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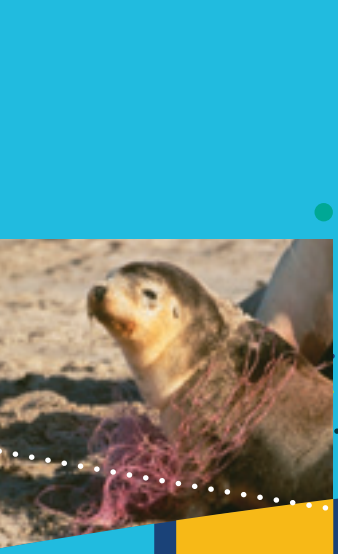

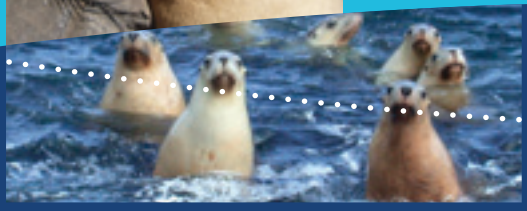

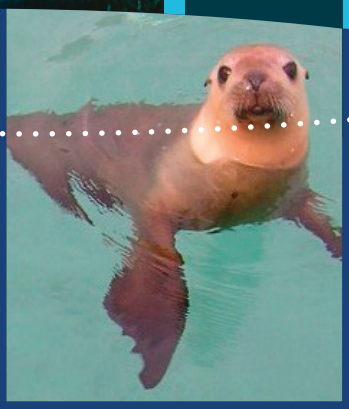

Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*)

2013

The recovery plan linked to this issues paper is obtainable from:
www.environment.gov.au/coasts/species/seals/index.html

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Images credits

Front cover left to right: entangled Australian sea lion, close up image of Australian sea lion, colony of Australian sea lions, Australian sea lion on the water's surface – Derek Hamer, Australian sea lion underwater – David Muirhead

Back cover left to right: Australian sea lion on a rocky shore, close up image of Australian sea lion, Australian sea lion on the water's surface – Derek Hamer

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Abbreviations

AFMA	Australian Fisheries Management Authority, Commonwealth
DAFF	Department of Agriculture, Fisheries and Forestry, Commonwealth
DEWHA	Department of Environment, Water, Heritage and the Arts
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities, Commonwealth
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1*999
IUCN	International Union for Conservation of Nature
PIRSA	Department of Primary Industries and Regions South Australia
SA DEWNR	South Australian Department of Environment, Water and Natural Resources
SARDI	South Australian Research and Development Institute
SESSF	Southern and Eastern Scalefish and Shark Fishery
TSSC	Threatened Species Scientific Committee
WA DEC	Western Australian Department of Environment and Conservation
WA DoF	Western Australian Department of Fisheries

1 SUMMARY

This document constitutes the Australian National Recovery Plan for the Australian Sea Lion (Neophoca cinerea). The plan considers the conservation requirements of the species across its range and identifies the actions to be taken to ensure its long-term viability in nature and the parties that will undertake those actions.

The Australian sea lion was listed as vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2005 and is also listed as a threatened species in each state in its range (South Australia and Western Australia). This is the first recovery plan for the species and this recovery plan will be reviewed after a five year period.

The Australian sea lion now only breeds in the coastal and offshore waters of South Australia and Western Australia. While the original range for the species is unknown, it was thought to extend into Bass Strait. The breeding colonies in Bass Strait were likely to have been eliminated due to seal harvesting during the late 18th, 19th and early 20th centuries. Unlike other pinnipeds that were harvested during that time, Australian sea lion populations have not recovered across their range and there is evidence in some areas that some small populations are still in decline.

While there are several possible reasons for the lack of recovery, the most likely explanation is that interactions with the commercial gillnet fishing sector have limited the species' potential for population growth. Other significant factors that may be contributing to the lack of recovery include mortality due to interactions with the rock lobster industry; deaths caused by fisheries related marine debris; habitat degradation and interactions with aquaculture operations; human disturbance to colonies; deliberate killings; disease; pollution and oil spills; prey depletion and climate change.

This recovery plan sets out the research and management actions necessary to stop the decline of, and support the recovery of, the Australian sea lion throughout its range. The overarching objective of this recovery plan is to halt the decline and assist the recovery of the Australian sea lion throughout its range in Australian waters by increasing the total population size while maintaining the number and distribution of breeding colonies with a view to:

- improving the population status, leading to future removal of the Australian sea lion from the threatened species list of the EPBC Act
- ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future.

This recovery plan should be read in conjunction with the accompanying Issues Paper for the Australian sea lion and a more detailed Australian Sea Lion Technical Issues Paper (DEWHA, 2010), which have been developed to provide background information on the biology, population status and threats to the species. The Issues Paper and this recovery plan are available for download from the department's website at: www.environment.gov.au/coasts/species/seals/index.html.

2 BACKGROUND

2.1 Species description and breeding cycle

The Australian sea lion is the only endemic pinniped (true seals, fur seals and sea lions) in Australian waters. It is a member of the Otariidae family. Adult males and females differ in size, with males growing to about 2 m in length and weighing around 220 kg, while females reach about 1.75 m and weigh about 100 kg (McIntosh, 2007).

The birth interval in Australian sea lions is around 17–18 months. The Australian sea lion is unique among pinnipeds in being the only species that has a non-annual breeding cycle that is also temporally asynchronous across its range (Ling & Walker, 1978; Gales, et al., 1992; Higgins, 1993; Gales, et al., 1994; Shaughnessy, et al., 2006). This means the breeding period (copulation and birthing) in one colony will occur at different times to breeding in another colony. In effect, over a 24 year period, breeding will have occurred across all calendar months.

2.2 Diet and foraging behaviour

The Australian sea lion is considered to be a specialised benthic forager — that is, it feeds primarily on the sea floor. Studies have shown that the species will eat a range of prey, including fish, cephalopods (squid, cuttlefish and octopus), sharks, rays, rock lobsters and penguins (Gales & Cheal, 1992; McIntosh, et al., 2006; Baylis, et al., 2009). The Australian sea lion feeds on the continental shelf, most commonly in depths of 20–100 m (Shaