principles at section 3A of the EPBC Act.
Protected species	Species listed under the EPBC Act as threatened (Critically Endangered, Endangered, Vulnerable, Conservation Dependent), Migratory, or Cetaceans.
Recovery Plan	The purpose of a Recovery Plan is to ensure the protection, conservation, and management of listed threatened species or ecological community. A Recovery Plan is developed in accordance with

	<p>Part 13 s269A and s270 of the EPBC Act, and it is a legal requirement to 'not act inconsistently' with the objectives and specific actions outlined in the Recovery Plan.</p>
Recovery Plan actions	<p>Specific actions designed to deliver tangible results against Recovery Plan objectives to minimise anthropogenic threats and allow for the conservation status of the southern right whale to improve, so that the species is removed from the EPBC Act threatened species listing.</p>
Reproductive area	<p>Areas known or likely to be regularly or repeatedly used by individuals or aggregations of a species for reproduction (including courtship, mating, egg laying, hatching, pupping, birthing, nursing or accompanied by a dependent young), or to provide refuge or other advantage to young.</p>
Stressor	<p>Any physical, chemical, or biotic entity that moves a biological system out of its normal operating range. The term stressor is synonymous with the term threat and relates to phenomenon or activities such as climate change, vessel strike or underwater noise.</p>

Acronyms

Term	Definition
ATCM	Antarctic Treaty Consultative Meetings
BIA	Biologically Important Area
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CMP	Conservation Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
ESD	Ecologically Sustainable Development
HCTS	Habitat Critical to the Survival
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
MNES	Matters of National Environmental Significance
NSW	New South Wales
QLD	Queensland
SA	South Australia
TAS	Tasmania
VIC	Victoria
WA	Western Australia

Executive Summary

Southern right whale (*Eubalaena australis*)

The purpose of this Recovery Plan is to set out the objectives, targets, and management and research actions necessary to minimise anthropogenic threats to facilitate recovery of the southern right whale and allow their conservation status to improve so they can be removed from the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Recovery Plan is developed in accordance with Part 13, Division 5 of the EPBC Act.

Status of taxon

Commonwealth legislation:

- *Environment Protection and Biodiversity Conservation Act 1999*: Endangered

State legislation:

- New South Wales *Biodiversity Conservation Act 2016*: Endangered
- Victoria *Flora and Fauna Guarantee Act 1988*: Endangered
- Tasmania *Threatened Species Protection Act 1995*: Endangered
- South Australia *National Parks and Wildlife Act 1972*: Vulnerable
- Western Australia *Biodiversity Conservation Act 2016*: Vulnerable
- Queensland *Nature Conservation Act 1992*: Least Concern

Assessment under the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species:

- *International Union for the Conservation of Nature Red List 2017*: Least Concern

Description, biology, distribution, and habitat

The southern right whale is listed as *Endangered* under the EPBC Act because population numbers have been severely reduced by historical commercial whaling. The origin of the name 'right whale' comes from recognition by whalers that the species was the 'right' whale to hunt due to the high oil content of their blubber and because it was easy to catch and process due to its nearshore migratory routes, slow swimming behaviour, and it floated when killed. Consequently, right whales were hunted to the brink of extinction throughout their range (Kenney 2018).

Southern right whales are large, baleen whales (Order Cetacea, Family Balaenidae), characterised by the lack of a dorsal fin, a distinctly 'V' shaped blow, and the presence of cornified skin growths on the head known as callosities (Kenney 2018). Southern right whales reach a maximum length of approximately 16 m and a weight of around 40 t, with mature females slightly larger than males and southern right whales smaller than northern hemisphere right whales (Jefferson et al. 2015, Christiansen et al. 2019). Contemporary body length data from the Head of Bight in South Australia, suggests southern right whale females (lactating

females) range between 13.0 and 14.9 m (mean = 14.2 m) and predicted calf body lengths at birth between 4.8 and 5.7 m (mean = 5.3 m) (Christiansen et al. 2018).

Two populations of southern right whale occur in Australian waters: the western and eastern. The two populations are defined by differences in mitochondrial DNA (Carroll et al. 2011, Carroll et al. 2015, Carroll et al. 2019), geographical ranges, historic whaling pressures, and varying rates of population increase (Stamation et al. 2020, Smith et al. 2022). Southern right whales occur seasonally in all state coastal waters, with sightings ranging from Hervey Bay in Queensland on the east coast, along the entire southern coastline and including Tasmania, to Exmouth Gulf in Western Australia (Smith et al. 2024). While the geographical boundary between the eastern and western Australian populations is unclear, for management purposes the western population includes Western Australia and South Australia waters west of Ceduna, whereas the eastern population comprises the coastal waters east of Ceduna in South Australia, Victoria, Tasmania, New South Wales, and Queensland. Southern right whales in Australian waters predominantly occur in aggregations in coastal water reproductive areas where they calve and nurse their young from May to October, primarily occupying shallow waters (< 10m depth) within 1 km of the coastline (Charlton et al. 2019, Smith et al. 2022).

There is evidence of a population increase of the western population where a regular annual census occurs, whereas there is greater uncertainty of the population status and trends of the eastern population. Current southern right whale abundance in Australian waters is still well below estimated historic abundance (< 20 percent), particularly for the eastern population. Recent estimates of the population size in Australia for the western population is around 3,200 individuals (~5.5 - 6.2 percent increase per annum (p.a.) for mother-calf pairs) and 268 individuals (4.7 percent increase p.a. for mother-calf pairs) for the eastern population (Stamation et al. 2020, Smith et al. 2022). Habitat occupancy is still constrained in comparison to historical occupancy, and knowledge about habitat use in both populations is limited.

Threats

The life history traits of southern right whales, which include a long-life span, low reproductive output, late sexual maturity, and strong fidelity to calving areas, make them vulnerable to anthropogenic threats. These life history traits mean that any long-term response to disturbance and impacts from threats that may affect recovery are unlikely to be detectable, or even reliably identified to a specific threat, over short timescales (i.e., 1 to 3 years). Consequently, long-term monitoring is required for effective management and assessment of the recovery of southern right whales.

Threats to southern right whales were assessed through a risk assessment process (section 3.11) and the highest rated threats (i.e., 'High' and 'Very high' rating) were identified. These are anthropogenic climate change and climate variability; entanglement in fishing and aquaculture equipment; habitat degradation from coastal and offshore development; anthropogenic underwater noise; vessel collision; whaling (if resumed at any time); and prey depletion from overfishing. The degree and associated level of risk to which these threats may impact southern right whales varies between the western and eastern population, given their different population sizes, varied rate of recovery, and differing levels of exposure to anthropogenic pressures.

Southern right whales are capital breeders, whereby they accumulate and store sufficient energy reserves on the foraging grounds to meet the cost of growth, maintenance, locomotion and reproduction in the breeding grounds (Jönsson 1997). Energy demands are greatest for breeding females due to the cost associated with gestation and lactation, and they require larger energy stores than males and non-pregnant females.

In Australian coastal waters, southern right whales are typically engaged in reproductive behaviours and do not feed, such that their energy stores decline. Environmental and anthropogenic stressors may further compound the energetic stress and reduced body condition of the whales (Christiansen et al. 2020). Consequently, it is important to protect the biologically important behaviours (e.g., reproduction, foraging, migration) that southern right whales undertake, and the Biologically Important Areas (BIAs) within which they engage in these life critical functions from anthropogenic threats and stressors.

Recovery Plan vision and objectives

Long-term vision

The long-term vision for the recovery of the southern right whale is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.

Due to intense historical exploitation of southern right whales and the species' life history characteristics, any population recovery to, or near, pre-exploitation levels will likely be a long process (i.e., multi-decadal). Consequently, achieving the long-term vision for southern right whales utilising Australian waters is also likely to occur over this timeframe.

Interim recovery objectives

Recognising the multi-decadal period over which the recovery of southern right whales is likely to occur, the following interim recovery objectives have been set for a shorter period relevant to the species (e.g., 10 years).

Interim objective 1: Current levels of Commonwealth and State legislative and management protection for southern right whales are implemented, maintained, or improved, so threats continue to be managed and reduced over the life of the plan.

Interim objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales.

Interim objective 3: Population dynamics, including demographics, distribution, residency, and coastal movement across the species range are monitored and quantified using robust, standardised, best-practice methodology to assess population recovery.

Interim objective 4: The population structure of southern right whales in Australian waters is clearly characterised, including the level of interchange of individuals among coastal reproductive areas, to evaluate the degree to which the western and eastern populations are separate populations and inform the degree of connectivity with other southern right whale populations (e.g., New Zealand).

Interim objective 5: Capability of First Nation Australians, research, citizen science, and general community groups is improved to assist in addressing recovery actions of southern right whales in Australia.

Recovery Plan actions

The following actions in Table 1 aim to achieve the interim recovery objectives (section 4.2) within a short-term period of ten years. Key threats to southern right whales have been identified through the risk analysis in section 3.11 and further detail on the actions designed to address the higher prioritised threats ('High' and 'Very High') are outlined in section 5. Risk assessments of threats were separately undertaken for the western and eastern populations to account for the different recovery trajectories and that identified threats may potentially impact the two populations differently.

Table 1 Summary of actions and priority ratings linked to interim recovery objectives developed to support the recovery of southern right whales.

Action	Interim objective	Priority rating	
		Western population	Eastern population
A: Assess and Address Threats			
A.1: Maintain, implement, and improve efficacy of current legislative and management protection.	1, 2	Very high	Very high
A.2: Address habitat degradation impacts from coastal and offshore marine infrastructure developments.	1, 2, 3	Very high	Very high
A.3: Understand impacts of climate variability and anthropogenic climate change on population recovery.	1, 2, 3, 4	Very high	Very high
A.4: Manage and mitigate the threat of entanglements from commercial active or discarded fishing gear.	1, 2, 3	Very high	Very high
A.5: Assess, manage, and mitigate impacts from anthropogenic noise.	1, 2, 3	Moderate	Very high
A.6: Manage, minimise, and mitigate the threat of vessel strike.	1, 2, 3	Moderate	Very high
B: Measure Recovery			
B.1: Measure and monitor population demographics and recovery.	1, 2, 3, 4, 5	Very high	Very high
B.2: Characterise population structure.	1, 2, 3, 4, 5	Very high	Very high
B.3: Determine migratory paths and offshore distribution.	1, 2, 3, 4	High	High
B.4: Improve capability of First Nation Australians, research, citizen science, and general community groups to assist management of southern right whales.	3, 4, 5	High	High

Criteria for success and performance of Recovery Plan

The Recovery Plan will be determined to be successful if by the end of the period set out for the interim recovery objectives, the following are achieved:

- The southern right whale population is demonstrated to be recovering via an effective national monitoring program across its known distribution and a sustained positive population trend is identified.
- Threats have been demonstrably reduced and effectively mitigated through the implementation of an adaptive management framework to facilitate species recovery.
- Understanding of the species' ecology has increased to a level that enables assessment of risks associated with anthropogenic threats and impacts on the species demographic parameters to be calculated. This includes an increase in knowledge of migration and movement patterns, habitat use, foraging grounds, reproductive success, and identification of habitat critical to the survival of the species (i.e., BIAs).
- National and state legislative protection is maintained and improved and efforts by all levels of government to improve the status of the southern right whale and its habitat are sustained.
- There is increased participation by Commonwealth and State government agencies, Indigenous Australians, key stakeholders and the public in monitoring and reduction of threats.
- There is an improved understanding of the cultural significance of whales (and southern right whales) to First Nation Australians and their aspirations related to monitoring, conservation, and management of southern right whales.

An interim review of progress in achieving management actions will be undertaken at a 5-year period and the performance of this Recovery Plan will be assessed at end of the interim recovery objective period. At this time, a performance rating (section 6.3) will be assigned that identifies the degree to which the interim recovery objectives, and specifically the targets, in Section 6.3 have been met. This rating will provide an indication of the degree of progress towards the long-term vision of the Recovery Plan. The Recovery Plan will be determined successful if all nine targets are met and unsuccessful if less than five targets are met or target 1.1 is not met.

1 Background and policy context

This document constitutes the National Recovery Plan for the Southern Right Whale, set out in accordance with Part 13, Division 5 of the EPBC Act. The plan considers the historical and current level of knowledge about southern right whale conservation requirements across their range and identifies the research and management actions necessary to support the species recovery to maximise their long-term survival in the wild.

This is the third Recovery Plan for southern right whales and replaces the *Conservation Management Plan for the Southern Right Whale 2011-2021 (CMP)* developed in 2013. Since the initial *Southern Right Whale Recovery Plan 2005 – 2010*, the southern right whale remains listed as Endangered under the EPBC Act, primarily due to intense historical commercial whaling that resulted in a severe reduction in population size, almost to the extent the species was extirpated in Australian waters.

1.1 Review of Conservation Management Plan 2011-2021

The Department of Agriculture, Water and the Environment (former) undertook a review of the CMP in 2022 with the support of Commonwealth and State government agencies, industry, and scientific experts. The review concluded that the previous plan resulted in progress in two main areas:

- Improved understanding of the coastal distribution and abundance of southern right whales, particularly for the western population. There is improved understanding of the abundance of the eastern population, although challenges remain with identifying the influence that varied survey effort may have on estimating the population. Continued efforts towards improved understanding of abundance and distribution of the eastern population through robust monitoring is required, and collection and analyses of genetic material from individuals are necessary for further finer scale insights into the delineation of both populations.
- Improved understanding of the offshore distribution and migratory movements, particularly via satellite tagging and associated identification of potential foraging areas. Further analyses of stable isotopes (able to be achieved through the utilisation of the same samples) and investigation of isoscapes (i.e., spatially explicit prediction of isotopic values across a landscape) in combination with past and current satellite tagging studies across the Australasian region, will provide further insights into utilisation of summer foraging areas.

The review identified that despite progress on many recovery actions, all threats and threatening processes identified in the 2011 CMP continue to either directly adversely affect or comprise a risk to the recovery of the species across its range. There is evidence of population increase of the western population, although current southern right whale abundance (both populations) is still well below estimated historic abundance and habitat occupancy is still limited to a portion of their range within well-established calving areas. Specifically, a comprehensive understanding of the population demographics, including the degree of spatial connectivity and population interchange, of southern right whales in Australian waters (and

Southern Ocean foraging grounds) limits our understanding of the impacts from threats on the species.

The seasonal spatial distribution of southern right whales in Australian waters is predominantly coastal, and the review highlighted limited understanding of the migratory paths connecting foraging grounds to coastal breeding areas. There is currently a varying degree of overlap between coastal and offshore industrial development activities, with the prospect of this overlap to increase with emerging industries such as offshore renewable energy. In association, and as coastal development expands, there is the potential for habitat degradation of BIAs, with greater risk to the eastern population.

The review identified there has been a better understanding of the correlation between climate variability and anthropogenically driven climate change and female reproductive success and recovery on their breeding grounds in regions other than Australia. This new knowledge highlights the need for long-term annual monitoring of population abundance and trend for identifying the contribution of separate potential threats to southern right whale breeding success, particularly within the context of the species non-annual calving rate. The review noted that the CMP objectives which related to threats such as anthropogenic underwater noise and entanglements had not been fully met, and nor had the plan adequately considered the effects of cumulative impacts.

The review recommended future recovery planning should prioritise actions to:

- Increase knowledge of southern right whale distribution, abundance and habitat use across the species' distribution range to inform a greater understanding of spatial and temporal recovery and improved management actions.
- Undertake studies on specific threats that quantify the degree to which the biology of southern right whales may be impacted and associated risks.
- Mitigate and manage threats to southern right whale populations across their range.
- Improve understanding and mapping of BIAs to identify habitat critical to survival of the species.
- Determine and implement an appropriate framework that addresses cumulative effects in conservation planning.

The review recommended a new Recovery Plan be made that would reflect the current knowledge accumulated during the lifetime of the CMP, prioritise research and management actions needed to monitor population recovery and better predict the risks and associated impacts from threats. The review acknowledged the complexities in ensuring ongoing recovery of southern right whale. Across the distribution of the species within Australian waters, there is a wide range of partners and management capacities, and a range of increasing marine development pressures. As such, a Recovery Plan is necessary to guide planning processes and the research required to improve understanding of the southern right whale population and inform adaptive management and programs.

1.2 Policy and management context

1.2.1 Commonwealth legislation and management arrangements

The following are Commonwealth legislation, management plans and guidelines current at the time of writing this Recovery Plan (2024) that relate to the protection of southern right whales in Australian waters. Many of these relate to the EPBC Act, which is Australia's primary environmental legislation. Policy statements and guidelines, including new legislation and guidelines, are found on the EPBC Act policy statements webpage at: <https://www.dcceew.gov.au/environment/epbc/publications>.

EPBC Regulations and Australian Whale Sanctuary

The Australian Whale Sanctuary was established under Part 13 of the EPBC Act to provide formal recognition of the high level of protection and management for cetaceans found in Australian Commonwealth waters. Within the Australian Whale Sanctuary, it is an offence to kill, injure, take, trade, keep, move, or interfere with a cetacean. The Australian Whale Sanctuary encompasses the area of the Australian Exclusive Economic Zone (EEZ) outside state waters and generally extends 200 nautical miles from the coast. It also includes waters around the Australian Antarctic Territory, and external territories including Christmas, Cocos (Keeling), Lord Howe, Norfolk, Macquarie, and Heard and McDonald Islands.

Part 8 of the EPBC Regulations makes provision for the regulation of persons within the Australian Whale Sanctuary to minimise the impact of activities on cetacean populations within the Sanctuary.

Threatened species Recovery Plans and EPBC Act cetacean permits

The southern right whale is a listed Threatened (Endangered) and Migratory species under the EPBC Act, and is afforded additional measures of protection as a Cetacean under Part 13 of the EPBC Act, such as establishment of the Australian Whale Sanctuary. Current species listings are located on the Species Profile and Threats Database, found at <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.

It is an offence to kill, injure, take, trade, keep or move listed threatened and migratory species in a Commonwealth area under Part 13 of the EPBC Act, unless the person taking the action holds a permit under the EPBC Act, or the activity is carried out in accordance with a state/territory or Commonwealth fishery plan of management accredited by the Commonwealth Minister responsible for the administration of the EPBC Act. This Recovery Plan was made under Part 13 s269 of the EPBC Act, and it is a legal requirement to 'not act inconsistently' with the objectives and specific actions outlined in the Recovery Plan.

Significant Impact Guidelines on Matters of National Environmental Significance

The *EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance 2013*, provide overarching guidance on determining whether an action is likely to have a significant impact on a listed threatened species. Under Part 3 section 18 of the EPBC Act it is an offence to undertake an action that will have a significant impact on listed threatened species unless approved by the Minister under Part 9.

Interaction between offshore seismic exploration and whales

The *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: Industry Guidelines (2008)* (*EPBC Act Policy Statement 2.1*) provides practical standards to minimise the risk of acoustic impairment to whales in vicinity of seismic survey operations. It also provides a framework and practical standards that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in BIAs (e.g., reproduction, resting areas or confined migratory routes or feeding areas) or during critical behaviours (e.g., reproduction, feeding, and resting).

Marine Bioregional Plans

Marine bioregional plans have been prepared under section 176 of the EPBC Act for the South-west, North-west, North, and Temperate East marine regions in Commonwealth waters around Australia. Each Marine Bioregional Plan describes the marine environment and conservation values of the region, identifies, and characterises the pressures affecting these conservation values, and identifies regional priorities and outlines strategies to address them. Southern right whales are identified as a regional priority in the Marine bioregional plan for the South-west Marine Region as part of this process. While not a bioregional plan, the South-east marine region profile also identifies that southern right whales are a protected species known to occur in the region.

World Heritage Areas

Australia's World Heritage Properties are protected under the EPBC Act, which ensures an assessment process for proposed actions of significant impacts on the World Heritage values of a declared world heritage property is undertaken. The southern right whale is a key listed value under Criterion (x) of the Shark Bay World Heritage Area.

Commonwealth Marine Park Management Plans

Under the EPBC Act, the Director of National Parks is responsible for managing Commonwealth marine parks. These marine parks are managed through management plans made under the EPBC Act to provide for the protection and conservation of biodiversity and other natural, cultural and heritage values of the parks. Management plans allow for management actions including control of activities through zoning prescriptions and authorisations to mitigate potential threats and protect key areas and habitats for southern right whales and other associated marine species. For example, the Marine Mammal Protection Area within the Great Australian Bight Marine Park provides additional seasonal protection for a globally important calving area for endangered southern right whales by prohibiting use of all vessels between 1 May and 31 October every year.

National Guidelines for Whale and Dolphin Watching

The *Australian National Guidelines for Whale and Dolphin Watching 2017* provide a consistent national set of guiding principles for the management of whale and dolphin watching to ensure animals are not harmed or disturbed.

National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna

The *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna 2017* provides guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna.

National Guidance on the Management of Whale and Dolphin Incidents in Australian Waters

The *National Guidance on the Management of Whale and Dolphin Incidents in Australian Waters 2017* provides a series of 'best practice' guiding principles for the management of cetacean incidents, in recognition of the fact that as cetacean populations continue to recover, incidences where cetaceans strand or become entangled are becoming more prevalent. This guidance applies to whales and dolphins in distress (i.e., sick, injured, stranded, or entangled) and addresses various factors involved in managing incidents.

National Guidelines for the Survey of Cetaceans, Marine Turtles and the Dugong

The *National Guidelines for the Survey of Cetaceans, Marine Turtles and the Dugong 2024* provides guidance and advice on best practice approaches and methods to conduct surveys of cetaceans, marine turtles (in-water) and the dugong to obtain high-quality species biology and ecology data on presence, abundance, distribution and habitat use.

Regulation of offshore energy activities

The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is responsible for the assessment and regulation of offshore petroleum and greenhouse gas activities and offshore renewable energy activities in Commonwealth waters under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGs Act) and *OPGGs (Environment) Regulations 2009* and the *Offshore Electricity Infrastructure Act 2021* (OEI Act), respectively.

NOPSEMA applies and complies with EPBC Act environmental protection responsibilities under the environmental management authorisations process endorsed by the Minister for Environment under section 146 of the EPBC Act (the Program). The OPGGS Regulations require a titleholder to have an accepted environment plan for any petroleum or greenhouse gas activity, which must demonstrate how the activity will not be inconsistent with any threatened species (e.g., southern right whale) Recovery Plan in place, and that any impacts are of an acceptable level. Under the OEI Act, NOPSEMA operates as the offshore infrastructure regulator of activities that include the construction, installation, operation, maintenance or decommissioning of offshore renewable energy infrastructure and offshore electricity transmission infrastructure as defined under the OEI Act.

Fisheries Bycatch Policy

The *Commonwealth Fisheries Bycatch Policy* aims to reduce fishing-related impacts on bycatch species by ensuring the exploitation of fisheries resources is consistent with the principles of ecologically sustainable development. The Bycatch Policy's central theme of avoiding or minimising bycatch is supported by the *Guidelines for the Implementation of the Commonwealth Fisheries Bycatch Policy 2018*.

1.2.2 State and territory legislation and management arrangements

The relevant legislation by state jurisdiction and conservation status of southern right whales under each piece of legislation are outlined in Table 2, and specific provisions for each State are provided.

Table 2 Conservation status of the southern right whale under Australian State legislation.

Jurisdiction	Legislation	Listing status
New South Wales	<i>Biodiversity Conservation Act 2016</i>	Endangered
Victoria	<i>Flora and Fauna Guarantee Act 1988</i>	Endangered
Tasmania	<i>Threatened Species Protection Act 1995</i>	Endangered
South Australia	<i>National Parks and Wildlife Act 1972</i>	Vulnerable
Western Australia	<i>Biodiversity Conservation Act 2016</i>	Vulnerable
Queensland	<i>Nature Conservation Act 1992</i>	Least Concern

New South Wales

Protection of marine mammals in NSW is legislated under the *Biodiversity Conservation Act 2016* (and Regulation 2017). Provisions of the Act and Regulation cover harming animals (s2.1), damaging habitat of threatened species (where habitat is known), dealing in animals, and providing regulations for approaching marine mammals (s2.3 to s2.7). The Regulation (under Part 2, Division 2.1) addresses whale watching and regulations on the ability to interfere, approach, operate vessels and aircraft, feed, swim with marine mammals, and marine mammals in captivity, including breeding and importing (s2.1 to 2.8).

The Act provides a mechanism that may allow for the declaration of an area to be an Area of Outstanding Biodiversity Value (s3.1 to s3.6), if that area contributes to the persistence of a threatened species, which may act as a form of marine sanctuary if declared. Furthermore, management plans for Marine Parks and Aquatic Reserves created under the *Marine Estate Management Act 2014* may allow for park or issue specific conditions (e.g., sanctuary zones, commercial activities, behaviours) for the use of Marine Parks, which advance the conservation of biological diversity.

Victoria

The *Flora and Fauna Guarantee Act 1988* and subsequent *Flora and Fauna Guarantee Amendment Act 2019* update are the primary Victorian legislation providing for conservation of threatened species and ecological communities, and the management of processes that threaten the sustainability of Victoria's native flora and fauna.

Regulatory provisions under the *Wildlife Act 1975* and *Wildlife (Marine mammals) Regulations 2019* are in place to manage interactions (human, vessel, and aircraft) with wildlife in all Victorian coastal waters. This act and associated regulations can protect southern right whales in Victorian waters through establishment of whale sanctuary zones and minimum approach

distances to whales. An exclusion zone at the known calving ground at Logan's Beach, Warrnambool (Logan's Beach Exclusion Zone), has been established by prohibiting powered vessels in the area at any time from 1 June to 31 October in any year. The *Marine and Coastal Act 2018* provides for implementation of a marine spatial planning framework for planning and managing the Victorian marine and coastal environment and development of conditions on approvals for development in the marine environment.

Tasmania

Threatened species are protected under the *Threatened Species Protection Act 1995* and *Nature Conservation Act 2002*, for which a permit is required to knowingly "take" (which includes kill, injure, catch, damage, destroy and collect), keep, trade in, or process any specimen of a listed species. Whales are also protected in Tasmanian waters under the *Whales Protection Act 1988*, which regulates human interactions with whales and dolphins.

South Australia

The South Australian Government has declared a whale sanctuary and marine park at the Head of the Great Australian Bight (Head of Bight), which is a consistent reproductive area for southern right whales. This declaration permanently excludes activities that are disruptive to habitat and/or have the potential to conflict with the whales and prohibits mining from the Conservation Zones in state waters.

Under the *National Parks and Wildlife Act (Protected Animals) Marine Mammals Regulations 2010*, the 'Encounter Bay Restricted Area' is a special purpose area and within this declared area you cannot move a vessel closer than 300 m to a whale (elsewhere in the state the approach distance is 100 m). The purpose of this restricted area is to afford greater protection for southern right whales with their calves from vessel disturbance in a portion of key nursery area.

Under the Harbors and Navigation Act Regulations 2009, the 'Victor Harbor Restriction Zone' prohibits personal watercraft and jet-ski operators from launching or operating their vessel within this zone from May 1 to September 30. The purpose of these restrictions is to minimise disturbance for whales.

Western Australia

The *Biodiversity Conservation Act 2016* and *Biodiversity Conservation Regulations 2018* provide legislative protection for biodiversity, particularly threatened species and threatened ecological communities in Western Australia. The *Biodiversity Conservation Act 2016* provides a statutory basis for the listing of threatened native species under section 19(1) of the act. The *Biodiversity and Conservation Regulations 2018* outline requirements related to interactions with marine fauna, including minimum separation distances for whales (Schedule 5) and interfering with the natural movement of marine fauna.

The WA Environmental Protection Authority is established under Part II of the *Environmental Protection Act 1986*. The Act provides for "the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing". The Department of Water and Environmental Regulation's EPA Services administers and operates under this Act and marine fauna is a key environmental factor considered by the EPA.

The objective for marine fauna is “to protect marine fauna so that biological diversity and ecological integrity are maintained”.

Queensland

The *Nature Conservation (Whales and Dolphins) Conservation Plan 1997* was repealed in 2013 and regulations to protect whales were introduced under subordinate legislation to the *Nature Conservation Act 1992 (Qld)*. The *Nature Conservation (Animals) Regulation 2020* manages vessel, aircraft, and swimmer approach distances to whales and includes provisions for increasing protection of declared temporary special marine mammals and in marine mammal special management areas.

Under the Commonwealth's *Great Barrier Reef Marine Park Regulations 2019*, there are requirements for whale and dolphin watching that relate to safe approach distances and operations around whales and dolphins, including the Whitsunday Whale Protection Area in the Whitsunday Planning Area.

1.2.3 International conventions and management arrangements

Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) - The southern right whale is protected against over-exploitation through international trade by its listing on Appendix I of CITES, as a species threatened with extinction.

Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) - Australia is the host country of the CCAMLR Secretariat and a key member in Antarctic Treaty Consultative Meetings (ATCM). Under CCAMLR, member states work to progress management of fisheries operating within the convention area (e.g., krill fishery), develop marine protected areas, and incorporate information on the ecology of marine living resources, including cetaceans, into scientific advice and conservation measures.

International Convention for the Regulation of Whaling (ICRW) - In 1931, right whales were the first of the great whales to be granted international protection under the *Covenant of the League of Nations* intended to take effect in 1935, and then protected under the International Whaling Commission (IWC) from its inception in 1946. Australia was a founding member of the IWC in 1948. All whales are protected from commercial whaling by the convention through the moratorium on commercial whaling introduced by the IWC in 1982 and implemented in 1986. Whales are also protected in IWC sanctuaries, including the Indian Ocean Sanctuary established in 1979, and the Southern Ocean Sanctuary established in 1994. Australia contributes to various IWC Committees, including the Conservation and Scientific Committees, the Working Group on Conservation Management Plans, the Ship Strike Working Group, and is a research partner of the IWC Southern Ocean Research Partnership (IWC-SORP), and within this partnership contributes to ‘*The right sentinel for climate change research theme*’.

Convention on the Conservation of Migratory Species of Wild Animals (CMS) – Australia became a party to the United Nations *Convention on the Conservation of Migratory Species of Wild Animals* in 1991. The convention promotes co-operation between countries in identifying, understanding, and conserving endangered and threatened migratory species and their habitats.

The southern right whale is provided a degree of international protection through its listing on Appendix I of the convention. Under the auspices of the CMS, a multi-lateral environment

Memorandum of Understanding for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (the Pacific Cetaceans MoU), to which Australia has signed, came into effect in 2006. Through this MoU, 15 states within the Pacific Islands seek to foster cooperation, build capacity, and ensure coordinated region-wide conservation for cetaceans and their habitats through this the Pacific Islands region. It also seeks to safeguard the cultural values cetaceans have for the people of the Pacific Islands.

United Nations Convention on Biological Diversity (UN CBD) – Australia is a party to the convention first developed at the 1992 Rio Earth Summit. The objectives of the convention are to conserve biological diversity and promote sustainable development. To meet the international obligations of this treaty the Australian Government undertakes to develop national biodiversity strategies and action plans that enable ecologically sustainable development that are relevant to the southern right whale.

1.3 Governance and coordination of the Recovery Plan

Key stakeholders who may be involved in the development, implementation, and review of the southern right whale Recovery Plan, including organisations likely to be affected by the actions proposed in this plan, are listed below.

1.3.1 Australian Government

Australian Fisheries Management Authority (AFMA)
Australian Maritime Safety Authority (AMSA)
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
DCCEEW, Australian Antarctic Division (AAD)
DCCEEW, Parks Australia (PA)
DCCEEW, Biodiversity Division (BD)
DCCEEW, International Environment, Reef and Oceans Division (IEROD)
Department of Defence (DoD)
Department of Industry, Science, Energy and Resources (DISER)
Great Barrier Reef Marine Park Authority (GBRMPA)
Indigenous Land and Sea Corporation (ILSA)
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)

1.3.2 State and local management agencies

Local government in coastal regions

State Environment agencies – WA Department of Biodiversity, Conservation and Attractions, WA Department of Water and Environmental Regulation, SA Department for Environment and Water, VIC Department of Energy, Environment and Climate Action, TAS Department of Natural Resources and Environment, NSW Department of Climate Change, Energy, Environment and Water, QLD Department of Environment and Science

State Fisheries agencies – WA Department of Primary Industries and Regional Development, SA Department of Primary Industries and Regions, VIC Victorian Fishing Authority, TAS Department of Natural Resources and Environment, NSW Department of Primary Industries, QLD Department of Agriculture and Fisheries
State Museums

1.3.3 Industry and non-government organisations

Boating Industry Australia
Commercial fishers and associations
General public
Indigenous land councils and communities
Local citizen science groups
Nature-based marine tourism industry – e.g., Whale-watching industry and associations
Non-government organisations – e.g., World Wildlife Fund, International Fund for Animal Welfare, Australian Conservation Foundation, Organisation for the Rescue and Research of Cetaceans in Australia.
Offshore renewable energy industry
Oil and gas exploration and production industry
Recreational fishers and associations
Universities and other research organisations

2 Biological, cultural, and ecological information

2.1 Taxonomy

The southern right whale is one of three extant species of right whales belonging to the genus *Eubalaena*, along with the North Atlantic (*E. glacialis*) and North Pacific (*E. japonica*) right whale. Along with the bowhead whale (*Balaena mysticetus*), they comprise the Family Balaenidae in the suborder Mysticeti (baleen whale) of the Order Cetartiodactyla, which is made up of the two orders Artiodactyla (even toed ungulates) and Cetacea (whales, dolphins and porpoises) (Jefferson et al. 2015, Kenney 2018). Although there is little morphological differences between right whale species, the southern right whale is widely accepted based on genetic analyses as a separate Southern Hemisphere species, distinct from the northern hemisphere right whale species (Rosenbaum et al. 2000). The taxonomy of right whales is recognised by the IWC, the Convention on Migratory Species, the IUCN (Kenney 2018) and the Society for Marine Mammalogy (Taxonomy 2022).

2.2 Cultural and community significance

2.2.1 Cultural significance of whales to Australian First Nations people

The cultural, customary, and spiritual significance of species and the ecological communities they form, are diverse and varied for Australia's First Nations Peoples and their stewardship of Country. This section describes some examples of this significance, although it is not intended to be comprehensive, applicable to, or speak for, all Australian First Nations peoples. It is acknowledged that First Nations people who are the custodians of this knowledge have the rights to decide how it is shared and used.

Australia's First Nations people have a culture that relates to a connectedness of land and sea in a holistic way and 'Sea Country', as on land, contains evidence of the ancient events by which all geographic features, animals, plants and people were created (Smyth 1994). First Nations people around Australia have long had a strong connection to whales, which has significance as totemic ancestors to some groups. The arrival of whales along Australia's coastline marked the arrival of the "elders of the sea", which follows a songline, or ancient memory code, that traces the journeys of ancestral spirits as they created the land, animals, and lore.

As an example, in South Australia the Ngarrindjeri people of the Fleurieu Peninsula and Lakes region have a strong relationship with the *Kondoli* (Whale) as a powerful *Ngatji* (totem), which was of the same flesh and closer than the bond between husband and wife. According to Ngarrindjeri creation stories, *Kondoli* was a large and strong man who had the ability to make fire; jealous men speared him in the back of his neck and flames leaped out. *Kondoli* fled to the nearby water to quench his burning wound and became the whale. His wound can still be seen in the spout from the whale's blowhole (Paterson & Wilson 2019).

At the Great Australian Bight in South Australia, the Mirning people are whale people, and the white whale *Jeedara* is their totem and part of the Dreaming, which tells how the Mirning and

southern right whales are connected (Burgoyne 2000). Mirning Country is the sacred place of the Mirning People, and the Yinyila Nation of Mirning clans forms a huge *yerrambai*, or rainbow arch, spanning the length of the coastal area of the Great Australian Bight from Point Culver in Western Australia to near Streaky Bay in South Australia (Burgoyne 2000). The Far West Coast Aboriginal Corporation (FWCAC) manages the Far West Coast land, which belongs to the Far West Coast Aboriginal Peoples. FWCAC represents six distinct cultural groups of Aboriginal people: Mirning Peoples, The descendants of Edward Roberts, Wirangu Peoples, Yalata Peoples, Kokatha Peoples and Maralinga Tjaratja (Oak Valley) Peoples.

In Victoria, Koontapool (southern right whales) occur along the coastlines of south-west Victoria in Gunditjmara Sea Country to feed and birth. These Koontapool Woorrkngan Yakeen (Whale Birthing Dreaming Sites), are in coastal bay areas from Port Campbell to Portland, including Warrnambool. These places on Gunditjmara Country are known resting and feeding sites for mothers and calves and are directly related to Gunditjmara Neeyn (midwives), explaining why Gunditjmara is a Matrilineal Nation.

Indigenous Australians have a long tradition of utilising beached (or stranded) whales as a food source and whale stranding's were occasions for feasting (Clarke 2001). For example, Ngarrindjeri had gathered to harvest the bodies of stranded whales well before *Kringkari* (pink-skinned men) arrived in their lands. Runners were sent inland telling others of the arrival of *Kondoli*, which was a time for ceremony and trade (Paterson & Wilson 2019).

2.2.2 Community cultural significance

Historically, cetaceans were culturally and economically important to Australia for what they could provide: oil, whalebone, teeth, and meat. Whaling became an important industry in Australia in the early 19th century following European colonisation, with whale products a major export and contributor to the Australian economy (Gill 1966). In the 20th century, whaling was considered good for international connections and relations, and many Australian ports provided berths to international vessels, such as Norwegian, Russian and Japanese ships in both Fremantle Harbour and Sydney Harbour (Kato 2015). During the mid-20th century, shore-based whaling operated around Australia with major stations in Albany (WA), Byron Bay (NSW), Eden (NSW) and Tangalooma (QLD), for which the industry was seen to bring modernisation, employment, and new amenities to many parts of Australia. With the end of whaling in Australia in 1978, whaling stopped being an economic issue and became an environmental one, and Australia made a rapid transition to an anti-whaling nation (Suter 1982, Kato 2015). From the 1970's some nations passed laws protecting whales and dolphins (e.g., United States *Marine Mammal Protection Act* in 1972 and United Kingdom *Wildlife and Countryside Act* in 1981). Australia established the EPBC Act in 1999 in recognition of the extreme exploitation many species underwent and their consequential threatened conservation status, the significant roles cetaceans play in ecosystems, their cognitive abilities, and the complex social societies in which they live (Allen 2014).

Many people today value whales as unique living resources that play an important role in their aquatic ecosystems. The International Monetary Fund (IMF) investigated the economic benefits whales provide to industries such as ecotourism, as well as the environmental benefits they may have as ecosystem engineers through carbon sequestration. The IMF found one great whale is potentially worth approximately \$2 million, and the global great whale population approximately \$1 trillion (Chami et al. 2019). For most Australians, the value placed on whales is

reflected in economic terms through development of ecotourism associated with whale watching. Commercial sustainable whale watching operators form an important nature-based industry that attracts a large number of tourists to coastal towns, providing important income to coastal regions in Australia, as well as promoting the conservation of whales and dolphins (O'Connor et al. 2009).

2.3 Historical whaling

Right whales were a primary target of whalers globally from the mid-16th century to late 20th century (Reeves & Smith 2003). Southern right whales were targeted for commercial hunting between 1790 and 1970, with at least 150,000 killed globally (Jackson et al. 2008). It was estimated that prior to whaling there were approximately 120,000 individuals in the Southern Hemisphere breeding grounds, although by 1920 there may have been as few as 300 remaining (IWC 2001). Despite international agreement in 1935 to protect southern right whales, the Soviet Union illegally hunted them in the 1950s and 1960s. The Soviet Union are believed to have illegally taken at least 3,300 southern right whales in the Southern Hemisphere at this time, removing more than half of whales existing at the time of protection (Tormosov et al. 1998).

In Australia, whaling became an important industry in the early 19th century following European colonisation, with the earliest reports of whaling right whales in 1805 by shore-based whalers in the Derwent Estuary near Hobart (Dakin 1934). The whaling industry in Australia effectively originated in Tasmania, with shore whaling companies from Sydney and Hobart expanding along the eastern Australian coasts, including Victoria, Tasmania and across to New Zealand (Nash 2003, Gibbs 2010). While the shore-based whaling industry operated in Western Australia in the 19th century, it was established later in the 1830's and was not as successful or profitable compared to the eastern parts of the country (Gibbs 2010, Gibbs 2012). Three main types of whaling occurred; 'shore-based', 'bay' and 'pelagic' whaling (Dawbin 1986, Carroll et al. 2014). Bay whaling occurred from 1805 to approximately 1845, and had effectively ceased in Australian waters by 1850 (Dakin 1934, Gill 1966), with the last shore-based Western Australian right whale catch recorded in 1866 when an estimated seven animals were taken (Bannister 1986). It is estimated 53,000 - 58,000 southern right whales were killed in eastern Australia and New Zealand over the 19th and 20th centuries, with most caught between 1830 and 1849 during coastal whaling (Dawbin 1986, Carroll et al. 2014). Following the decline in southern right whale numbers in the 1840's, pelagic whaling became a more prominent and lucrative form of whaling from the 1860's that largely focused on sperm whales. Pelagic whaling operated until the end of the 19th century, and while there was some pelagic whaling of southern right whales their catches in the last three decades were almost exclusively sperm whales (Dawbin 1986).

Prior to whaling, wintering aggregations of southern right whales, particularly cows with calves, were reported across the southern coast of Australia (IWC 2001). Following overexploitation by commercial whaling, southern right whales were thought to be almost extinct in the first half of the 20th century based on a scarcity of reports (Bannister 1986). Shore-based whaling inherently targeted females and calves and both shore- and ship-based whaling was heavily concentrated in southeast Australia and New Zealand (Carroll et al. 2011, Carroll et al. 2015, Harcourt et al. 2019). It is likely that the substantive whaling pressure that occurred off south-east Australia resulted in local extirpation of breeding females and a consequent loss of 'cultural memory' of calving areas, which may explain the slow rate of recovery in the Australian south-east region (Carroll et al. 2015). Southern right whales were only rediscovered in Australia in 1955, with

anecdotal reports of a small number of whales occurring up until 1970 (Chittleborough 1956, Bannister 1986) followed by increases in numbers from the 1980's. The intense over-exploitation of right whales has shaped their current population structure, demographic parameters, and rates of recovery in the two different populations across their range (Harcourt et al. 2019).

2.4 Biological information

2.4.1 Morphology and physical characteristics

Southern right whales are large baleen whales of rotund body shape and are recognised by the lack of a dorsal fin, broad and short pectoral fins and distinct skin growth on their heads and lower jaw called callosities (Figure 1). They use baleen plates made of keratin (a protein) as a sieve to filter water through to feed on their prey. Southern right whales reach a maximum length of approximately 16 m, with contemporary body length data from Head of the Bight suggesting southern right whale females (lactating females) range between 13.0 and 14.9 m (mean = 14.2 m) and between 11.1 and 16.2 m for southern right whales including data from Argentina (Christiansen et al. 2018, Christiansen et al. 2022). Mature females are slightly larger than males and southern right whales slightly smaller than Northern Hemisphere Right Whales (Tormosov et al. 1998, Jefferson et al. 2015). With a predicted weight of around 40 tonne, they are heavier than other baleen whales of a similar length and their bulky body form is markedly different from the more streamlined balaenopterid whales (Jefferson et al. 2015, Christiansen et al. 2019).

Southern right whale callosities are patches of keratinised skin colonised by cyamids (i.e., small crustaceans), that provide unique markings on the dorsal surface of the rostrum, the lip line of the lower jaw, and just posterior to the blowhole that are present from birth and persist throughout their life (Payne et al. 1983). Given their uniqueness and persistence, callosity patches (Figure 2) form the basis of long-term identification and monitoring of individuals using methods such as photo-identification. This ability to identify individuals allows for estimation of life history parameters (e.g., calving intervals, age of sexual maturity, survival, and mortality), assessment of movement patterns, residency and site fidelity, and investigation into correlations between environmental and climatological variations on reproductive rates and trends in abundance.

2.4.2 Demographics and reproduction

Gestation in southern right whales is thought to be approximately 11 - 12 months (Burnell 2001), lactation lasts at least 7 - 8 months (Tormosov et al. 1998), with weaning occurring within 12 months (Lockyer 1984). The apparent age at first parturition is reported to occur at a minimum of five years and average of nine years in whales utilising the Head of the Bight (Charlton et al. 2022). Southern right whales from the Australian population are known to still be reproductively viable to at least 41 years of age and the oldest recorded whale in Australia is estimated to be at least 50 years old (Charlton et al. 2022). Surface active mating and socialising groups observed in reproductive areas are believed to be involved in mating (Burnell et al. 1990, Parks et al. 2007, Charlton 2017), with adults not accompanied by a calf making up approximately 20 percent of overall sightings at major calving grounds (Charlton et al. 2019).



Figure 1 Physical morphology of a southern right whale mother and calf.
© Joshua Smith.

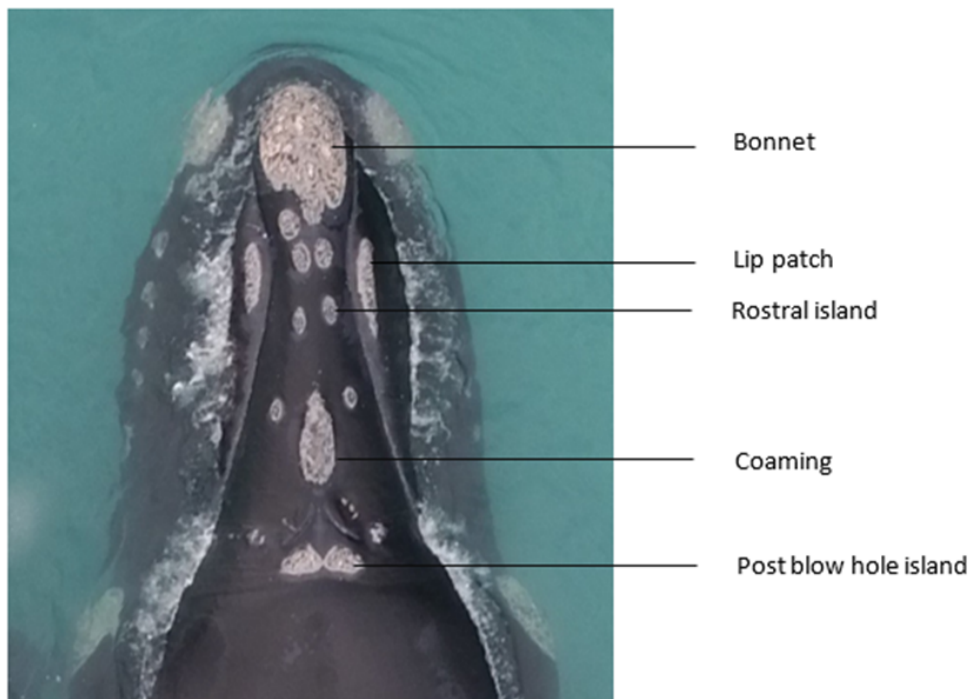


Figure 2 Southern right whale callosity features used for photo-identification.
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However, mating and conception does not exclusively occur in reproductive areas of the Australian coast, yet there is limited understanding on the extent it occurs outside known reproductive areas. Known females are rarely observed on the Australian coastline in the year prior to calving, suggesting conception may predominantly occur away from calving grounds, potentially on the feeding grounds (Watson et al. 2021). It is difficult to determine the sex of whales at sea which provides challenges to identifying mating behaviour. Whales in close association with a calf over extended periods (weeks) are typically identified as females, and sex can be determined by photographing the ventral ano-genital configuration. Mating behaviour typically involves a single female being pursued by several males over several hours to several days and males may jostle for position and attempt to mate from an inverted position underneath the female (Donnelly 1967, Burnell et al. 1990).

Southern right whales are capital breeders, and the female reproductive cycle is closely linked to their migratory cycle. They build up energy stores on high latitude feeding grounds, which are then relied upon while on their breeding/calving grounds to enable lactation during a time that they do not feed (Lockyer 2007). Given finite energy stores on the calving grounds, and the energetic costs of reproduction to females, environmental influences and/or disturbance from anthropogenic activities may impose further demands on the whale's limited energy stores and affect the body condition of lactating females and the reproductive viability of offspring. There is a significant energetic cost to the mother in the late stages of gestation (i.e. last trimester), and calf growth rate has been observed at the Head of the Bight and found to be dependent on the maternal body size and condition of the mother (Christiansen et al. 2018, Christiansen et al. 2022). The proportion and duration of time calves spend nursing increases with increased calf size throughout the breeding season, and lactating females can lose up to 25 percent of their initial body volume (Christiansen et al. 2018, Nielsen et al. 2019). Behavioural disturbance from human activities can also incur energetic costs to southern right whales, associated with changes in more energetically expensive behaviours. For example, southern right whales off the coast of Argentina were found to decrease their proportion of time spent resting and increase the proportion of time spent travelling in the presence of tourism swim with interactions, with mothers and calves being most sensitive to the presence of swimmers (Lundquist et al. 2013).

Southern right whales have a single calf on average every three years, with a maximum of up to five-year intervals. Post-partum ovulation does not typically occur in right whales and no published record exists of a female right whale giving birth in consecutive years. Calving intervals shorter than three years are considered rare but have been recorded in instances where a mother loses a calf, and calving intervals observed to be greater than five years are not considered likely but rather a consequence of missed intervening calving's (Bannister 1990, Cooke et al. 2001, Brandão et al. 2011, Charlton et al. 2022). Based on the predominant 3-year calving cycle, females form breeding cohorts, in which it is assumed that the year following calving is a rest year followed then by a mating year (Burnell 2001, Cooke et al. 2001, Brandão et al. 2018). This assumption is supported by observations that identify that reproductively mature females that calve in Australian waters are almost never recorded on the Australian coast between calving years (Bannister 1990, Burnell & Bryden 1997). At the Head of Bight, the mean calving interval for breeding females during 2015-2021 has been observed to increase from three to four years (Charlton et al. 2022). The factors associated with this increase are unknown but may have been influenced by factors such as climate change (Pirzl 2008) Pirzl et al. 2009).

2.4.3 Mortality and survivorship

Reliable estimates of mortality rates are generally unknown for Australian southern right whales, although concerted effort to compile stranding records in South Australia has been undertaken, revealing cases of known entanglements (Segawa & Kemper 2015) is presumed low given their life history traits, lack of reporting of deceased whales, and increase in long-term population trend. Southern right whales have few natural predators, although calves, and possibly adults, may be vulnerable to shark and orca (*Orcinus orca*) predation, particularly during migration and in high latitudes (Bannister et al. 1996). Bite marks and scars consistent with shark attack have been photographed on animals in Australian waters from all population classes (e.g., males, non-calving females, juveniles, sub-adults). In adults, these appear confined to the flukes and are unlikely to cause death in healthy, mature individuals (Burnell 1999), whereas direct attacks on a sub-adult and an entangled adult whale have been observed. Adult southern right whales rarely strand, but small numbers of calves are found regularly dead or stranded near calving grounds. Neonatal mortality at the Head of Bight has been estimated to be at least 3 percent during the first three months of life (Burnell 1999).

2.5 Species bioacoustics

All species of right whales are known to produce a range of low frequency vocalisations, with most concentrated at energies below 1 kHz. They produce vocalisations with a fundamental frequency range of 50 to 500 Hz, modelled hearing range between 10 Hz to 22 kHz (functional range of 15 Hz to 18 kHz), and source levels ranging from 132 to 192 decibels (Parks & Tyack 2005, Parks et al. 2007). Vocalisations have been categorised in various ways, although they can be grouped into tonal (including the upcall, downcall and constant call) and broadband pulsive (including hybrid) vocalisations (Clark 1982, Webster et al. 2016, Ward 2020). The vocalisation types and call rate produced by individual whales can be highly variable, depending on individual or group behaviour and age/sex composition of groups (Clark 1982, Parks et al. 2011).

The first characterisation of southern right whale vocalisations in Australia was undertaken in established aggregation areas at Point Ann (WA) and Fowlers Bay (SA), which found low detection call rates (Ward 2020). The most well documented vocalisation is the upcall, which is a simple, short duration (0.5 to 1.5 s), low frequency (50 to 300 Hz) tonal sound that increases in frequency toward the end of the sound. The upcall is considered the primary contact call used by both males and females of all age classes of right whale that may relate to the individual identity of a whale (Clark 1982, McCordic et al. 2016), and constituted ~76 percent of all vocalisations in the Australian WA and SA aggregation areas (Ward 2020). Consequently, given it is the most dominant vocalisation type it is predominantly used in passive acoustic monitoring to detect the presence of right whales (Van Parijs et al. 2009, Parks et al. 2011).

Lactating females with calves on calving grounds in both the North Atlantic and Australia have been found observed to produce vocalisations at low amplitude (123 ±8 dB and 133 ±10 dB re 1 µPa rms for non-harmonic and harmonic sounds, respectively; Flinders Bay, Western Australia), and relatively infrequently, potentially as a strategy to decrease the risk of acoustically alerting predators of their presence (Nielsen et al. 2019, Parks et al. 2019, Zeh et al. 2022). North Atlantic right whales have been reported to increase the amplitude of their upcall in response to increasing background noise levels (Parks et al. 2010), and there is also evidence that ship noise

can increase stress in right whales (Rolland et al. 2012). To date, similar studies on the responses of southern right whales to increasing background noise or to noise produced by ships has not been undertaken in Australia, although similar behavioural responses by southern right whales would be plausible.

2.6 Population structure

Southern right whales that occur seasonally off the Australian coast are identified as derived from two populations: the western and eastern populations. This delineation of populations is based on genetic differentiation (Carroll et al. 2011, Carroll et al. 2015) and varying rates of population increase (Stamation et al. 2020, Watson et al. 2021, Smith et al. 2022), resulting in differing recovery trajectories likely as a result of differences in historical whaling pressure as discussed in section 2.3. The western population occurs off Western Australia and South Australia waters, while the eastern population occurs off coastal waters of Victoria, Tasmania, New South Wales, and Queensland. The two populations are proposed as two distinct management units (Brownell et al. 1986, Carroll et al. 2015), whereby recruitment from within the management unit is more important to its maintenance than immigration from neighbouring populations (Carroll et al. 2015).

Delineation of distinct western and eastern Australian populations was initially made on the basis of mitochondrial DNA (mtDNA; female inherited) haplotype frequencies (Carroll et al. 2011). This was supported by further analyses of mtDNA using an increased sample size that identified genetic differentiation between the Australian western and eastern populations and individuals from New Zealand calving grounds. These findings are consistent with long-term fidelity to calving areas (Carroll et al. 2015). In contrast though, no genetic differentiation has been observed between the western and eastern population management units using microsatellite DNA, and between individuals sampled from the Australian calving grounds and migratory corridors based on either mtDNA haplotype or microsatellite allele frequencies (Carroll et al. 2015). This indicates whales from the calving areas across Australia are mixing on shared migratory corridors.

2.7 Abundance and population trends

The western and eastern populations of southern right whales in Australia demonstrate varying patterns of recovery, following severe depletion from commercial whaling. The western population has been monitored annually at varying extents of its range since 1976, which represents the longest continuous record of southern right whale abundance in Australia and is central to understanding recovery of the species post-exploitation. Annual aerial surveys were initially conducted in WA between Cape Leeuwin and Israelite Bay, which were extended further east to Twilight Cove from 1985, and then further east again to Ceduna in SA in 1993 (Bannister 1990, Bannister 2001, Evans et al. 2021, Smith et al. 2022). Land-based cliff-top surveys have been conducted at the Head of Bight reproductive aggregation site since 1991, providing information on the relative proportion (~0.21) of the western population and associated growth trends and demographic data (Burnell 2001, Charlton et al. 2022). Monitoring in the south-eastern parts of Australia have largely been opportunistic in nature, with the exception of an aerial survey conducted twice between Ceduna and Sydney (including Tasmania) in 2013 and 2014 (Watson et al. 2015). Long-term monitoring of Australian southern right whales has thus focussed on the largest remnant part of the population, which have estimated inter-annual

trends in relative abundance and rates of population increase and studied elements of reproductive biology and behaviour.

The maximum biological rate of increase for southern right whales across their range is estimated at approximately 6 - 7 percent per year (IWC 2013). The formation of breeding cohorts (section 2.4.2) due to a three year calving cycle results in inter-annual variation in population counts of southern right whales observed in Australian waters and consequently the estimation of overall abundance and trends need to be calculated over multi-year periods (i.e., a 3-year rolling average). At the Head of Bight, the mean calving interval for breeding females during 2015 - 2021 has been observed to increase from three to four years (Charlton et al. 2022), which may have implications on population size estimation in future years if the change applies across the population.

The most recent population size estimate for the western population derived from the annual aerial survey is 2,549 whales (1993 – 2021), with a per annum rate of increase of ~4.3 percent (C.I. 2.8 – 5.8) for all animals observed and ~5.4 percent (C.I. 3.6 - 7.2 percent) for mother and calf pairs observed (Smith et al. 2022). However, low whale counts in a given year can influence subsequent population estimates and the 2017 estimates of ~3,200 whales and rate of increase p.a. of 5.5 percent (C.I. 4.0 - 7.3 percent) for all animals and 6.2 percent (C.I. 3.9 - 8.6 percent) for mother-calf pairs are likely a better representation of the status (Smith et al. 2019). The western population is therefore recovering near to the maximum rate of population growth biologically possible. The whales that utilise the Head of Bight potentially represent 21 percent of the western population, with an estimated mean rate of increase of 3.2 percent (\pm 1.3 percent) per annum and 4.6 percent (\pm 1.7 percent) per annum for females with a calf (Charlton et al. 2022). Although recently (from 2007), the long-term population abundance data have shown greater inter-annual variation and anomalous years of pronounced low whale numbers are potentially becoming more frequent (Evans et al. 2021, Charlton et al. 2022, Smith et al. 2022).

Based on breeding females sighted across the period 1996 to 2017 prior to the post-breeding southward migration (i.e. month of September), an estimate of population size for the eastern population resulted in 268 (146-650) whales (1996 - 2017) and a rate of increase of 4.7 percent (C.I. 2.3 – 7.3 percent) (Stamation et al. 2020). Contrary to the increase estimated for the population, there is no evidence of an increase in annual numbers of mother-calf pairs at Logan's Beach, the only established calving aggregation in the south-east of Australia (Stamation et al. 2020). Based on these estimates, the eastern population appears to be recovering at a slower rate than the western population, and abundance remains very low in comparison with expectations based on historical evidence of occupation (Pirzl 2008, Stamation et al. 2020).

2.8 Distribution and habitat occupancy

Southern right whales have a circumpolar distribution in the Southern Hemisphere approximately between latitudes 20°S and 65°S (Kenney 2018). Reproductive areas where females calve and nurse their young appear to be exclusively coastal, occurring either off continental landmasses or oceanic islands, and occupied during late autumn, winter, and early spring. Foraging and feeding occurs in a similarly broad latitudinal range between at least 30°S and 65°S, particularly in offshore areas associated with large-scale features such as the Sub-Tropical and Polar Fronts (Torres et al. 2013, Carman et al. 2019).

Breeding aggregations of southern right whales occur over a wide environmental range across the entire southern Australian coast, although preferred habitat generally includes shallow sloping sandy bottom bays that provide protection from prevailing wind and weather (Elwen & Best 2004, Pirzl 2008). Fine-scale habitat selection by southern right whales appears to be influenced by breeding status, with breeding females being more selective than non-calving whales and preferring sheltered, nearshore waters during the early life-stages of their calves (Pirzl 2008, Rayment et al. 2015). At the Head of Bight, whales show preference to < 10 m depth and within 1 km from shore, with some geographic separation of population classes. Females accompanied by a calf favour the shallow embayment and unaccompanied adults favour the deeper water. Females accompanied by a calf demonstrate seasonal variation in distribution, by expanding their range throughout the season and moving from the sheltered embayment to deeper waters (Burnell 2001, Charlton et al. 2019).

2.8.1. Seasonal distribution

Southern right whales in Australian waters predominantly occupy shallow, coastal areas where they calve and nurse their young from May to October, although may occur as early as April and as late as November on the Australian coast. The peak period of abundance is typically in late July and August, although there is within season variability that differs between females with calves and unaccompanied whales. Females accompanied by a calf generally occupy the calving ground for 2 to 3 months between June and September, whereas unaccompanied whales (males and females without a calf) are more variable in their occupancy of coastal areas throughout the reproductive season (Burnell & Bryden 1997, Charlton et al. 2019).

2.8.2 Spatial distribution and re-occupation of historical habitat

In Australian coastal waters, the southern right whale distribution range (i.e., species range) represents the area the whales can occur in Australian waters between April and November (Figure 3). The species distribution range extends north to Hervey Bay in Qld. (23°S, 150°E) on the east coast and Exmouth/Ningaloo Reef (21°S, 114°E) off the WA coast (Bannister 1986, Smith et al. 2024). Within the species distribution range southern right whales occupy nearshore areas with greater consistency each year, predominantly in coastal areas and around oceanic islands. The greatest numbers of whales constitute the western population and occur in the coastal waters between Cape Leeuwin in Western Australia and Ceduna in South Australia, and are particularly concentrated in three main regions of Albany east to Doubtful Island Bay (WA), Israelite Bay (WA) and Head of Bight (SA) (Charlton et al. 2022, Smith et al. 2023). The eastern population has very low abundance and whales occur to a lesser extent off Victoria, Tasmania, New South Wales and Queensland (Stamation et al. 2020). In Victoria, there is a regular aggregation area in waters off Warrnambool at Logans Beach and increasing numbers of sightings along the Gippsland coast (east from Wilsons Promontory), and relatively regular sightings along the south east coast of Tasmania (Stamation et al. 2020, Watson et al. 2021).

There has been expansion and re-occupation into historic breeding areas as the population has increased in abundance, with whales now utilising areas such as Geographe Bay, Fowlers Bay and Encounter Bay (Charlton et al. 2019, Kemper et al. 2022, Salgado Kent et al. 2022). Unpublished sightings data in NSW indicate an increasing use of areas up the NSW coast by southern right whales (particularly mothers and calf pairs) which may have been historically used areas lost from the cultural memory of southern right whale following early whaling (pers comm Andy Marshall 2023). Since 2006, there has been increasing numbers of sightings of

southern right whales occurring in the whale's northern range limits, with the most northerly sighting of a southern right whale (mother and calf) near Hinchinbrook Island (18°S) in Qld (Smith et al. 2024).

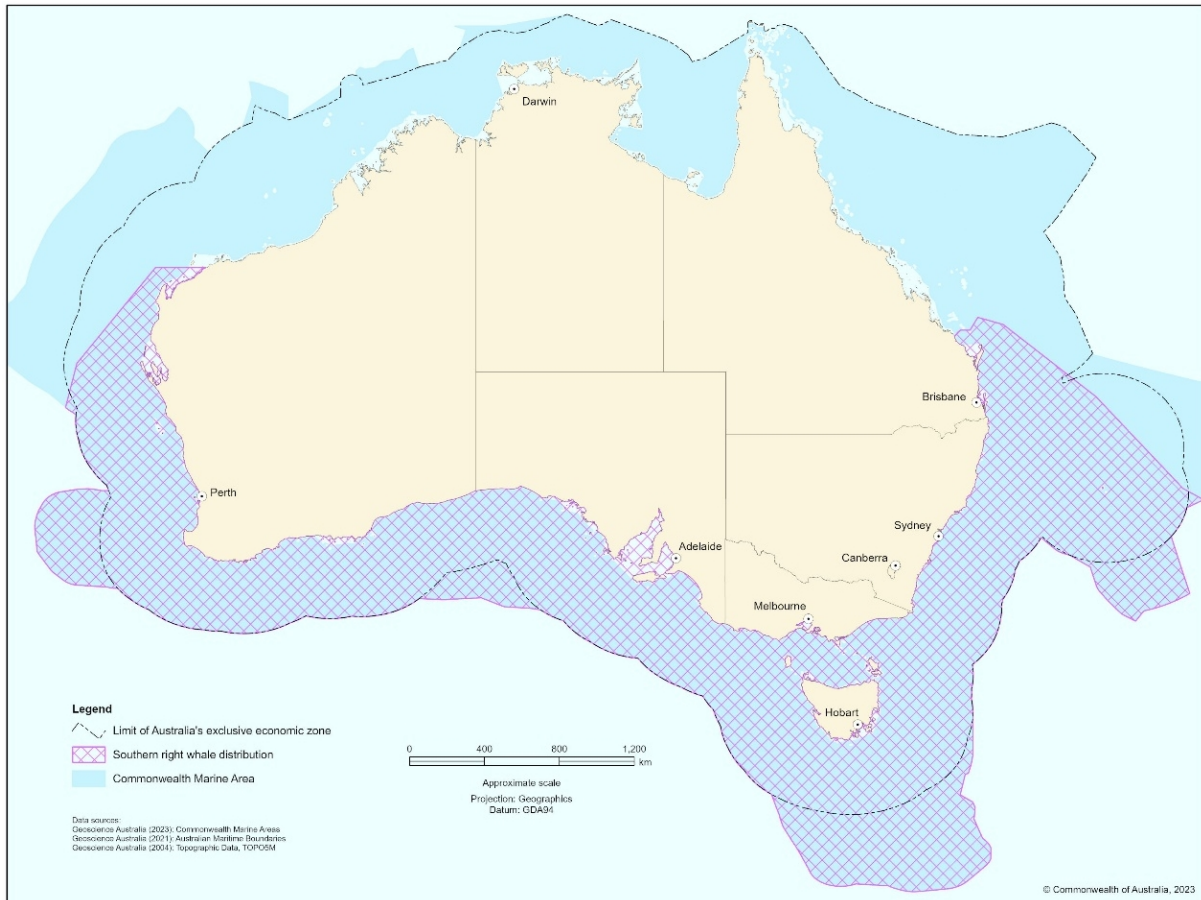


Figure 3 Spatial distribution of the southern right whale within the Commonwealth Marine Area and State waters.

Female southern right whales show strong site fidelity to certain areas for breeding (mating, calving, nursing), generally returning to the same location to give birth and nurse offspring. Females are believed to transmit preferences for both winter calving/breeding areas and summer foraging areas to their calves during the first year of the calf's life (Valenzuela et al. 2009, Carroll et al. 2015, Carroll et al. 2016). Consequently, the loss of significant numbers of individuals from a breeding area may result in loss of the collective memory (i.e., cultural memory) of good breeding areas (Carroll et al. 2015, Harcourt et al. 2019). This may then result in suitable habitat not being utilised or recolonised, particularly if there is no immigration from nearby populations, which could be the case for historically used sites in the eastern population not presently occupied to the same level they were historically before whaling. However, while strong site fidelity occurs within and between years and over decadal time spans (Bannister 2001, Charlton 2017), a small proportion of breeding females have been observed to change the location at which they calve (Watson et al. 2021).

Historic high use areas are where both intensive shore-based whaling effort occurred (based on years of operation and number of stations) and southern right whales occupied the area (Pirzl 2008), with evidence of current use. However, it should be noted that shore-based whaling

records may potentially have been incomplete, and consequently the determination of historic high use areas underestimated. Of the four high historic use areas, southern right whales are consistently observed in two of these areas, in southeast South Australia and southwest Victoria. In the two other high historic use areas off the southeast coast of Tasmania and near Eden on the border between Victoria and New South Wales, they are less consistently observed. While there is no current published evidence for consistent re-occupation of areas by the eastern population other than some bays in southwest Victoria, there are increasingly regular records of short-term use by mother-calf pairs along the Victorian, Tasmanian, and southern NSW coastline from May to September. In these areas, small but growing numbers of calving and non-calving whales have been observed to regularly aggregate for short periods (days to weeks). These include coastal waters between Binalong Bay to South-east Cape in Tasmania, the Gippsland coast in Victoria (Stamation et al. 2020), and in numerous protected bays generally south of the NSW Central Coast, potentially extending north as far as Port Macquarie (pers comm Andy Marshall 2023).

2.8.3 Coastal movements

Movements of each population of southern right whales along the Australian coast occur within and between years in areas of coastal connecting habitat, with a high degree of movement having been observed in the western population (Burnell & Bryden 1997, Charlton 2017, Evans et al. 2021, Watson et al. 2021). Movement and interchange between the eastern and western population has also been documented (Burnell 2001, Pirzl et al. 2009, Charlton 2017), with varying percentages of whales sighted in the south-eastern Australian region also sighted in the south-western Australian region and vice versa, depending on the datasets used (Evans et al. 2021, Watson et al. 2021).

These movements along the Australian southern coast demonstrate the importance of coastal connecting habitat for southern right whales. The longest within season movement of ~1,600 km has been recorded between Cape Nelson (VIC) and Head of Bight (SA), whereas the longest between season movement of ~3,800 km was recorded between Sydney (NSW) and Israelite Bay (WA) (Watson et al. 2021). Furthermore, despite strong natal philopatry to calving areas, the first long-term re-location of a female to a different calving ground has been documented from Logans Beach in south-east Australia to Head of Bight in South Australia (Watson et al. 2021). This is consistent with the findings of Carroll et al. (2015) that mixing of whales from genetically distinct populations occurs along migratory corridors.

2.9 Migration, diet, and foraging grounds

Southern right whales demonstrate strong fidelity to feeding and breeding areas and are a highly mobile migratory species that can travel thousands of km's between habitats used for these essential life functions (Kenney 2018). The foraging ecology of southern right whales is poorly understood, and observations of feeding whales are rare. Feeding whales have been observed in the region of the Subtropical Front (41 – 44°S) in January and December and catches of whales from this region have recorded predominantly copepods in their stomach, while those caught at higher latitudes (south of 50°S) have been observed to have mainly krill (Townsend 1935, Bannister et al. 1997, Tormosov et al. 1998). Feeding has not been observed in coastal Australian waters, although other parts of the Australian Exclusive Economic Zone (EEZ) may be utilised for feeding (Torres et al. 2013).

A counter-clockwise migration between foraging and breeding areas has been proposed, whereby whales from the south-western population travel north to south-eastern Australian waters before traveling west to their calving grounds (Burnell 2001). Current knowledge of summer feeding grounds is based on historical whaling data (Townsend 1935, Smith et al. 2012), habitat suitability models (Torres et al. 2013), recaptures of commercial whaling *Discovery* tags (Tormosov et al. 1998), photo-identification of individuals (Bannister et al. 1997, Bannister et al. 1999), and satellite tagging data (Childerhouse 2010, Mackay et al. 2020, Riekkola et al. 2021). Based on these datasets, southern right whales most likely forage south of Australia in the region of 30°S and 65°S within three likely foraging grounds; south-west of WA, waters associated with the Subtropical Front, and Antarctic waters (Childerhouse 2010, Mackay et al. 2020, Riekkola et al. 2021). Preliminary findings from stable isotope analyses suggest remarkable consistency in the distribution of southern right whales in mid latitude (< 40°S) foraging areas across the past two centuries. Foraging in high latitudes (> 60°S), however, appear to have undergone recent changes in the past two decades. While there has been an estimated 19 percent decline in the foraging surface area extending to 60°S for the Australian western population, there has been an increase of 25 percent for the eastern population to high latitude foraging areas (Derville et al. 2023). Satellite tagging studies indicate variability in migratory pathways undertaken by populations of southern right whales utilising Australian and N.Z. waters. Southern right whales tagged from southwest Australia (Albany, Augusta) demonstrate tracks from the Australian coastline to areas in the Southern Ocean, including Kerguelen Islands, Iles Crozet and Antarctic waters. Southern right whales tagged at Auckland Islands of New Zealand demonstrated consistent westward migratory movements to offshore waters south of the Head of the Bight and WA (Riekkola et al. 2021).

A strong correlation between environmental conditions (e.g., sea surface temperature anomalies) at right whale high latitude feeding grounds and female reproductive success and calving rates and recovery on their winter breeding grounds has been observed (Leaper et al. 2006, Meyer-Gutbrod et al. 2015, Seyboth et al. 2016). Similar effects have been demonstrated for the Australian population by Pirzl et al. (2008), where annual calf production has been linked to variability in the El Niño-Southern Oscillation (ENSO), with reduced reproductive output associated with El Niño conditions on a 2.5 to 3-year time lag. The fluctuation of prey abundance on summer high latitude foraging areas has been linked with climate cycles and ocean warming resulting from anthropogenic climate change (Pirzl et al. 2008, Dedden & Rogers 2022), with low prey abundance having a negative impact on reproductive success and calving rates of southern right whales. It is suggested that variation in calving rate may be influenced by climate factors impacting changes to calving intervals (Pirzl et al. 2009), which could become evident through pronounced inter-annual variation in whale numbers on the coastal breeding areas (Charlton et al. 2021, Charlton et al. 2022, Smith et al. 2022). Whether these correlations explain recent fluctuations in breeding cycles reported for breeding females at Head of Bight (Charlton et al. 2022) is unknown.

2.10 Biologically important areas and habitat critical to survival

2.10.1 Biologically Important Areas

Biologically Important Areas (BIAs) for southern right whales were originally developed as part of the Commonwealth Bioregional Planning Process to develop Marine Bioregional Plans that were released in 2012 and a review and update of the BIA framework was undertaken in 2022/23. The BIA framework is comprised of the protocol for Designation of BIAs for Protected Marine Species (the BIA Protocol), the BIA designation process, and BIA geospatial map layers. Maps produced in association with the identification of BIAs allow current information to be stored and referenced in a geospatial environment and can be updated by the Australian Government as new information becomes available. Consequently, the most current BIA information and spatial data layers must be considered and used to inform conservation planning, environmental impact assessments and decision-making.

Information on BIAs can be found at:

<https://www.dcceew.gov.au/environment/marine/marine-species/bias>

BIAs represent spatially and temporally defined areas of the marine environment used by protected species for carrying out life critical functions. These are areas known or likely to be regularly or repeatedly used by individuals or aggregations of a species, stock or population for reproduction, feeding, migration or resting. It is important to note, BIAs do not represent a species' full range and are different to their distribution maps, which indicate the present distribution of the species within Australia and the Commonwealth Marine Area. BIAs occur within the areas defined by distribution maps and provide more specific information about areas used by species for biologically important behaviour. BIAs are not formally protected areas, parks, reserves, or sanctuaries, although they may be designated within these areas.

Each BIA has been identified based on the best available information and knowledge, including peer-review scientific literature, unpublished grey literature, and expert knowledge. The presence of the observed behaviour indicates that the habitat required for the behaviour is also present. However, the absence of an identified BIA does not mean that an area is not important habitat and rather insufficient data may currently exist to designate it as a BIA. New or unpublished data may exist that may need to be considered in the context of marine estate management and marine development proposals.

Southern right whale BIAs are mapped in this Recovery Plan for reproduction and migration areas.

Reproductive areas

These are areas regularly used by breeding females and are likely to be important for the species recovery through contributing to overall population increases in abundance, maintenance of genetic diversity (given site fidelity may lead to small-scale genetic differences) and expanding habitat occupancy. Within reproductive BIAs, southern right whales demonstrate a spatial and temporal dependence to these areas, and calving and nursing is known (due to presence of calves) to consistently occur in varying densities.

Migration areas

These are areas known, or likely, to be used for movement between regions that support biologically important behaviours. This includes the movement of whales along the coast and the movement from offshore areas, including foraging areas, to nearshore and coastal areas.

2.10.2 Habitat critical to the survival of the species

A Recovery Plan, under Part 13, section 270 of the EPBC Act, must identify the habitats that are critical to the survival of the species or community concerned, and the actions needed to protect those habitats. The *EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance 2013* state that “An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will: adversely affect habitat critical to the survival of a species.” The definition of habitat critical to the survival (HCTS) of a species are areas necessary:

- for activities such as foraging, breeding, roosting, or dispersal,
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators),
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Habitat critical to survival for the southern right whale has been identified as all reproductive BIAs across the species range (Figure 4). The identification of HCTS reflects that southern right whales display strong site fidelity to calving areas in Australian coastal waters, within and between years, over decadal time spans (Bannister 2001, Charlton et al. 2021, Watson et al. 2021). Reproductive areas have been identified as HCTS of the species based on:

- they meet the species essential life cycle requirements for reproduction (e.g., mating, calving, and nursing) and reproduction is known to occur at that location,
- there is a level of occupancy by individual breeding females at these locations of multiple days in any given year, and across multiple years, for long-term maintenance of the species, and
- they are critical for recovery of the southern right whale in terms of expanding habitat occupancy and contributing to the maintenance of genetic diversity as site fidelity may lead to small-scale genetic differences.

No ‘Critical Habitat’ as defined under section 207A of the EPBC Act has been identified, or included, in the Register of Critical Habitat. ‘Critical Habitat’ is different from HCTS and only applies to Commonwealth land and sea. There are also no important cetacean habitat areas identified in the Australian Whale Sanctuary as defined under section 228A of the EPBC Act for southern right whales.

National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)

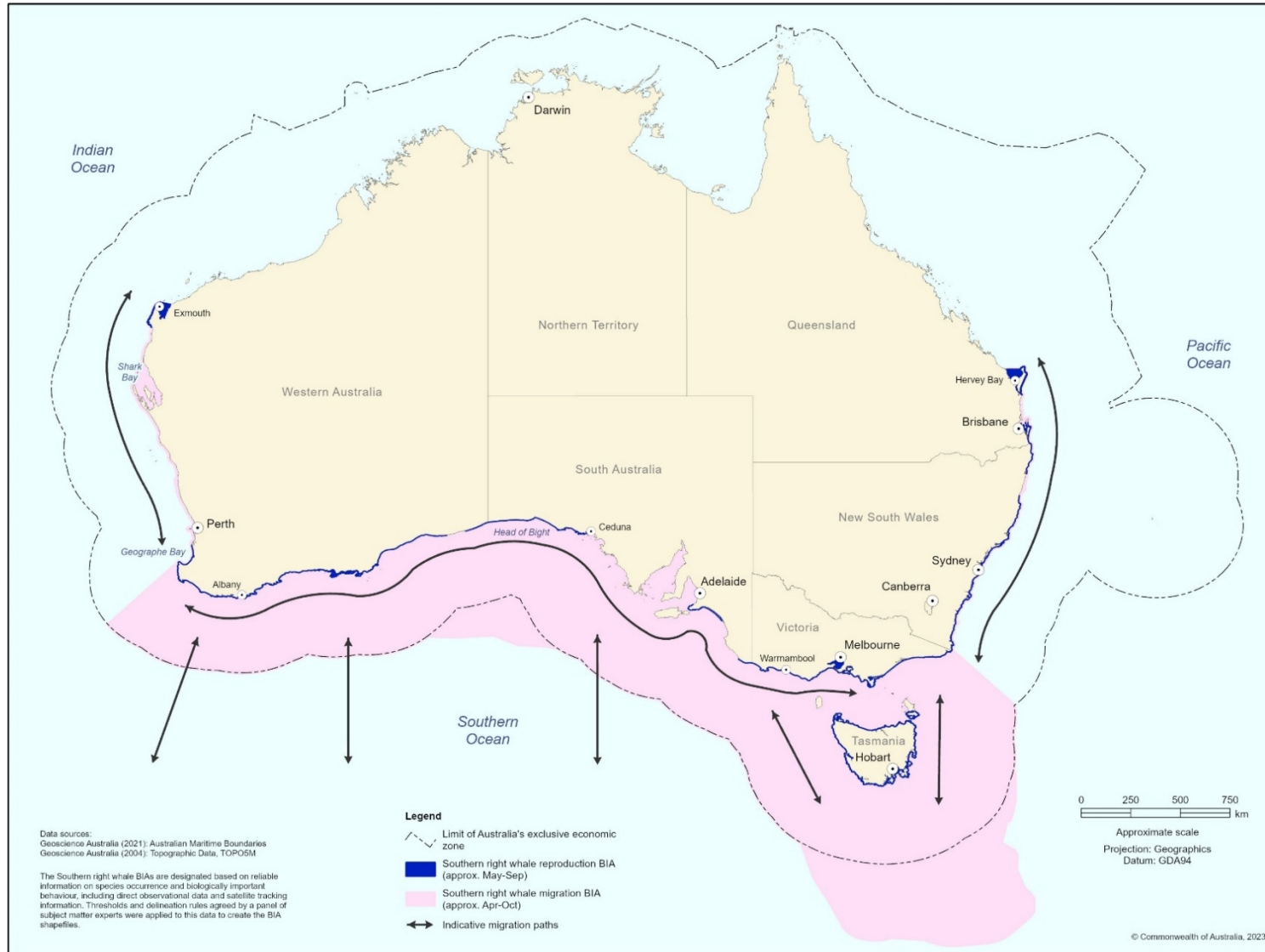


Figure 4 Southern right whale Biologically Important Areas (reproduction and migration) and Habitat Critical to the Survival (reproduction BIA).

National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)

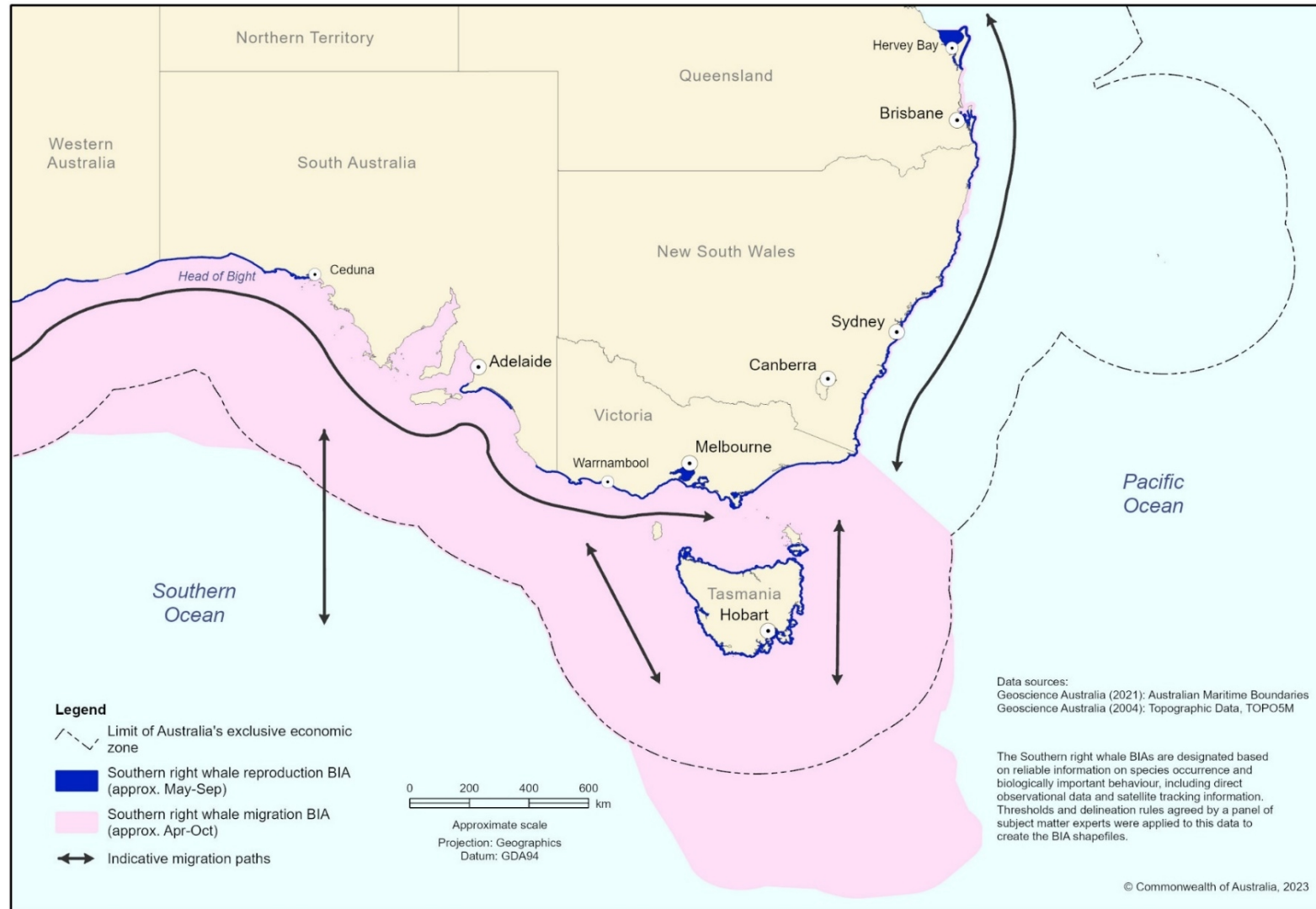


Figure 5 Southern right whale Biologically Important Areas and Habitat Critical to the Survival (reproduction BIA) in eastern Australia.

National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)

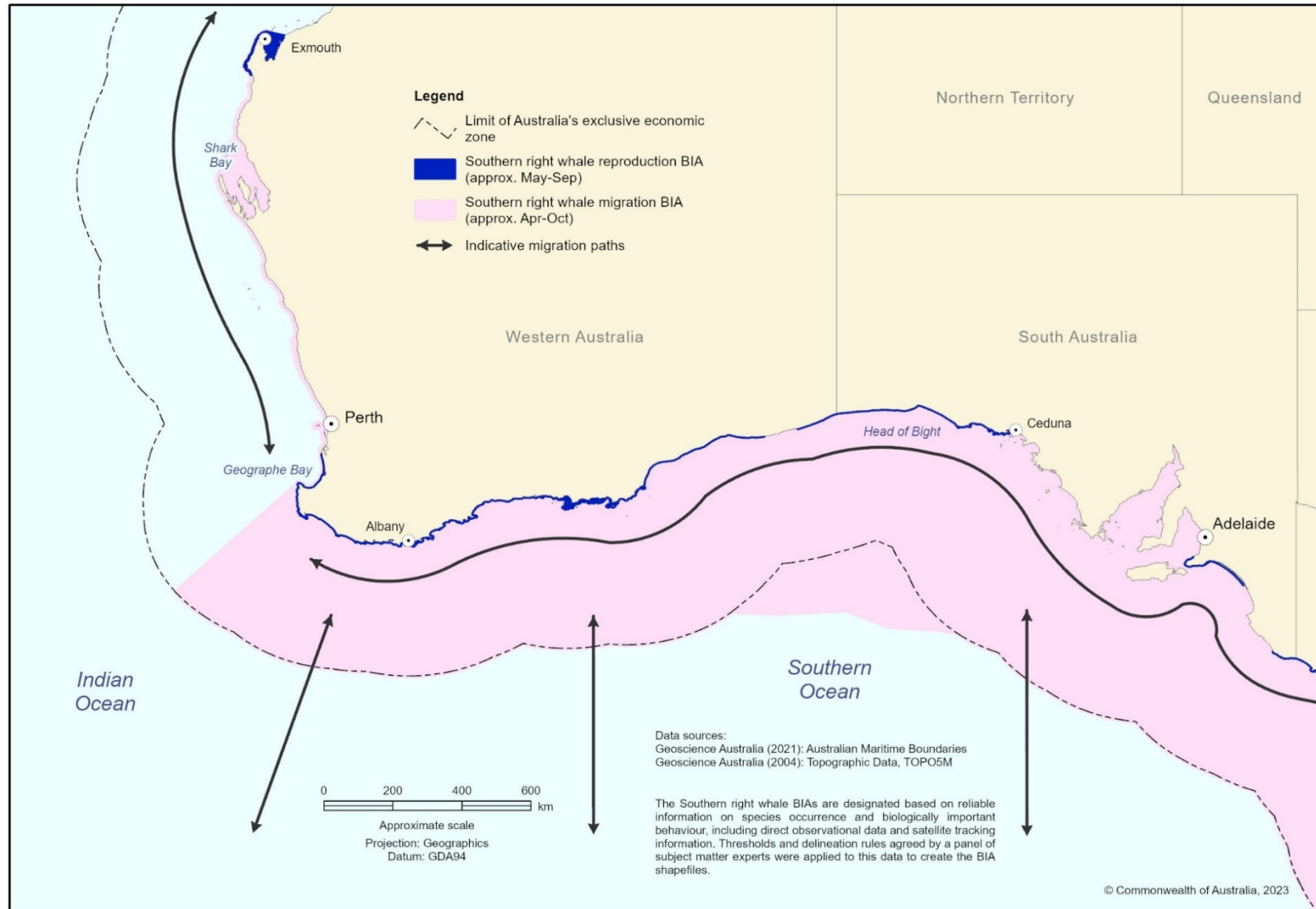


Figure 6 Southern right whale Biologically Important Areas and Habitat Critical to the Survival (reproduction BIA) in western Australia.

3 Threats and threat prioritisation

The life history traits of southern right whales make them particularly vulnerable to anthropogenic threats, which include a long-life span, low reproductive output, late sexual maturity, and strong fidelity to calving areas. Human activities can potentially cause mortality, injury, disturbance, and stress to marine mammals. There are activities that may have lethal effects that result in immediate fatalities (e.g., whaling, entanglement, collisions with large vessels) and will increase the population mortality rate above that caused by natural factors alone, and directly affect population abundance. In contrast, human activities with sub-lethal effects (e.g. habitat displacement) on marine mammals may affect their behaviour and physiology and lead to impacts on their health that may ultimately have population level effects (National Academies of Sciences 2017).

The largest threat to southern right whales that resulted in their dramatic population reduction was commercial whaling. This has resulted in a reduction of their historical range, and varying levels of recovery across the two populations (Carroll et al. 2014, Harcourt et al. 2019). Due to the life history characteristics of southern right whales (section 2.4), any impacts from threats will unlikely be detectable, or even reliably identified, over short timescales (i.e., 3 years). Impacts at the population level will likely only become identifiable over decadal timescales.

The main threats to the survival of the southern right whale are anthropogenic climate variability and change, entanglement in fishing gear, habitat degradation, anthropogenic underwater noise, and vessel strike. Other known or potential threats identified in this plan include whaling (if it were to resume), pollution, and prey depletion from overharvesting. To ensure the conservation and recovery of southern right whales, there is a need to protect existing and potential breeding habitat throughout the species current and projected range. Improved knowledge of their seasonal movements between calving areas, foraging, and migratory habitat is needed to implement effective management interventions.

The following provides an overview of the key threats to southern right whales in Australian waters, noting the current management measures in place to address the threat. Threats are listed in order of priority based on risk, as determined by the threat prioritisation process outlined in section 3.11.

3.1 Anthropogenic climate change and climate variability

Modelling the links between krill and whale population dynamics with climate change, including changes in ocean temperature, primary productivity, and sea ice, suggests future ocean conditions are likely to have a negative impact on krill populations and in association the baleen whale species that feed on them (Tulloch et al. 2019). Strong correlations have been observed between environmental conditions (e.g., sea surface temperature anomalies) on right whale high latitude feeding grounds and female reproductive success and recovery on their winter breeding grounds (Leaper et al. 2006, Meyer-Gutbrod et al. 2015, Seyboth et al. 2016). In the South Atlantic, conception can be affected by high sea surface temperatures (which can also occur as a result of earlier onset of El Niño conditions) in the autumn months of the previous year of conception, and can lead to depressed pregnancy rates (Leaper et al. 2006). Variability in prey abundance has been linked with climate cycles (e.g. El Niño-Southern Oscillation; ENSO) and

ocean warming in high latitude ecosystems, with anthropogenic climate change increasing the frequency and intensity of these climate cycles, and potentially impacting foraging opportunities for southern right whales (Dedden & Rogers 2022).

Southern right whale breeding success is believed to be driven by an underlying relationship with the availability and fluctuation of prey abundance on summer high latitude foraging areas and variation in calving rate may be influenced by climate factors impacting changes to calving intervals (Pirzl et al. 2008). If so, data on calving histories may be more effective and accessible indicators of the effects of oceanographic conditions on breeding success than data on pregnancy rates (Leaper et al. 2006). Annual calf production at the Head of Bight has been linked to variability in the ENSO, with reduced reproductive output associated with El Niño conditions on a 2.5 to 3-year time lag. Extended intervals between successful calving events have also been associated with variability in the Southern Annular Mode (SAM) on a 3-year time lag (Pirzl et al. 2008). The likelihood of a negative impact from climate change on southern right whale breeding success is unclear, and at present there are uncertainties in how anthropogenic climate driven changes might impact the Southern Ocean ecosystems and the food webs on which southern right whales rely.

3.2 Entanglement

Entanglements occur when whales encounter materials such as fishing lines, ropes, and nets and parts of their body become entangled. Entanglement and bycatch in fisheries gear (either active or discarded fishing gear) is a significant threat to the survival of cetacean species and populations globally (IWC 2010). There is relatively good understanding on the types of gear involved in causing death to marine vertebrates by entanglement, although comparatively little is known about which types of debris cause mortality through ingestion (Roman et al. 2021). Entanglement in fishing gear is one of the major threats to the survival of the Critically Endangered North Atlantic right whale (NARW) (Moore et al. 2021, Knowlton et al. 2022). Sub-lethal entanglements in fishing gear are energetically costly for large whales (van der Hoop et al. 2017) and have been attributed to depressed growth in NARW, resulting in poorer body condition (Christiansen et al. 2020), and shorter body lengths that also extends to offspring of females of shorter body length (Stewart et al. 2021). The impact of entanglement on the body length and condition of whales has consequences on reproductive success, with reduced body length a potential contributor to low birth rates (Stewart et al. 2022). The risk of entanglement is not as high to southern right whales in Australian waters compared to NARW, however, the consequences in terms of energetic costs and impact to body condition and health could likely be the same.

3.2.1 Active fishing or aquaculture equipment

In Australia, the overlap between the nearshore coastal distribution of southern right whales and inshore fisheries increases the risk associated with encountering fisheries gear and entanglement. Historical analyses of entanglements has observed an increase in reported entanglements of southern right whales across their range in fishing gear from the 1980's to 2006, with at least one fatal entanglement (in longline fishing gear) and 12 non-fatal entanglements (Kemper et al. 2008). Most entanglements were related to lines or nets, often associated with traps and pots set to catch crustaceans, with one entanglement in a fish farm in Tasmania (Kemper et al. 2008). More recent evaluation of cetacean incidental entanglements

and bycatch throughout Australian waters reported 28 entanglements between 1887 to 2016, and identified that the highest risk to southern right whales was from trap and net gear (Tulloch et al. 2020).

Passive fishing gear, such as mesh nets and conventional drumlines, are often deployed adjacent to populated beaches as a public safety measure for bather protection to reduce shark interactions with beach-goers (McPhee et al. 2021). This is particularly prominent in Queensland and New South Wales, and results in the capture of target and non-target species, including whales such as humpback whales (Industries 2022). There is the potential risk of entanglement in bather protection shark mesh nets to southern right whales due to their coastal dependence and distribution, and in NSW these nets remain in place where southern right whales have been recorded. There has also been a recognised need for non-lethal methods, including new technologies, due in part to the consequence of bycatch in these systems. Recently, the new shark fishing device known as the Shark-Management-Alert-in-Real-Time (SMART) drumline has been trialled in many coastal areas in NSW and WA waters, which could assist mitigation of southern right whale entanglements associated with bather protection programs (McPhee et al. 2021).

The impact of entanglement to southern right whales is likely to be greatest for the eastern population, given that any entanglement affecting mortality or fitness of even a low number of breeding females in that region may have a significant impact on recovery rates. The eastern population is distributed across a region of densely human populated cities and coastal areas and overlaps with State and Commonwealth commercial and recreational crab and lobster fisheries. In comparison, due to the higher population abundance of the western population, entanglement is unlikely to have population level impacts at current levels of entanglement rates. However, changes to the southern rock lobster trap fishery in SA, including opening the fishing season year round since 2017 (Linnane et al. 2017), have increased the number of gear and vessels in or near important calving grounds and migratory routes, and this may result in more right whale entanglements in the future (Tulloch et al. 2020).

Substantial progress towards addressing the threat of entanglement can occur when there is collaboration between the fishing industry, government, non-government organisations and research organisations, e.g. How et al. (2015). In WA, the Western Rock Lobster Council developed the *West Coast Rock Lobster Managed Fishery Code of Practice for Reducing Whale Entanglements* in association with government and non-government agencies to reduce interactions with whales. Similarly, a *Code of Practice Southern Rocklobster Responsible fishing guidelines for operators in Victoria* was developed in Victoria and a *Code of Practice for the NSW Lobster Fishery* was established in NSW. Gear modifications have been shown to effectively reduce the threat of entanglement in fishing gear. For example, in the WA rock lobster fishery the elimination of surface rope through shortened rope lengths and reduced float numbers reduced entanglement by at least 25 percent, with a median reduction of 64 percent (How et al. 2021). There is substantial focus and effort being undertaken in evaluating and implementing ropeless fishing gear to reduce the risk of entanglement to whales and minimise gear loss (Myers et al. 2019), with trials of ropeless technology underway in several States (i.e. NSW, VIC, WA).



Figure 7 A southern right whale off western Victoria in 2021 with rope entangled around the tail stock. © Ian Westhorpe.

3.2.2 Marine debris

Pollution of the marine environment by solid waste termed “marine debris” is a growing global challenge that has concerns to the welfare of all marine wildlife, including charismatic megafauna such as whales (Roman et al. 2021). The United Nations Environment Program define marine debris (or marine litter) as any persistent, manufactured or processed solid material discarded, disposed of, or abandoned in the marine and coastal environment (Macfadyen et al. 2009). Marine debris may cause injury or death through drowning, injury through entanglement and internal injuries, or starvation following ingestion. Marine debris that causes injury and fatality through entanglement and ingestion was recognised in 2003 as a key threatening process for marine vertebrates under the EPBC Act. In response, the *Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans 2018* (Marine Debris TAP) was developed. Marine debris, as defined under the Marine Debris TAP, consists of:

- land-sourced garbage,
- fishing gear from recreational and commercial fishing abandoned or lost to the sea, and
- vessel-sourced, solid, non-biodegradable floating materials disposed of or lost at sea.

Entanglement of whales in derelict fishing gear that has been abandoned, lost or discarded from commercial or recreational fisheries can pose a risk to cetaceans and other protected marine

species, such as marine turtle, dugong and sawfish (Kiessling 2003). In the case of whales, it can be difficult to determine the proportion of entanglements caused by active versus discarded fishing gear because they can potentially interact and displace active fishing gear that may not be recorded using standard bycatch methods (Macfadyen et al. 2009, Tulloch et al. 2020). In Australia, the risk of entanglement in active fishing gear is far greater than discarded and derelict gear and few southern right whales have been reported entangled (Tulloch et al. 2020).

Marine debris can also enter the marine environment in the form of plastic from multiple sources from land-based activities, and coastal urban areas can heavily pollute watersheds and contaminate the oceans. There is a positive correlation between urban density and microplastic abundance and therefore marine organisms inhabiting coastal waters are at risk of microplastic ingestion (Au et al. 2017). Microplastics are ingested by marine animals in a range of ways, such as up the food web via trophic transfer and of particular concern for baleen whales, directly consumed in large volumes of water while foraging (Zantis et al. 2022). Ingestion of marine debris, however, is thought to be unlikely for southern right whales in Australian coastal waters given whales are less likely to be feeding.

3.3 Habitat degradation

Physical modification of habitat can degrade the quality and reduce the quantity of available habitat and may be caused by the construction of ports and marinas, oil and gas infrastructure, marine aquaculture facilities, marine (offshore) renewable energy infrastructure and coastal development. It has the potential to spatially displace individuals or modify behaviour. Habitat degradation may result in short-term physical displacement of individuals from areas and habitat that they may rely upon (e.g., BIAs), and over the long-term could result in loss or abandonment of important habitats such as those used for reproduction and feeding, ultimately reducing a population's capacity for recovery.

3.3.1 Infrastructure/coastal development

Habitat degradation through the development of infrastructure such as ports, marinas, aquaculture facilities, and marine/ocean energy production facilities could lead to disturbance, and potentially physical displacement, of southern right whales from preferred habitats and may disrupt movements (i.e. coastal and offshore movement) by acting as barriers to migration into and along coastal breeding areas. The construction of such infrastructure may involve dredging and pile driving which can also alter and degrade habitat through creation of underwater noise. Displacement of whales through habitat degradation has the potential to reduce breeding success (Best 2000) by forcing animals to reproduce in more marginal environments and by increasing their exposure to other risks such as entanglement, predation, collisions and pollution. Associated industrial activities in the coastal zone may also reduce habitat within BIAs.

3.3.2 Infrastructure/offshore development

Offshore development is largely associated with the production of energy and addressing Australia's energy demands, and includes infrastructure related to extraction of fossil fuels (e.g., oil and gas platforms) and production of offshore renewable energy. Potential impacts on habitat that can lead to degradation can occur in the various stages of the development, including exploration, infrastructure installation, operation, and de-commissioning. An

emergent market now in Australia is offshore renewable energy, involving using offshore wind, waves, and tidal power in coastal and offshore waters. With the introduction of the *Offshore Electricity Infrastructure Act 2021* to facilitate and regulate the development of electricity infrastructure in Commonwealth waters, there is expected to be substantial increases in the development of offshore renewable energy facilities and infrastructure in coastal and offshore waters. Offshore development, including installation of infrastructure, could lead to disturbance of southern right whales, and may act as barriers to migration into coastal breeding areas.

3.4 Anthropogenic underwater noise

Anthropogenic underwater noise is recognised as having a potentially significant impact on marine animals, and in particular marine mammals, because they rely on sound for basic life functions such as communication (including for mating), navigation, foraging, and predator avoidance. Their dependence on sound for their survival makes them sensitive to anthropogenic noise, which can affect the health and fitness of individuals, and can ultimately result in population level effects (Erbe et al. 2018). Anthropogenic underwater noise is categorised as impulsive noise types (e.g., pile driving and seismic airguns) or non-impulsive noise types (e.g., shipping), that can be of short (i.e., transient) or longer duration (i.e., chronic). These may have impacts on marine mammals ranging from physiological stress, temporary behavioural responses/disturbance and acoustic interference (i.e., masking) to auditory impairment (e.g., temporary threshold shift or permanent threshold shift), which includes acoustic injury (Southall et al. 2007, Southall et al. 2019). Growing evidence demonstrates that the probability of a behavioural response involves various factors, which includes the received levels that animals are exposed, the animals behavioural state, and the nature and novelty of the sound (Ellison et al. 2012). The following sections focus on the main types of activities that produce impulsive and non-impulsive sounds that southern right whales will most likely encounter.

Impacts to marine mammals from anthropogenic underwater noise can be assessed using noise exposure criteria, which considers that marine mammals vary in hearing sensitivity and underwater noise in certain frequency ranges may impact marine mammal taxa differently (Southall et al. 2019). Much of the research attention on determining impact and threshold levels for regulation has focused on single exposure metrics to assess acute effects. Adverse effects of chronic sound sources (e.g. commercial shipping) at the individual, population, species' habitat, or ecosystem levels have not been incorporated into management decisions to the same extent as transient impulsive sound types (Ellison et al. 2012). Furthermore, there is currently a lack of understanding of the impacts from cumulative exposure from multiple sources of anthropogenic underwater noise on marine mammals and the appropriate frameworks for assessment (Faulkner et al. 2018).

The potential for impacts from anthropogenic underwater noise is of particular concern within or close to HCTS for southern right whales (i.e., reproduction BIAs) where whales, including pregnant and nursing females and calves, are resident for long periods (e.g., weeks to months). Marine mammals, such as southern right whales, rely on underwater sound to communicate. The range their sounds can be successfully detected can be limited by contributions of anthropogenic noise to the marine soundscape, which can mask the whale's underwater acoustic communication. Right whales have demonstrated increases in the amplitude of their upcall in response to increasing background noise levels, particularly in the frequency below 400 Hz, which is the range they use to communicate (Parks et al. 2010). As southern right whales

recover from commercial whaling and their distribution and abundance increases, anthropogenic underwater noise may have the potential to disturb and/or deter southern right whales from occupying HCTS or currently unused but historically important areas.

3.4.1 Industrial noise

Industrial noise, particularly from underwater construction activities arising from coastal and offshore developments, provides a potentially increasing threat to southern right whales and may interfere in their acoustic communication. The construction, operation and decommissioning of coastal and offshore developments, such as oil and gas platforms or floating processing facilities, marinas and ports, and marine renewable energy facilities, all create underwater noise from a wide range of activities. Development activities produce anthropogenic underwater noise as impulsive and non-impulsive sounds, including pile-driving, blasting, some forms of dredging, and sonar, that may be transient in nature whereas chronic industrial noise may include vessel noise (shipping and tender vessels) and operation of oil and gas facilities. There are also peripheral support activities, such as additional shipping traffic around marinas and ports and helicopter activity around oil and gas platforms to transport personnel. Most of these infrastructure projects require pile-driving during construction, which involves driving piles (beams or posts) into the seafloor to support the foundations of the structure. This creates strong (e.g. dependent on hammer energy; 237 dB re: 1 μ Pa @ 1 m for 1000 kJ hammer) and predominately low frequency (< 1000 Hz) intermittent noise (Hildebrand 2009). Oil and gas developments also include other activities that contribute to anthropogenic noise, including trenching and pipe laying during construction, drilling, power generation and pumping during operation.

Associated with a greater understanding of the impacts of climate change on our environment, there is growing demand for sustainable, or green energy, to reduce our greenhouse gas emissions. Subsequently, there has been an increasing number of offshore wind farms and tidal turbines proposed, developed, and installed globally in recent years, predominantly in Europe. Australia is undergoing the development and installation of offshore energy infrastructure, regulated through the *Offshore Electricity Infrastructure Act 2021*. Most research of underwater noise impacts related to offshore wind energy has focussed on the construction phase rather than the operational phase, and particularly pile driving (Stöber & Thomsen 2021), which requires an assessment of impacts to southern right whales and appropriate management. Most of the energy of operational noise from offshore wind infrastructure is in the lower frequency range (i.e. below 1 kHz) and underwater noise levels from operational wind farms increase with the size of the wind turbines, expressed in terms of their nominal power output (Tougaard et al. 2020, Stöber & Thomsen 2021).

3.4.2 Seismic surveys

Seismic systems use intense, impulsive sound to actively image geological structures below the seafloor and seismic surveys used for oil and gas exploration are a particularly intense source of noise when undertaken. Marine seismic surveys are a method of locating and describing marine oil and gas deposits. This is achieved by using air gun arrays towed behind ships to release air downward under pressure, producing powerful (up to 260 dB re: 1 μ Pa @ 1 m) and predominately low frequency (5 to 300 Hz) sound waves typically repeated in ~10 s intervals (Hildebrand 2009). Impulsive sounds such as these present a greater risk than most continuous sounds because of the high peak levels and frequent repetition. Note that while the level of the

anthropogenic sound is usually reported at 1 m from the source as is standard, it is the level of the sound when received by the individual that is relevant for the whale (but this value is more difficult to determine). At lower received levels other responses may occur such as displacement and behavioural responses, such as increased social and feeding call rates as demonstrated in blue whales (Di Iorio & Clark 2010).

Implementation of the practical measures outlined in the *EPBC Act Policy Statement 2.1* are intended to minimise the risk of auditory impairment (including acoustic injury) to whales. Impacts can be classified as physical (e.g., permanent or temporary hearing loss) when within proximity to a seismic noise source, and behavioural (e.g., avoidance of areas, disturbance and disruption to calving and nursing behaviour, stress) which may occur many kilometres from the seismic survey. While these guidelines advise that seismic surveys should be undertaken outside of times the species occupy BIAs, it is not known at what distance from a seismic source behavioural impacts occur or the extent of any behavioural impact. Furthermore, the *EPBC Act Policy Statement 2.1* does not consider cumulative noise exposure from multiple noise sources and periods. The precautionary principle should be applied in these cases when a lack of full scientific certainty exists.

3.4.3 Vessel noise

Marine traffic in the world's oceans is increasing and consequently so too are the levels of vessel noise, with shipping noise being the primary source of chronic noise exposure on marine mammals. Marine traffic consists of small recreational vessels ranging to large commercial ships. Vessel noise from ship traffic contributes to increasing low frequency ambient noise levels within the vocalisation and hearing range of baleen whales (Miksis-Olds et al. 2013, Miksis-Olds & Nichols 2016, Erbe et al. 2019). Increases in numbers of smaller recreational vessels (< 25 m long) is linked to increasing human population and use of the coastal marine environment, whereas commercial ships are increasing in number and size, which is linked to overall economic growth (Erbe et al. 2019). There can be a large range in the source levels of small vessels (< 25 m) depending on vessel type and design, with vessel noise potentially ranging from 130 dB re 1 μ Pa m for 'electric' vessel types to 195 dB re 1 μ Pa m for 'cargo' vessels (Parsons et al. 2021).

There have been periodic reviews of the state of knowledge of impacts from vessel noise on marine mammals (Richardson et al. 1995, Nowacek et al. 2007, Erbe et al. 2018). Most research of the impact of vessel noise on right whales has been on North Atlantic right whales because the population is Critically Endangered, and vessel strike is one of the major causes of mortality. Ship noise can potentially increase stress in right whales, with analyses of North Atlantic right whale faecal hormone metabolites showing a decrease in baseline stress hormone levels associated with a reduction in ship traffic, and a 6 dB decrease in background noise levels with significant reduction in noise below 150 Hz (Rolland et al. 2012). Modelling of shipping noise and right whale vocalisations suggests that nearby large vessels (e.g. container ships) and increased background noise from distant shipping may mask vocalisations and substantially limit the communication space of right whales, particularly mother and calf pairs (Cunningham & Mountain 2014, Tennessen & Parks 2016).

Modelling the cumulative levels of shipping noise in Australian waters shows areas where shipping noise may have greater contributions to the marine soundscape above background

noise from natural processes such as wind noise (Peel et al. 2021). Areas where shipping noise has a greater contribution to the marine soundscape and are closest to southern right whale BIAs, occur off the Gippsland coast of Victoria and the northern NSW coastline, where there is greater vessel traffic from domestic and international shipping vessel transits (Peel et al. 2021). The other area where shipping noise contributes above wind noise, although to a lesser extent than Victoria and NSW, is the south-west WA coast near reproductive BIAs occurring from Augusta to Albany.

Much of the nearshore, coastal areas that southern right whales occupy around the Australian coastline are predominantly used by small (< 25 m-long) vessels, which depending on the type of vessel have different source levels and levels of noise they input into the marine soundscape (Arranz et al. 2021, Parsons et al. 2021). Typically, electric and hybrid engine powered vessels have lower estimated source levels than vessels (e.g., catamarans) with inboard diesel/petrol engines (Parsons et al. 2020, Arranz et al. 2021, Parsons et al. 2021). Consequently, different vessels may produce very different received levels to the animals, and increasing vessel speed can increase vessel noise, which may elicit behavioural disturbance in whales (Sprogis et al. 2020, Arranz et al. 2021). This has important implications on the whale-watching industry given the often greater duration spent in the presence of whales (section 3.6.1).

3.4.4 Aircraft noise

Low-flying airplanes and helicopters (e.g., used for tourist charter flights and research) can propagate sound along the ocean surface and into the water column. The volume and extent of propagation vary depending on the type of aircraft and the length of time the aircraft is in the area (Luksenburg & Parsons 2009). These sounds are typically of short duration and limited to the area directly below the aircraft. Aircraft noise, most likely from a light aircraft, was recorded in underwater noise recordings in Fowlers Bay (SA) and characterised by relatively low frequency sound between approximately 150 and 600 Hz (Ward et al. 2019). Fowlers Bay is identified as a reproductive BIA and is largely removed from major shipping routes that would contribute vessel noise to the marine soundscape, such that anthropogenic noise from vessels and aircrafts was sporadic and did not contribute significantly to noise levels (Ward et al. 2019).

Noise from low-flying aircraft and helicopters could cause disturbance in aggregation areas, especially when whales spend a significant amount of time at the surface (e.g., resting mother and calf pairs) and where there is repeated exposure. Southern right whales have demonstrated behavioural reactions to helicopters, most likely as a result of the down draught of the rotor blades at low altitude, by increasing their dive times (Ling & Needham 1988).

3.5 Collision

The risk of collision can result from the introduction of physical objects, mobile or immobile, that may collide with or result in potential collision of marine mammals. The most common type of collision involving whales is vessel strike, where vessels may cause physical injury or behavioural disturbance to whales. Vessel collision or vessel strike is defined as any physical impact (i.e. including non-fatal and fatal) involving any part of a vessel (most commonly bow or propeller) and a live whale (Cates et al. 2017). Vessel collisions can involve a range of vessel types from large commercial vessels to recreational vessels, including personal watercraft. Interactions of southern right whales with commercial vessels involved in whale-watching

activities is addressed in a separate section due to the specific management arrangements (i.e., national guidelines) that exist for these vessels.

There is also the potential risk of collision with underwater turbines associated with wind energy developments, although this predominantly relates to tidal and river energy conversion technologies and their underwater moving components (Sparling et al. 2020). It is possible the greater risk of collision associated with offshore wind turbines would be associated with vessel strike from support vessels.

3.5.1 Vessel strike

In Australia, southern right whales are the second most common species involved in Australian vessel strikes, which is consistent with worldwide data (Peel et al. 2018). An historical assessment of vessel strike between 1950 – 2006 involving southern right whales undertaken by Kemper et al. (2008) found two fatal and three non-fatal vessel collisions in Australian waters, although this likely provided an underestimate due to the use of mainly stranding records to assess human related mortality and injury. At present, there have been ten vessel strike reports of southern right whales in Australian waters between 1997 and 2015, with at least four mortalities including mother-calf pairs in the region of the eastern population (Kemper et al. 2008, Lanyon & Janetzki 2016, Peel et al. 2018). A presumed non-fatal vessel collision was documented by local researchers at Head of Bight in 2016, where a mother with a calf with propeller cuts on her body were photographically documented although no other reports of the interaction exist, presumably because the vessel strike went unnoticed from on-board the vessel (Peel et al. 2018).

The greatest challenge to understanding the threat of vessel strike is that many incidents go unreported for a range of reasons (e.g. particularly from large vessels that may not notice a strike), which makes quantifying the threat difficult (Peel et al. 2018, Ritter & Panigada 2019). For example, there is only one vessel strike report involving a large vessel (> 50 m) in Australian waters, yet there is evidence that collisions with larger vessels are occurring (e.g. photographs of vessel strike wounds and whale stranding's with wounds consistent of propeller cuts), therefore the lack of data is most likely a detection issue (Peel et al. 2018).

Vessel strike has been demonstrated to have a significant impact on small recovering whale populations, such as the North Atlantic right whale, whereby the mortality rate is particularly high compared to the overall population size (Conn & Silber 2013). Consequently, the threat of vessel strike in Australia is likely to be greater in the eastern population than the western population, given its small population size and overlap with highly human populated regions and Australia's largest ports (i.e., Melbourne and Sydney).

Proven effective mitigation measures for addressing vessel strike are to reduce co-occurrence of vessels with whales through separation of vessels from areas with high concentrations of whales and to reduce vessel speeds. Such measures require the identification of high risk areas through detailed studies of patterns of whale and vessel distribution (MEPC 2021). The timing of reported vessel strike incidents in Australia matches the migratory patterns of whale species (Peel et al. 2018). Mitigation actions to prevent injury and minimise disturbance from vessels to southern right whales include seasonal or temporary area restrictions/exclusions and speed restrictions in BIAs and habitat critical for survival.

The *National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna 2017* outlines a strategic framework for minimising the risk of vessel strike, including data acquisition to address knowledge gaps, data analysis to determine the risk of vessel strike, mitigation to reduce the likelihood and severity of vessel collision and effective communication at all stages of the process. The Australian Maritime Safety Authority regulates and manages commercial shipping in Australia and is responsible for the safety and navigation of domestic commercial vessels and prevention of shipping related pollution in the marine environment.



Figure 8 A Southern right whale mother and calf at Head of Bight (SA) in 2016 with evidence of vessel strike. © Fredrik Christiansen, Aarhus University.

3.6 Disturbance from vessels and water activities

3.6.1 Boat-based whale watching

Commercial whale watching is recognised as having educational, cultural, and direct and indirect economic benefits for regional communities. However, there is also the potential for whale watching by commercial vessels to negatively impact whale populations over time. Direct and modelled evidence documents short-term responses of cetaceans to disturbance caused by whale-watching vessels (Erbe 2002, Parsons 2012, Christiansen et al. 2013, New et al. 2015, Sprogis et al. 2020, Sprogis et al. 2023). For example, modelled short term exposure of vessel noise causing a temporary shift in hearing threshold of killer whales and prolonged exposure potentially causing permanent shifts in hearing (Erbe 2002), or behavioural disturbance to minke whales through shorter dives, increased sinuous movement, and reduced foraging

activity (Christiansen et al. 2013). For southern right whales, there are potential concerns regarding vessel disturbance from noise (section 3.4.3) and the presence of whale watch vessels in BIAs where there might be repeated exposure on individuals, such as mothers and calves. In Encounter Bay (SA), behavioural focal follow data shows resting behaviour of mother and calf pairs is significantly reduced following the presence of commercial whale-watch vessels, which may be due to increased vessel speed (and subsequent vessel noise) on departure of a whale-watch interaction (Sprogis et al. 2023).

The Australian Government developed the *Australian National Guidelines for Whale and Dolphin Watching 2017* to ensure whale watching is a sustainable practice that minimises impacts on whales and dolphins. The Commonwealth, State and Territory governments have regulations on interacting with marine mammals, including specified approach distances, no approach and caution zones, and restrictions on the numbers of vessels allowed around marine mammals. Consequently, the whale-watching industry is regulated and the risk of vessel collision from whale-watching vessels is considered low, although compliance with regulations is difficult to monitor. Given the scale of the industry and number of whale-watch operators that may opportunistically encounter southern right whales, there is the potential for acute disturbance events related to the presence of vessels that could lead to cumulative chronic disturbance across their range if regulations are not complied with.

Commercial boat-based whale watching targeting southern right whales is currently located in Busselton, Augusta, Flinders Bay and Albany in south-west Western Australia, around the Fleurieu Peninsula and Fowlers Bay in South Australia. Within the NSW South Coast, whale watch operators are also beginning to target southern right whales during June to August when humpback whales are less frequent and southern right whale sightings are slowly increasing. These areas include Eden, Merimbula, Bermagui, Narooma, Batemans Bay and Shellharbour. Opportunistic whale watching also occurs in western Victoria (i.e., Port Phillip and Westernport Bays), Tasmania, Western Australia, and New South Wales. Most of the opportunistic whale watching occurs in the eastern population range of southern right whales where the numbers of whales are lowest and most inconsistent. Consequently, this may have a significant impact on the eastern population if opportunistic whale watching causes disturbance to resting and calving southern right whales and is not actively managed.

A form of commercial interaction that has emerged is the “swim-with” industry in which swimmers enter the water and attempt to closely observe free ranging whales and dolphins, particularly with humpback whales (Sprogis et al. 2020, Stack et al. 2021). There are currently no ‘swim-with-whale’ programs permitted for the southern right whale in Australia, although a high degree of scrutiny should be given if ever proposed given the potential impacts reported for other species. Behavioural responses from humpback whales to swim-with whale tours have been reported in both Hervey Bay and Ningaloo Reef. While responses will likely be context-dependent, these include whales exhibiting horizontal and vertical avoidance strategies by adopting a less predictable path, increasing turning angles away from the vessel, increasing swim speeds, and decreasing the duration of their dives (Sprogis et al. 2020, Stack et al. 2021). Off the coast of Argentina, southern right whales were found to decrease their proportion of time spent resting and increase the proportion of time spent travelling in the presence of “swim with interactions”, with mothers and calves being most sensitive to the presence of swimmers (Lundquist et al. 2013).

3.6.2 Recreational vessels and waterborne activities

Disturbance from opportunistic (e.g., sightseeing, fishing, scuba diving) and private recreational vessels and watercraft (e.g., jet skis), or others, may negatively affect whale populations over time as an incidental consequence of the primary activity being undertaken. This may occur from associated waterborne and in-water activities such as swimmers in the water or the presence/noise of the vessel. The shallow waters and protected embayments preferred by southern right whales resting and weaning calves often overlap favoured areas by recreational water users and waterborne activities, including swimmers, kayakers, stand-up paddle boarders and small motorised vessels (i.e., jet-skis). Mother and calf pairs resting in these areas are at potential risk of disturbance from recreational users which may result in displacement from these areas. The *Australian National Guidelines for Whale and Dolphin Watching 2017* and State and Territory approach guidelines define standards for the approach distances of all vessels to whales and dolphins to reduce disturbance and potential risk of vessel collisions.



Figure 9 A southern right whale mother and calf responding to surfers at Manly Beach (NSW) with a tail flick in August 2020. © Thom and Lianne @whatifwefly.

3.7 Whaling

Right whales were a primary target of whalers from the mid-16th century to late 20th century and the near extirpation of many southern right whale populations from commercial whaling has been well documented (Reeves & Smith 2003, Jackson et al. 2008) (section 2.3). Commercial whaling of southern right whales is currently banned under the IWC moratorium on commercial whaling, and protection is afforded due to their classification by the IWC as ‘Protected Stocks’. It is currently unlikely that commercial whaling in areas covered by the IWC Southern Ocean

Sanctuary will resume, however, there is no certainty that countries not part of the IWC may not renew whaling interests in these areas in the future.

3.8 Prey depletion

Southern right whales rely on krill and copepods as a major food source, and as capital breeders require adequate supplies of food to accumulate energy reserves for migration and breeding (Bannister et al. 1997, Tormosov et al. 1998).

3.8.1 Prey depletion from climate change

Climate change and ocean warming are projected to reduce available krill habitat in the Southern Ocean (section 3.1), with contraction to their southern limits and resulting in possible declines in abundance and/or biomass (Murphy et al. 2017, Atkinson et al. 2019, Veytia et al. 2021). Climate change alters the extent and structure of sea-ice environments, and krill are highly dependent upon sea-ice habitats for survival in their early life stages (Murphy et al. 2007). Climate change is predicted to negatively impact krill and whale population dynamics, with predicted declines in southern right whale abundance resulting from krill biomass (particularly in latitudes 50 - 60°S) and increased interspecific competition between whale species (Tulloch et al. 2019).

3.8.2 Prey depletion from overfishing

Over-exploitation of prey stocks may impose a further major threat to southern right whales that are dependent upon them for food (section 2.9). Antarctic krill (*Euphausia superba*) are an ecologically and commercially important species in the Southern Ocean (McBride et al. 2021), with the Antarctic Krill Fishery being the largest fishery by tonnage in the Southern Ocean (Nicol et al. 2012). The krill fishery is managed through CCAMLR on an ecosystem basis that takes into account the needs of predators such as whales (McBride et al. 2021). Risk frameworks for vulnerable marine ecosystems, seabirds, and marine mammals have been developed.

Australia is a Member of CCAMLR, and krill fishery catch limits off the Australian Antarctic Territory are determined using a precautionary approach that aims to minimise the threat of overfishing by krill fisheries to species such as southern right whales. The CCAMLR Working Group on Fishery Stock Assessments undertake regular risk assessments of the fishery. Vulnerable marine ecosystems and impacts on the environment, including impacts to food chains, are considered in the management of CCAMLR fisheries.

3.8.3 Prey depletion from seismic survey

Current understanding of the potential impacts of seismic survey airgun noise on zooplankton is limited, despite their importance in marine ecosystems, although high mortality can occur on small localised scales of < 10 m (Fields et al. 2019). Exposure of zooplankton to the intense, low-frequency, acoustic impulse signals in the first large experimental field setting found a decrease in zooplankton abundance with associated mortality within the area of seismic activity up to 1.2 km from the source (McCauley et al. 2017). A modelled simulation scenario based on these findings, utilising the same mortality rates and ocean circulation models, found the decline in zooplankton can be spatially dependent and affected by ocean circulation. Zooplankton biomass within 15 km recovered quickly (~ 3 days) based on fast growth rate parameters. Greater

declines were estimated at closer distances (up to 15 km), with minimal impact at regional scales (≥ 15 km) (Richardson et al. 2017).

Any impacts of seismic activity on prey abundance or distribution are unlikely to have a substantial impact on southern right whales during the austral winter breeding season because the whales do not typically forage during this time. If opportunistic foraging were undertaken, it would likely be constrained to upwelling areas of higher productivity. The greatest impact to southern right whales from prey depletion by seismic surveys would likely occur on southern right whale foraging areas in the Southern Ocean and Antarctic waters (Erbe et al. 2019), although seismic activity is low at present in these areas.

3.9 Pollution

A wide variety of pollutants can enter the marine environment through processes including dumping, run-off from urban, agricultural, or industrial sources, effluent from sewerage treatment outflows and atmospheric transport. Marine pollution can have a variety of possible direct consequences for southern right whales at an individual and population level, or indirectly through harming their prey or the ecosystem. In extreme cases, acute chemical discharge such as oil or condensate spills have shown to cause long-term, population-level declines in whales (due to toxicity and associated mortality) (Matkin et al. 2008). The threat of toxic marine pollution to the environment is managed through a variety of initiatives. The threat of pollution entering the sea through dumping is managed by the *Environment Protection (Sea Dumping) Act 1981* and the *Environment Protection (Sea Dumping) Amendment Act 1986*. Land-based pollution sources are managed through Australia's National Programme of Action for the Protection of the Marine Environment from Land-Based Activities.

3.9.1 Chronic chemical pollution

Southern right whales may be regularly exposed to chemical pollution from sewage and industrial discharges and high nutrient load run-off from onshore activities such as agriculture, all of which are the most likely source of pollution in coastal BIAs. Although, given southern right whales are rarely believed to feed in their coastal distribution the risk from chemical pollution is likely low. In their feeding grounds, southern right whales are most at risk from bioaccumulation of human-made chemicals such as organochlorines and persistent organic pollutants. There has been growing concern regarding pollutants that undergo bioaccumulation (i.e., the accumulation of substances in an organism) and biomagnification (i.e., the increase in concentration of a substance in an organism) up the food chain. Pollutants with these characteristics do not break down quickly in the environment and given many marine mammals are apex marine predators (e.g., killer whales), they have the potential to accumulate relatively high levels through biomagnification. Marine plastics, and particularly microplastics, provide a global transport medium for the most toxic chemicals into the marine food chain and ultimately, to humans. Persistent organic pollutants (POPs) is one example of pollutants that comprise a wide range of chemicals (e.g. DDT, PCBs) that undergo bioaccumulation and biomagnification (Jones & de Voogt 1999), predominantly entering the marine environment through atmospheric transport, reaching as far as Antarctica (Bengtson Nash 2011). Due to the recognition of the threat of POPs on human health and the environment, the *Stockholm Convention on Persistent Organic Pollutants* was enacted in 2001 under the United Nations Environment Programme for which Australia ratified the Convention in 2004. POPs have been found in the blubber and tissue

samples of many cetacean species, including killer whales (Desforbes et al. 2018, Schlingermann et al. 2020), humpback, blue (Metcalf et al. 2004) and fin whales (Taniguchi et al. 2019), and is of particular concern for odontocetes given their marine apex predator status (Jepson Paul & Law Robin 2016). Currently, an evaluation of the threat of POPs to southern right whales has not been undertaken.

Heavy metals are also persistent and can bioaccumulate and biomagnify. Heavy metal concentrations can increase in the environment through mining and processing, burning fossil fuels, and the use of fertilisers or pesticides containing heavy metals. These can enter the marine environment through run-off, effluents, or atmospheric transport. The effects of heavy metals and their degree of toxicity in cetaceans is poorly understood, but there is evidence that heavy metals may pose a threat in baleen whales through immunosuppression, such as hexavalent chromium in North Atlantic right whales (Wise et al. 2008).

3.9.2 Acute chemical discharge

Southern right whales could also be exposed to acute chemical discharge from accidental oil or condensate spills from oil rigs and vessels. Oil spills can affect marine mammals through a variety of direct and indirect pathways. Direct pathways include inhalation, ingestion, and dermal exposure, each of which can initiate a range of physiological responses with health and long-term survival and/or reproduction consequences. For most marine mammals, the most serious acute health threat may be severe damage to the respiratory system through inhalation of the volatile and highly toxic aromatic components of oil (Helm et al. 2014). Ingestion of oil through consumption of contaminated prey would be expected to harm various internal organs (e.g., liver, kidney, and intestines) and organ systems (e.g., digestive and urogenital). Mild dermal exposure would cause at least short-term injuries to mucus membranes, eyes, and other external soft tissue areas, while severe oiling could result in death by smothering (Helm et al. 2014). Oil spills have the potential to have the greatest impact on southern right whales within or near reproductive BIAs, when there are larger concentrations of whales engaged in breeding activities over sustained periods of time (i.e., weeks to months). Oil spills may also affect southern right whales in offshore foraging areas or migratory paths.

3.9.3 Electromagnetic field disturbance

There is an increase in offshore renewable energy development in Australia's marine environment to meet the country's energy needs. Associated with this is likely the installation of subsea power cables connecting turbines, storage banks, and export cables to shore. While electromagnetic fields (EMF) occur naturally in the environment, cables associated with marine renewable energy installations generate their own EMF (electric and magnetic field) that can alter the background EMF within an area (Gill 2005). Cetaceans can sense the geomagnetic field and potentially use it to navigate during migrations, although it is unclear whether they use the geomagnetic field solely or in addition to other regional cues (Klinowska 1990, Walker et al. 1992). It is also not known which components of the geomagnetic field cetaceans are sensing (i.e., the horizontal or vertical component, field intensity or inclination angle) and what effects the perturbations in the geomagnetic field within the vicinity of buried power cables may have on these animals. There is a potential for whales to respond to local variations of the EMF resulting from increased sources from marine renewable energy installations that could induce short-term behavioural responses (i.e., changes in swim direction) to larger effects influencing migration.

3.10 Cumulative effects from threats

The assessment of risk for each threat to southern right whales in this Recovery Plan is considered in isolation of every other threat (section 3.11). Although when southern right whales are subject to multiple threats, acting either simultaneously or consecutively across their life cycle, cumulative effects may occur. A range of natural and anthropogenic stressors can affect southern right whales and these stressors are likely to interact, yet their cumulative effects are difficult to predict. Furthermore, larger-scale ecological drivers may affect many of these stressors. For example, anthropogenic climate change and ocean warming affects southern right whale prey availability on their foraging grounds, and reduced prey availability has been linked to depressed calving intervals for breeding female southern right whales (Leaper et al. 2006, Seyboth et al. 2016). However, the ability to reliably identify and separate the effects of climate change on female calving rates and breeding success from other threats, such as habitat degradation and disturbance within calving areas, is difficult. Irrespective, if both threats potentially impact on breeding success, then the cumulative effects from both could result in the species decline. Due to the life history characteristics of southern right whales, any cumulative effects are unlikely to be detectable over short timescales (i.e., 1 - 3 years).

Consideration of the spatial and temporal patterns of exposure to stressors and threats is necessary when assessing the potential for cumulative effects of these combined stressors. The occurrence of individual stressors may demonstrate strong spatial and/or temporal variation. Their effects depend on the extent and timing that whales use BIAs and the whales' proximity to these stressors. As a migratory species, southern right whales can be exposed to a wide range of threats. However, they also demonstrate philopatry and site fidelity to reproductive areas for calving and nursing, which may lead to cumulative exposure to stressors within these areas. Although threats to southern right whales operate across the entire species range, they can be spatially biased and usually occur close to more populated coastal areas. Consequently, the eastern population may be at higher risk to threats than the western population given their lower abundance and rate of recovery (Stamation et al. 2020) and greater proximity to higher human density coastal areas and human activities.

The challenge with assessing cumulative effects on animals is that combined effects may not always be reliably predicted from the individual effect of each stressor, because the way each stressor operates in isolation may change or be modified in the presence of other stressors (Pirotta et al. 2022). At present, the quantitative prediction of cumulative effects of stressors on marine mammals has not been achieved and consequently conceptual frameworks for assessing the population consequences of multiple stressors are developed (National Academies of Sciences 2017). A key component of this framework is an assessment of the health of individuals. The Population Consequences of Multiple Stressors (PCoMS) model is a framework proposed for exploring pathways from exposures to stressors through their effects on physiology, behaviour, and health of an individual, to their effects on vital rates and population dynamics (National Academies of Sciences 2017). An important component to this is the use of early warning indicators for adverse impacts, including health and population measures (e.g., changes in southern right whale calving intervals), given that reliably measuring trends in marine mammal populations over time scales that enable appropriate management responses is often inherently difficult.

Assessing cumulative effects from various threats or stressors in the context of species recovery fundamentally requires a management focus on reducing the current risk to a species. However, some stressors such as climate change or persistent pollutants that operate over long timescales (i.e., years to decades) cannot be mitigated rapidly. Consequently, this may require a greater focus on managing stressors that can be reduced in the short term, such as anthropogenic underwater noise, entanglement and/or vessel strike (Pirodda et al. 2022). Empirical data or mechanistic predictions of the dose-response of individuals to threats and interactions among stressors are vital to informing a cumulative effects framework. For example, a conceptual framework for assessing combined effects of multiple stressors has been applied to North Atlantic right whales which feed on limited prey resources while simultaneously being affected by entanglement in fishing gear (Pirodda et al. 2022). It demonstrates the application of assessing cumulative effects from multiple stressors along the spectrum of data-driven to mechanistic process-driven analytical approaches dependant on the level of data/information available on the impact of threats to the species.

3.11 Threat Prioritisation

A Southern Right Whale Recovery Plan stakeholder workshop was held in April 2022 that was attended by Commonwealth and State regulatory agencies, threatened species managers, and scientific experts. Each of the threats outlined in sections 3.1 to 3.9 were assessed using a risk matrix approach to identify threats of highest risk, and therefore highest priority for action. The risk matrix in Table 3 uses a qualitative assessment drawing on peer reviewed literature and expert opinion to evaluate the likelihood of a threat occurring and the consequences of that threat or impact considering existing mitigation measures. Threats were considered in the context of current management regimes and the impact of each threat has been assessed assuming that existing management measures continue to be applied appropriately.

Threat risk assessments were undertaken for the western and eastern populations separately to account for differences in the trends in recovery between the two populations. Due to different recovery trajectories, the extent to which the identified threats may potentially impact the two populations can differ. The outcome of the threat prioritisation process was used to determine the priority for actions outlined in Section 5. Only recovery actions that address the higher risk threats (rated as 'very high' (pink) or 'high' (yellow) priority), and measure recovery and address knowledge gaps, have been developed in this Recovery Plan.

Table 3 Risk prioritisation matrix template.

Likelihood of occurrence (relevant to species)	Consequence				
	No long-term effect	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Moderate	Very High	Very High	Very High
Likely	Low	Moderate	High	Very High	Very High
Possible	Low	Moderate	High	Very High	Very High
Unlikely	Low	Low	Moderate	High	Very High
Rare or unknown	Low	Low	Moderate	High	Very High

Levels of risk and the associated priority for action are defined as follows:

- **Very High** – immediate additional mitigation action required.
- **High** – additional mitigation action and an adaptive management plan required; the precautionary principle should be applied.
- **Moderate** – obtain additional information and develop additional mitigation action is required.
- **Low** – monitor the threat occurrence and reassess threat level if likelihood or consequences change.

Categories for likelihood are defined as follows:

- **Almost certain** – expected to occur every year.
- **Likely** – expected to occur at least once every five years.
- **Possible** – might occur at some time.
- **Unlikely** – such events are known to have occurred on a worldwide basis but only a few times.
- **Rare or unknown** – may occur only in exceptional circumstances; OR it is currently unknown how often the incident will occur.

Categories for consequences are defined as follows:

- **No long-term effect** – no long-term effect on individuals or populations.
- **Minor** – individuals are affected but no affect at population level.
- **Moderate** – population recovery slows or stalls.
- **Major** – population declines.
- **Catastrophic** – population extinction.

National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)

Table 4 Western southern right whale population residual risk matrix.

Likelihood of occurrence	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	- Anthropogenic underwater noise: aircraft noise	- Anthropogenic underwater noise: industrial noise * - Anthropogenic underwater noise: vessel noise * - Collision: whale-watching - Collision: recreational vessels - Pollution: chronic chemical pollution - Entanglement: marine debris	- Entanglement: active fishing or aquaculture equipment - Habitat degradation: infrastructure of coastal development - Habitat degradation: infrastructure of offshore development	- Anthropogenic climate variability and change	
Likely		- Anthropogenic underwater noise: seismic surveys - Collision: vessel strike - Pollution: EMF *			
Possible					
Unlikely		- Pollution: acute chemical discharge		- Whaling ◊ - Prey depletion from overfishing ◊	
Rare or unknown	- Prey depletion: from seismic survey				

* Given the behavioural impacts on southern right whales are largely unknown, a precautionary approach is applied regarding the assignation of possible consequences.

◊ Threat occurs outside of Australian waters.

National Recovery Plan for the Southern Right Whale (*Eubalaena australis*)

Table 5 Eastern southern right whale population residual risk matrix.

Likelihood of Occurrence	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	- Anthropogenic underwater noise: aircraft noise	- Anthropogenic underwater noise: vessel noise * - Collision; whale-watching - Collision; recreational vessels - Pollution: chronic chemical pollution - Entanglement: marine debris	- Anthropogenic underwater noise; industrial noise * - Habitat degradation; infrastructure of coastal development - Habitat degradation; infrastructure of offshore development	- Entanglement: active fishing or aquaculture equipment - Collision: vessel strike - Anthropogenic climate variability and change	
Likely		- Pollution: EMF *	- Anthropogenic underwater noise: seismic surveys		
Possible					
Unlikely		- Pollution: acute chemical discharge		- Whaling ◇ - Prey depletion from overfishing ◇	
Rare or unknown	- Prey depletion from seismic surveys				

* Given the behavioural impacts on southern right whales are largely unknown, a precautionary approach is applied regarding the assignation of possible consequences.

◇ Threat occurs outside of Australian waters.

3.12 Key considerations for environmental impact assessment processes

This Recovery Plan outlines the key anthropogenic threats and management actions needed to assist the recovery of southern right whales and should be considered when assessing the impact of proposed actions, particularly within BIAs and HCTS. Underlying this is consideration of the principles of ecologically sustainable development, as outlined under s3A of the EPBC Act. In particular, the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making, and environmental considerations should be properly and equally valued in association with economic and social considerations.

Another key consideration is the *EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance 2013*, which provide overarching guidance on determining whether an action is likely to have a significant impact on a listed threatened species. For southern right whales, actions that interfere with the recovery of the species will ultimately have a significant impact. Further guidance on key environmental factors to identify and manage impacts to the environment for the offshore renewable energy industry can be found in the *Key environmental factors for offshore windfarm environmental impact assessment under the Environmental Protection and Biodiversity Conservation Act 1999*.

3.12.1 Context of species recovery for environmental impact assessments

The southern right whale is an Endangered species under the EPBC Act due to severely reduced population numbers by historical commercial whaling in the 19th century (particularly mid 1800's), and was considered almost extinct in Australia in the first half of the 20th century (Bannister 1986, Dawbin 1986, Carroll et al. 2014). The intense over-exploitation of right whales has shaped their current population structure, demographic parameters, and rates of recovery in the different populations across their range (Harcourt et al. 2019). The western and eastern populations of southern right whales in Australia demonstrate varying patterns of recovery, with the eastern population recovering at a slower rate. Although both populations show signs of increase in abundance, current abundance levels remain very low compared to pre-exploitation numbers (Carroll et al. 2014, Stamation et al. 2020).

The life history traits of southern right whales make them particularly vulnerable to anthropogenic threats. They have a long-life span, late sexual maturity, and low reproductive output of one calf every three years on average. These life history traits make it difficult to detect impacts from threats, other than direct mortality, over short time scales that may affect recovery. This consequently warrants a precautionary approach in the assessment of activities that may impact southern right whales, particularly in and adjacent to southern right whale HCTS and BIAs.

3.12.2 Guidance for decision makers

Actions that will likely compromise the recovery of southern right whales and have a significant impact on the species must be managed to reduce risk, which includes, but is not limited to, actions that:

- increase southern right whale mortality and may likely result in declines in population abundance,
- disrupt the breeding cycle, such as by reducing the reproductive success of breeding southern right whale females,
- reduce the area of occupancy in the species, including preventing the re-occupation of historic high use areas, and
- adversely affect HCTS, potentially through decreasing the availability or quality of the habitat.

The main threats to the survival of the southern right whale are anthropogenic climate variability and change, entanglement in fishing gear, habitat degradation, anthropogenic underwater noise, and vessel strike. Some of the main associated actions that may present risk to southern right whales include installation of offshore infrastructure development (e.g., offshore renewable and oil and gas activities), shipping, and fisheries. The best available knowledge, including scientific advice and published information, should be used to inform environmental impact assessments for southern right whales. Current information on HCTS and BIAs for southern right whales must be used to inform planning, assessment, and decision-making of actions in the marine environment. This must address that female southern right whales have strong site fidelity to certain areas along the Australian coast for reproduction (mating, calving, nursing), generally returning to the same location to give birth and nurse offspring. Furthermore, as the population size increases there will be re-occupation of historical habitat and establishment in new areas that need consideration for protection to enable the species to recover. Historic high use areas need consideration in site-selection of marine projects due to their importance historically in supporting large numbers of breeding females, and presently to support re-occupation of these areas as the population recovers. The importance of historic high use areas is supported by two of the four historic high use areas (in southeast South Australia and southwest Victoria) demonstrating consistent current use.

The impact mitigation hierarchy is the framework to avoid, mitigate and offset environmental impacts on Matters of National Environmental Significance (MNES), which identifies that avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action. Given southern right whales demonstrate high site fidelity to calving areas, offsets cannot compensate for habitat loss in southern right whale reproductive BIAs. The first approach to reduce the risk of impacts from key threats to southern right whales is to avoid southern right whale BIAs, and particularly HCTS, wherever practicable at any time whales are present, predominantly between April to November. For example, in the case of threats from anthropogenic underwater noise resulting from development of marine infrastructure (i.e., pile driving in the pre-operational phase of offshore development), construction activities should be planned at a time when southern right whales are not present. This requires the implementation of temporal (i.e., seasonal) avoidance measures in or adjacent to HCTS during the critically important calving season.

Where it is not possible to avoid HCTS when southern right whales are present in those areas, reasonably practicable minimisation controls supported by appropriate whale detection and adaptive management measures must be adopted that clearly demonstrate risk minimisation to achieve the actions set out in this Recovery Plan. Verification of the effectiveness of mitigation measures should be undertaken and reported, which may include underwater noise verification studies of noise modelling used to predict impacts and effectiveness of whale detection methods. Impacts that cannot be sufficiently avoided or mitigated should not be approved.

3.12.3 Southern right whale monitoring programs

It is incumbent on the proponent to identify the species that may occur in the proposed area of interest and obtain current information about their presence, distribution, and abundance to inform risk assessments. Desktop reviews are useful for obtaining information on the occurrence and use of certain areas by the species, which may identify limitations in baseline data. The adequacy of a desktop review relates to the extent of the baseline information obtained, the nature and scale of the activity proposed, and measures adopted to address information gaps. In cases where there are limitations in baseline data, and scientific uncertainty exists of potential impacts to southern right whales, options to address this include implementing baseline surveys, applying precautionary control measures and developing robust monitoring and adaptive management measures. Fundamentally, environmental impact assessments require sufficient data to support determinations of acceptable impacts to southern right whales and where limitations in baseline data and scientific uncertainty exists and is not addressed, significant delays to projects may occur.

Baseline surveys and monitoring must consider best-practice methods, such as those outlined in the *National Guidelines for the Survey of Cetaceans, Marine Turtles and the Dugong 2024*. Surveys should take into consideration appropriate spatial and temporal considerations to evaluate the effectiveness of the mitigation measures to ensure activities avoid injury and disturbance to southern right whales. This requires consideration of the spatial scales that southern right whales can range across given they are a migratory species that also undertake coastal movements within the calving season. This would support a regional planning assessment approach of the risk of threats and monitoring in survey areas that extend beyond the construction and operational footprint of a proposed action site. Within a strategic regional planning approach, there should be collaboration and sharing of baseline monitoring data to maximise resources used to inform the status of the species and risk of threats.

Baseline surveys should be undertaken to inform knowledge gaps and scientific uncertainty in baseline data at the pre-referral stage and to allow an adequate baseline understanding to be obtained so that potential impacts to southern right whales can be assessed. Baseline surveys and monitoring of southern right whales should be undertaken in accordance with best practice standards and guidelines (e.g., national fauna survey and underwater noise guidelines) to enable standardised data collection and analysis methodologies that can result in the integration of comparable datasets and better-informed environmental management decision making. Baseline surveys should be undertaken across multiple years (minimum 3 – 5 years) to reliably capture the presence of breeding females given female southern right whales have an average 3-year breeding cycle and any annual variability in the distribution and abundance of southern right whales in Australian coastal areas. It is important that cross industry and research collaborations be encouraged in broad-scale monitoring aimed at better informing baseline

knowledge to reduce duplication in efforts within the same region. In the case of mitigating ongoing impacts, robust monitoring should be undertaken throughout the life of the action to appropriately evaluate outcomes of the predicted levels of impact and inform decisions on adaptive management.

3.12.4 Adaptive management

The primary goal for adaptive management should be to identify the most practical and effective ways to remove or reduce the risk of adverse impacts on southern right whales. There must be an intentional approach to evaluate the effects of the development activity and effectiveness of the mitigation measures implemented through monitoring to reduce uncertainty around the potential impacts. Adaptive management frameworks should be adopted that can account for any new science, new technology and unanticipated changes in environmental factors to reduce uncertainty in the risk of threats throughout the life of a project or activity.

3.12.5 Cumulative effects

There are a range of natural and anthropogenic threats that affect southern right whales (section 3), and these stressors are likely to interact. Combined, their cumulative effects can potentially severely affect recovery of the species. For example, the effects of climate change on environmental conditions (e.g., sea surface temperature anomalies) on right whale foraging grounds can affect female reproductive success, resulting in depressed pregnancy rates and subsequently impact recovery on their coastal breeding grounds (Leaper et al. 2006, Meyer-Gutbrod et al. 2015, Seyboth et al. 2016). The risk of threats to southern right whales should not be assessed in isolation, and consideration must be given to existing, and future processes and actions, that may affect recovery of the southern right whale (section 3.10). Assessing cumulative effects from various threats in the context of species recovery fundamentally requires a management focus on reducing the current risk to a species. However, some threats operate over longer time scales (e.g., climate change) and there should be a focus on managing threats that can be reduced in the short term, such as anthropogenic underwater noise, entanglement, and/or vessel strike, while maintaining efforts to reduce impacts from long-term threats such as climate change.

4 Vision, objectives, and targets

4.1 Long-term recovery vision

The long-term vision for the recovery of the southern right whales in Australian waters is that the population has increased in size to a level that the conservation status has improved, and the species no longer qualifies for listing as threatened under any of the EPBC Act listing criteria.

Due to intense historical exploitation of southern right whales and the species life history characteristics, population recovery to, or near, pre-exploitation levels will likely be a long process (i.e., multi-decadal). Consequently, achieving the long-term vision for southern right whales utilising Australian waters is also likely to occur over this timeframe.

4.2 Interim recovery objectives and targets

Recognising the long-term nature of the Recovery Plan vision, five interim recovery objectives have been set for a shorter-term period relevant to the species of ten-years. These objectives will be achieved by implementing the actions set out in this Recovery Plan to minimise threats while protecting the species' habitat, adequately monitoring recovery, generating new knowledge to guide recovery, and increasing public awareness.

The first interim objective provides the context for the management and legal protection that underpins this Recovery Plan, whereas the second identifies the principles of ecologically sustainable development that should be applied when assessing risk from recognised and emerging anthropogenic threats to southern right whales. The third and fourth interim recovery objectives assist in assessing the conservation status of southern right whales against the EPBC Act threatened species listing criteria, and whether threats are reduced, and species recovery is subsequently being achieved. The fifth interim objective addresses supporting capability in achieving the Recovery Plan actions.

Interim objective 1: Current levels of Commonwealth and State legislative and management protection for southern right whales are implemented, maintained, or improved, so threats continue to be managed and reduced over the life of the plan.

Target 1.1: Domestic and international legislation, and other management agreements, that support the recovery of southern right whales in Australian waters are maintained and, where necessary, strengthened, and enforced.

Interim objective 2: Anthropogenic threats are managed consistent with ecologically sustainable development principles to facilitate recovery of southern right whales.

Target 2.1: Robust and adaptive management principles are implemented to reduce anthropogenic threats to southern right whales in Australian waters and minimise the risk of mortality, injury, auditory impairment, or disturbance to biologically important behaviours from anthropogenic activities.

Target 2.2: Management decisions are supported by high quality information and scientific data, and high priority research areas identified in the Recovery Plan to deliver this information are supported through national and/or state funding programs and conservation planning.

Interim objective 3: Population dynamics, including demographics, distribution, residency, and coastal movement across the species range are monitored and quantified using robust, standardised, best-practice methodology to assess population recovery.

Target 3.1: The western and eastern populations of southern right whales are monitored at a frequency that will obtain reliable estimates of population abundance and trends to demonstrate trends in recovery.

Target 3.2: An annual increase in abundance is recorded for southern right whales in the western population range at, or near, a maximum biological rate of increase of 6 - 7 percent.

Target 3.3: An increase in the abundance and habitat occupancy of the eastern population is recorded, including an increase in the number and/or size of reproductive BIAs.

Interim objective 4: The population structure of southern right whales in Australian waters is clearly characterised, including the level of interchange of individuals among coastal reproductive areas, to evaluate the degree to which the western and eastern populations are separate populations and inform the degree of connectivity with other southern right whale populations (e.g., New Zealand).

Target 4.1: The population structure of the western and eastern populations is characterised to the extent that the degree of genetic separation can be evaluated, and the number of management units assessed.

Target 4.2: Migratory paths from foraging grounds to coastal reproductive areas are determined and the degree of mixing in migration BIAs by the western and eastern populations is known to inform population structure.

Interim objective 5: Capability of First Nation Australians, research, citizen science, and general community groups is improved to assist in addressing recovery actions of southern right whales in Australia.

Target 5.1: Improve recognition, awareness, and understanding of First Nation Australians cultural connections with southern right whales, and aspirations related to monitoring, conservation, and management of the species.

Target 5.2: Improve communication and partnerships with Traditional Owner groups, research institutions, citizen science groups, and public to increase partnerships, collaboration and equal benefit sharing of research.

5 Recovery Actions

To achieve the long-term vision, it is necessary to meet the interim recovery objectives and implement the actions set out in this Recovery Plan. These actions aim to minimise threats while protecting and enhancing the species' habitat throughout its range, adequately monitoring the species recovery, generating new knowledge to guide recovery, and increasing public awareness.

This section prioritises activities that will assist recovery of southern right whales and support achievement of the interim recovery objectives and their targets as outlined in section 4. It is expected that every action will be progressed or completed during the life of this plan. It is recognised that information on threats or species knowledge may change as new information becomes available, requiring change to some of the priorities listed in this plan. This may include the emergence of new threats or changes in relative risk of existing threats, due to increased knowledge about a threat. It could also be due to changes in BIAs, such as new emerging areas and areas of habitat critical to survival of the species. New information must be taken into consideration as it becomes available in the context of this plan. Where appropriate the Australian Government will work with key stakeholders in each area to develop implementation plans for groups of actions.

5.1 Recovery actions to be implemented

The following section outlines the key action areas identified to meet recovery targets, address threats, and the specific actions identified to support recovery of the species.

5.1.1 Assess and address key threats

Action Area A1	Priority
Maintain, implement, and improve efficacy of current legislative and management protection for southern right whales.	Very High
Action	
<ol style="list-style-type: none"> 1. Maintain, implement, and improve efficacy of existing legislation and management arrangements (e.g., Managements Plans and Guidelines) as listed under section 1.2. 2. Maintain functional utility of management advice and actions through clear communication among stakeholders, and periodic review. 	
Interim objectives addressed	Threats to be mitigated
1, 2	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Description	
<p>Australia should maintain its position promoting high levels of protection for southern right whales domestically and in all relevant international agreements and fora (section 1.2). All management decisions and supporting tools should continue to be informed by current and best available information, including published and peer-reviewed evidence, noting the precautionary principle where necessary. Decisions must consider the cumulative impacts of multiple pressures and resulting actions must not affect continued use of habitat critical to the survival of the species, or BIAs. All management actions should be informed by current information on southern right whale spatial and temporal distribution, BIAs, HCTS and current and emerging threats.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. Australia continues to implement domestic legislation and management actions to protect southern right whales, and actively promote appropriate protection for, and management of, southern right whales in international bodies (e.g., IWC). 2. Management decisions are based on the best available published and peer-reviewed scientific evidence. <p><i>Risks:</i> There are inconsistent approaches for mitigating the impacts of threats to southern right whales and/or reduced level of communication between Commonwealth and State agencies and with management and/or regulatory responsibilities and industry. This risk may be mitigated by sustained communication between Commonwealth and State agencies and industry through annual or greater periodic meetings and relevant published guidance material.</p> <p><i>Likelihood of success:</i> Moderate to High.</p>	

Action Area A2	Priority
Address habitat degradation impacts from coastal and offshore marine infrastructure developments within the species' range.	Very High
Action	
<ol style="list-style-type: none"> 1. Coastal and offshore development actions are assessed according to principles of ecological sustainable development to ensure the risk of injury, auditory impairment and/or disturbance to southern right whales is minimised. 2. Baseline surveys and monitoring undertaken during activity implementation are conducted in accordance with best practice standards and guidelines to ensure standardised datasets are obtained and suitable to inform environmental management decision making that can reduce the risk of threats to southern right whales. 3. Current information on species' occurrence, particularly in HCTS, BIAs, and historic high use areas, are used to inform planning, assessment, and decision-making on marine infrastructure development actions. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3	3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8
Description	
<p>Actions related to marine infrastructure development can result in the degradation of HCTS for reproduction, and disturbance to southern right whales in these areas may disrupt key life history behaviours. Southern right whales demonstrate high site fidelity to important reproductive areas used for the critical biologically important behaviours of mating, calving, and nursing. To minimise degradation of these habitats and ensure southern right whales continue to utilise HCTS, proposed actions need to consider habitat requirements of southern right whales and BIAs at early stages of planning. Marine infrastructure development projects should have effective measures and mitigation implemented to address identified threats to southern right whales, and primarily consider avoiding undertaking activities in HCTS during southern right whale calving season. Cumulative impacts of development undertaken in HCTS should be considered in the assessment of activities to ensure there is continued use of HCTS and BIAs for southern right whales.</p>	
Within the period of this plan	
<i>Measure of success</i>	
<ol style="list-style-type: none"> 1. All levels of government and industry consider HCTS for southern right whales at all stages of project planning and assessment of development proposals. 2. The recovery of southern right whales, and their occupancy and residency within reproductive BIAs, is not adversely affected by coastal and offshore development, demonstrated by no long-term decrease in current levels of use. 	
<p><i>Risks:</i> Marine development project assessments are made without the use of available robust information, and the precautionary principle is not applied where information is lacking on habitat use by southern right whales in areas of coastal development. There may be inconsistent approaches between Commonwealth and State government in assessing the impacts of development proposals to southern right whales.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

Action Area A3	Priority
Understand impacts of climate variability and anthropogenic climate change on the species biology and population recovery.	Very High
Action	
<ol style="list-style-type: none"> 1. Continue to meet Australia’s international commitments to address causes of climate change, including greenhouse gas emissions. 2. Continue to contribute via CCAMLR to the sustainable management of the krill fishery in Antarctica to mediate potential reduction in prey resources due to climate change. 3. Support international collaborations in understanding the responses of southern right whales to climate variability and change through ongoing commitments to the IWC and CCAMLR. 4. Increase understanding of the effects of anthropogenic climate change on environmental conditions, including the impacts on prey availability in high latitude foraging areas and links with southern right whale foraging ecology, health, and population demographics (e.g., reproductive success). 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3, 4	3.1, 3.2, 3.7
Description	
<p>Australia’s broader policy actions will attempt to combat climate change (e.g., through the National Climate Resilience and Adaptation Strategy). There is a strong negative correlation between environmental conditions (e.g., sea surface temperature anomalies) at southern right whale feeding grounds and female reproductive success. However, the specific processes and pathways that link the impacts of climate change on environmental conditions, prey availability, and whale reproductive success and health, are not understood to a level that allows an understanding of how these might affect the recovery of the species. Australia is a partner of the IWC-SORP research consortium and collaborates on the theme <i>The right sentinel for climate change: linking foraging ground variability to population recovery in the southern right whale</i>. Continued engagement in this program will assist with better understanding of the linkages between foraging success, the energetics of individuals and breeding success, and climate change impacts. Australia contributes to CCAMLR and the management of its fisheries and should continue engagement with CCAMLR to support the sustainable management of Antarctic fisheries, particularly those that target the prey resources of southern right whales.</p>	
Within the period of this plan	
<i>Measure of success</i>	
<ol style="list-style-type: none"> 1. Australia continues its commitment to mitigate climate change and meet internationally agreed targets. 2. An improved understanding of the links between climate change and reproductive success and health of whales is obtained. 3. Australia retains a strong engagement with CCAMLR and the IWC to understand the linkages between a changing environment, prey resources, and the recovery of southern right whales. 4. Measures required to facilitate adaptive management of impacts from climate change are better understood. 	

Risks: Actions at the global scale are not sufficient to affect the current rate of climate change, which may negatively impact southern right whale prey stocks and subsequent reproductive success of southern right whales.

Likelihood of success: Moderate.

Action Area A4	Priority
Manage and mitigate the threat of entanglements from commercial active or discarded fishing gear throughout the species' range in Australian waters.	Very High
Action	
<ol style="list-style-type: none"> Promote and support commercial fishing industries, government, and research collaborations that address alternate fishing techniques, gear modifications and/or management arrangements (e.g., spatial and/or temporal area closures) to reduce the risk of entanglements from active or discarded fishing gear. Develop, update, and promote industry Codes of Practice and awareness courses for fishers, specific to each relevant fishery, to address the threat of whale entanglement in fishery gear in BIAs and HCTS. Improve standardised and coordinated recording and reporting of entanglements and data sharing of fisheries interactions with whales between industry, government, and research bodies. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3	3.2, 3.3
Description	
<p>Right whales are particularly susceptible to entanglements because of their coastal distribution and the resulting overlap with fisheries areas. Accurately assessing and spatially mapping areas of risk from entanglement are hindered by discrepancies and inconsistencies in the quality of data and data collection related to incidences of entanglement across jurisdictions. Codes of Practice for industry (e.g., rock lobster fisheries from Western Australia and Victoria) aimed at reducing entanglements and improving reporting of interactions will assist with better understanding the risk of entanglements and mitigating and responding at-sea to entanglements. Actions to achieve a reduction in marine debris, including lost or discarded fishing gear, entering the environment should be undertaken in accordance with the <i>Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018)</i>. Australia should maintain engagement with international organisations, such as the IWC Global Whale Entanglement Response Network, for fostering knowledge in the best practice of whale disentanglement.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> Increased collaborative projects between the fishing industry, government, and research organisations that address reductions in entanglements with fishing gear. Codes of conduct developed by relevant state government agencies and relevant fishing industries to minimise the risk of entanglement. An improved reporting system for entanglements and data sharing of fisheries interactions between government and industry and ongoing support for the maintenance of data repositories, including publication of reports/data to provide baseline and trend data. <p><i>Risks:</i> Reduced levels of communication, understanding and collaboration between the commercial fishing industry, government and research organisations that hinder the effective development and implementation of Codes of Practice.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

Action Area A5	Priority
Assess, manage, and mitigate impacts from anthropogenic underwater noise.	Very High
Action	
<ol style="list-style-type: none"> 1. Improve baseline understanding of southern right whale acoustic communication to better inform potential impacts from anthropogenic underwater noise. 2. Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that it does not prevent any southern right whale from utilising the area or cause auditory impairment. 3. Actions within and adjacent to southern right whale BIAs and HCTS should demonstrate that the risk of behavioural disturbance is minimised. 4. Ensure environmental assessments associated with underwater noise generating activities include consideration of national policy (e.g., <i>EPBC Act Policy Statement 2.1</i>) and guidelines related to managing anthropogenic underwater noise and implement appropriate mitigation measures to reduce risks to southern right whales to the lowest possible level. 5. Quantify risks of anthropogenic underwater noise to southern right whales, including studies aimed to measure physiological effects, behavioural disturbance, and changes to acoustic communication (e.g., masking of vocalisations) to whales. 6. Prioritise government/industry funding opportunities to support research to identify short and long-term responses of southern right whales to underwater noise. 7. Improve understanding and characterisation of marine soundscapes, including the application of new technologies for data processing, within southern right whale BIAs to facilitate quantification of anthropogenic noise in the marine soundscape. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3	3.3, 3.4, 3.5
Description	
<p>The potential for impacts from anthropogenic underwater noise is greatest where noise-generating activities occur within or close to southern right whale reproductive BIAs. Within these areas whales demonstrate site fidelity, are resident for long periods (e.g., weeks to months) of time, young calves are present, and females are engaged in calving and nursing. The risks from anthropogenic underwater noise to southern right whales need to be quantified, considered in environmental impact assessments in accordance with policy (e.g., <i>EPBC Act Policy Statement 2.1</i>) and guidelines, and appropriate mitigation measures implemented to reduce the risks within BIAs. To ensure the risks of auditory impairment and disturbance from anthropogenic underwater noise to southern right whales are minimised, there is need for improved understanding of the characteristics of underwater noise (i.e., amplitude, frequency, duration) that individual whales are exposed to and their behavioural and physiological responses. There is also need for a better understanding of the overlap between southern right whale BIAs and potential sources of significant anthropogenic underwater noise. Currently, little is known on the direct pathways of impact to southern right whales from anthropogenic noise and what long-term effects from cumulative exposure may have on their behaviour, health, and life history traits. A precautionary approach should be applied where relevant, to the management of activities proposed to occur in or adjacent to designated HCTS and BIAs.</p>	

Within the period of this plan

Measure of success

1. Activities that generate underwater noise and the risks they pose to southern right whales are assessed in accordance with relevant policy and guidelines, and mitigation measures outlined in these documents are implemented to minimise the potential for disruption and displacement from BIAs and HCTS to an acceptable level.
2. An improved understanding of the exposure and behavioural responses to impulsive and non-impulsive anthropogenic noise.

Risks: There are difficulties in assessing both short and long-term impacts of anthropogenic noise on southern right whales and there is potential that short-term effects will not inform the long-term effects on health, habitat occupancy, and life history traits (i.e., calving rates).

Likelihood of success: Moderate.

Action Area A6	Priority
Manage, minimise, and mitigate the threat of vessel strike.	Very High
Action	
<ol style="list-style-type: none"> 1. Assess risk of vessel strike to southern right whales in BIAs. 2. Improve understanding of the behavioural response of southern right whales in close vicinity to vessels (e.g., type, number, distance) in BIAs to inform risk assessments of vessel strike. 3. Ensure environmental impact assessments and associated plans consider and quantify the risk of vessel strike and associated potential cumulative risks in BIAs and HCTS. 4. Undertake a review of the <i>National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna 2017</i>, and update if necessary. 5. Ensure all vessel strike incidents are reported in the National Ship Strike Database managed through the Australian Marine Mammal Centre, Australian Antarctic Division. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3	3.3, 3.4, 3.5
Description	
<p>Vessel strike is demonstrated to have a significant impact on small recovering right whale populations in other areas (e.g., North Atlantic right whale). There have been reported vessel strikes of southern right whales in Australian waters and individuals have been observed with evidence of vessel strikes. Although, there is still a lack of understanding of the extent that vessel collisions occur and that vessels cause behavioural disturbance. Detection and subsequent reporting are still potential issues that hinder an understanding of the extent of risk to southern right whales by vessel strike. The <i>National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna 2017</i> outlines several objectives and actions for reducing vessel strike injury and/or mortality. Reviewing the applicability and effectiveness of this strategy and updating the objectives, if necessary, would assist in ensuring the strategy provides relevant guidance on understanding and reducing the risk of vessel strike and associated impacts on southern right whales.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. Improved reporting of vessel strikes to the National Ship Strike Database. 2. Implementation of effective management of vessels in BIAs and HCTS to minimise the risk from vessel strike. 3. Review and update, if necessary, of the <i>National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna</i>. <p><i>Risks:</i> Changes in occupancy of southern right whales in new and/or expanding reproductive areas and vessel densities in these areas may occur at a rate that inhibits assessment of available information to inform conservation planning in a time effective manner. Vessel strikes with southern right whales are not observed and/or reported.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

5.1.2 Measure recovery

Action Area B1	Priority
Measure and monitor population demographics and recovery.	Very High
Action	
<ol style="list-style-type: none"> 1. Establish effective monitoring techniques for the eastern population and implement a targeted long-term monitoring program capable of measuring and evaluating population recovery. 2. Maintain long-term annual monitoring programs of the western population across its range that are capable of measuring and evaluating population recovery, including continuance of aerial surveys and photo-identification. 3. Characterise, measure, and monitor the biology of southern right whales (i.e., fitness related traits) to evaluate factors that might influence population recovery, including supporting the development of new technologies to facilitate such characterisation. 4. Prioritise long-term monitoring programs for the western and eastern populations within national and/or state threatened species funding programs. 5. Enable sharing and exchange of information required for monitoring the population recovery of southern right whales through support for national databases (e.g., Australian Right Whale Photo Identification Catalogue) and data processing (e.g., automated image matching). 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3, 4, 5	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Description	
<p>Long-term monitoring is required to understand ongoing population trends and recovery trajectories of southern right whales, including expansion of spatial distribution and occupancy of coastal habitat within Australian waters. Specifically, a targeted long-term monitoring program needs to be established for the eastern population to provide information required for establishing recovery rates for this population. To date, most data from the eastern population has been opportunistic citizen science monitoring data. Effort should focus on research that determines environmental influences and impacts from anthropogenic activities on important biological rates for the species that can affect population recovery. New technologies and methods should explore to support effective, efficient, and sustained approaches to the long-term monitoring of both populations, particularly where they can be utilised to expand existing collection, utilisation, and delivery of information.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. The western and eastern populations are monitored to provide reliable population estimates, demographic data (e.g., calving rates, movement, temporal and spatial habitat occupancy, behaviour) and recovery rates. 2. Population modelling is undertaken in standardised and comparative frameworks to promote streamlined processes for future updates. <p><i>Risks:</i> Long-term monitoring programs may not be financially supported, which may result in gaps in information needed to establish the status of southern right whales.</p> <p><i>Likelihood of success:</i> Moderate to high.</p>	

Action Area B2	Priority
Characterise population structure.	Very High
Action	
<ol style="list-style-type: none"> 1. Characterise the population structure and degree of connectivity between the Australian western and eastern populations and southern right whales in New Zealand waters using multiple approaches (e.g., photo-identification, molecular and biochemical methodologies). 2. Quantify the spatial and temporal interchange and intra-season coastal movement of individuals between the western and eastern population regions. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3, 4, 5	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Description	
<p>Southern right whales that occur seasonally off the Australian coast are recognised as constituting two populations (the western and eastern) based on genetic differentiation, population size, and varying rates of population increase. There is some evidence that whales from each population are mixing on shared migratory corridors as they move from summer foraging grounds to winter breeding grounds. Greater understanding of the connectivity and degree of interchange of individuals between the two populations is needed to evaluate population abundance estimates of each population, particularly as there is a risk that estimates for the eastern population may incorporate individuals from the western population to an unknown degree. Further improved understanding of the genetic connectivity of the eastern population with breeding areas in New Zealand is also needed for better evaluating recovery trajectories, repopulation of historical habitats, and factors that might be currently limiting recovery of this population.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. The population structure of southern right whales in Australian waters is characterised to the extent that the degree of genetic and reproductive isolation of the western and eastern populations are determined. <p><i>Risks:</i> Contemporary samples that would facilitate the establishment of this information are not collected during the life of the plan, and population structure that enhances current understanding is not achieved. Research may be initiated, yet not completed, during the life of this Recovery Plan.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

Action Area B3	Priority
Determine migratory paths and offshore distribution.	High
Action	
<ol style="list-style-type: none"> 1. Spatially identify and map migratory pathways and movement between high latitude foraging grounds and coastal breeding areas. 2. Review and update BIA maps as new information becomes available. 3. Support international collaborations (e.g., IWC-SORP) that facilitate improved understanding of distribution and migrations. 	
Interim objectives addressed	Threats to be mitigated
1, 2, 3, 4	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Description	
<p>Southern right whales demonstrate strong fidelity to feeding and breeding areas and annually migrate to coastal winter grounds to mate, calve and rest. However, little is known about the summer feeding grounds and migratory routes between these coastal breeding areas and offshore foraging areas. There is a degree of movement and genetic mixing between the western and eastern population demonstrated by photo-identification and genetic data (Carroll et al. 2015, Evans et al. 2021, Watson et al. 2021). Such movements indicate that connectivity of coastal habitat is important for southern right whales and given connectivity may be disrupted temporarily or permanently by human activities, it is important conservation planning considers the importance of connecting coastal habitat as well as aggregation areas.</p> <p>Australia is a partner of the IWC-SORP research consortium and collaborates on research themes such as <i>'The right sentinel for climate change: linking foraging ground variability to population recovery in the southern right whale'</i> that links southern right whale population dynamics and health with foraging ecology. Continued collaboration in this research consortium will support improved understanding of the factors influencing southern right whale recovery in Australian waters.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. Indicative foraging areas used by whales that breed in Australian coastal waters and migratory pathways to Australian coastal breeding areas are spatially identified and mapped. <p><i>Risks:</i> A high level of mixing between southern right whales that breed in Australian waters and nearby countries (i.e., New Zealand), and low sample sizes, hinder a comprehensive understanding of migratory movements and offshore distribution.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

Action Area B4	Priority
Improve capability of First Nation Australians, research, citizen science, and general community groups to assist management of southern right whales.	High
Action	
<ol style="list-style-type: none"> 1. Improve recognition, awareness, and understanding of First Nation Australians cultural connections with whales, including southern right whales. 2. Assess the level of interest of Traditional Owner groups in the monitoring, conservation, and management of southern right whales by consulting relevant indigenous groups and organisations that occur within the species' range. 3. Improve active participation of interested Traditional Owner groups in the monitoring, conservation, and management of southern right whales. 4. Provide advice, education, and support, to research organisations, citizen science groups, and volunteer and community groups regarding management of southern right whales, including providing a greater awareness of the Recovery Plan. 5. Investigate establishment of a Recovery Team, consisting of a collaboration of key partners to coordinate implementation of the Recovery Plan. 	
Interim objectives addressed	Threats to be mitigated
3, 4, 5	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Description	
<p>Southern right whales spend their breeding season on the Sea Country of numerous Traditional Owner groups, although the cultural and customary significance of the species across their range is not well documented. Further consultation with the Traditional Owners of these lands will benefit the conservation of the species by providing awareness of traditional knowledge and management practices on Country. It is important to obtain an understanding of the level of engagement in the monitoring, conservation, and management of southern right whales by consulting relevant indigenous people and organisations that occur within the species' range.</p> <p>The southern right whale is a nationally listed Endangered species, that has significant cross-jurisdictional complexities for conservation planning and is subject to multiple and increasing cumulative anthropogenic threats. A coordinated approach among all partners (e.g., Traditional Owner groups, researchers, community groups) is required for effective implementation of the Recovery Plan, which may best be undertaken through establishment of a Recovery Team.</p>	
Within the period of this plan	
<p><i>Measure of success</i></p> <ol style="list-style-type: none"> 1. Successful implementation of conservation management activities that require collaboration and cooperation among Traditional Owner and various stakeholder groups. 2. High-level community support is achieved for actions to conserve the southern right whale. <p><i>Risks:</i> Ineffective communication and support for the engagement of Traditional Owner groups and the various necessary stakeholders results in unsuccessful implementation of conservation management activities.</p> <p><i>Likelihood of success:</i> Moderate.</p>	

6 Implementation of Recovery Plan

6.1 Responsible agencies and partners

The Australian Government is responsible for managing and coordinating domestic policy on protected and threatened species and supporting management and protection of Australia's protected species in international fora. The Australian Government collaborates with state and territories either directly, or through fora such as round table discussions, to assess the progress of implementing the Recovery Plan objectives and targets.

Many of the actions identified in this plan will fall under the jurisdiction of state and territory governments and may be undertaken by industry groups, research institutions, non-government organisations and the broader community, many of which are identified in section 1.3 under 'Governance and coordination of the Recovery Plan'. As a result, while the plan may identify activities that need to be ongoing, a range of partners might undertake the mechanisms that support those activities.

6.2 Duration and cost of the recovery process

The recovery of southern right whales in Australia is likely to occur over a long-term multi-decadal timeframe. A plan should remain in place until both populations of southern right whales in Australian waters have recovered to such an extent that the conservation status of the species no longer meets the criteria for being listed as a threatened species under the EPBC Act.

The cost of implementing this plan will be met through various direct and indirect funding providers. These include Commonwealth, state and territory governments, non-government organisations such as conservation groups and research organisations that prioritise whale conservation, and marine based industries. The key stakeholders who may be involved in the development, implementation and contribution to costs associated with implementing the southern right whale Recovery Plan are outlined in section 1.3. The cost of implementing the actions outlined in this Recovery Plan are already largely borne by the Commonwealth, State and Territory governments in the delivery of their core business, plans, and programs, both domestically and internationally. State, Territory and Commonwealth governments also collaborate with universities and scientific institutions, industry, Traditional Owner groups, business, NGOs, and communities in the delivery of their programs and research activities. Consequently, it is difficult to determine with any high degree of certainty what each action costs to be implemented, other than potentially specific research actions.

It is expected that Commonwealth and State government agencies will use this plan to assist in prioritising actions to protect the southern right whale and enhance their recovery. Projects will be undertaken according to agency priorities and available resources, and available funding is aimed at assisting conservation planning and managing threats. Key mechanisms and indicative costings to achieve priority actions as outlined in this Recovery Plan are provided in Table 6.

Table 6 Key mechanisms and indicative costing to carry out some of the priority actions for southern right whales.

Actions	Mechanisms to achieve actions	SW population indicative costings	SE population indicative costings
A: Assessing and addressing threats			
A1	<ul style="list-style-type: none"> Continue or improve existing national and state legislative and management actions to minimise anthropogenic threats. 	Core government business	Core government business
A2	<ul style="list-style-type: none"> Manage anthropogenic activities to minimise impact from threats. 	Core government business	Core government business
A3	<ul style="list-style-type: none"> Australian Government climate change adaptation initiatives. Government grants programs. 	Core government business	Core government business
A4	<ul style="list-style-type: none"> State government programs to disentangle whales. State government / industry partnerships to implement gear modifications to reduce entanglement risk. State government / industry Codes of Practice to reduce the risk of whale entanglements in fishing gear. Australian Government <i>Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Marine Life</i>. 	Core government business DPIRD: \$750,000 for a 3-year study	Core government business
A5	<ul style="list-style-type: none"> Development of <i>National Anthropogenic Underwater Noise Guidelines</i> for the management of anthropogenic noise for marine mammals. Update <i>EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales 2008</i>. Guidance to proponents about their legal responsibilities under the EPBC Act to minimise impacts from anthropogenic noise to cetaceans. Research to assess impacts of anthropogenic noise through behavioural responses, such as behavioural disturbance. 	Core government business \$200,000 p.a. for 3-to-4-year study	Core government business \$200,000 p.a. for 3-to-4-year study
A6	<ul style="list-style-type: none"> Update <i>National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna 2017</i>. Research to assess behavioural responses of southern right whales to vessel interactions in BIA's. 	Core government business \$100,000 p.a. for 2-to-3-year study	Core government business \$100,000 p.a. for 2-to-3-year study

B: Enabling and measuring recovery			
B1	<ul style="list-style-type: none"> Ongoing Commonwealth and state government monitoring programs Ongoing research activity Government grant programs 	\$200,000 p.a. for monitoring Core government business	\$100,000 p.a. for monitoring Core government business
B2	<ul style="list-style-type: none"> Ongoing Commonwealth and state government monitoring programs Government grant programs 	\$100,000 p.a. for 2 - 3-year study Core government business	\$100,000 p.a. for 2 - 3-year study Core government business
B3	<ul style="list-style-type: none"> Ongoing Commonwealth and state government monitoring programs National government and international organisations grant programs 	\$100,000 p.a. for 3-year study Core government business	\$100,000 p.a. for 3-year study Core government business
B4	<ul style="list-style-type: none"> Ongoing Commonwealth government Indigenous Protected Areas Program Oral history project with Traditional Owner groups to improve recognition, awareness and understanding of Indigenous Australians cultural connections with whales. 	Core government business \$75,000 p.a. for 2-year study	Core government business \$75,000 p.a. for 2-year study

6.3 Reporting process and performance of the Recovery Plan

Monitoring of the Recovery Plan will require tracking the progress of actions designed to improve management of the population and reduce threats. The progress of the plan in achieving the management actions will be considered at an interim review of the plan at a period of no greater than 5-years, and at completion of the interim recovery objective period, by evaluating the *'Measure of success'* as outlined for each Action Area in Section 5.1. A process for reporting and review is essential to determine how well the Plan is contributing towards its overall long-term objectives and, specifically, how well it is meeting the interim objectives and their targets within the period of the plan.

This review will identify:

- 1) Actions that have been completed.
- 2) Actions that are on track for completion; and
- 3) Actions that have not commenced.

The performance of this plan will be determined at its completion and assessed by assigning one of the performance ratings in Table 7. The performance rating assigned will demonstrate how successful the plan has been in meeting interim recovery objectives and specifically the targets in section 4.2, and will provide an indication of the degree of progress towards the long-term recovery objective.

Table 7 Performance measures for the southern right whale Recovery Plan.

Performance rating for the Plan	Targets	Progress towards long-term recovery objective
Successful	All targets met	Excellent
Moderately Successful	Six of the nine targets met incl. 1.1	Sound
Moderately unsuccessful	Five of the nine targets met incl. 1.1	Adequate
Unsuccessful	Less than five targets met or target 1.1 not met	Failure

6.3.1 Data resources and data management

There are a range of data resources and data repositories that will aid informing and addressing management and research actions outlined in this Recovery Plan. These include, but are not limited to:

- The Protected Matters Search Tool (PMST) – an online search tool with interactive mapping functions that is valuable for decision-making and research and can be used to identify MNES and other matters protected by the EPBC Act that may occur in a particular area.
- The Australian Marine Spatial Information System (AMSIS) – provides information on BIAs for protected species as well as a range of other national data on Australia's marine environment, such as specific information on the location and area of important marine habitats, ecological features, and other conservation values in the marine regions.
- National Marine Mammal Data Portal – database for stranding, sighting, entanglement, and ship strike data, developed by the Australian Marine Mammal Centre at the AAD. Reports related to these data can be submitted online through the portal.
- Australasian Right Whale Photo-Identification Catalogue (ARWPIC) - a centralised online platform developed to share images and sightings of southern right whales. It allows upload and matching of southern right whale images and catalogues between different regions for better understanding movements of southern right whales and connectivity of populations in the Australasia, and ultimately the Southern Hemisphere. Researchers and the public can browse this catalogue and match their own photographs of right whales to one in the catalogue.
- State government wildlife sightings databases – various wildlife sightings databases are managed by State government to supports biodiversity and protected areas by providing important wildlife information that underpins conservation policies, programs, and management responses.

- Atlas of Living Australia (ALA) - a collaborative, digital, open infrastructure that pulls together Australian biodiversity data from multiple sources, making it accessible and reusable.

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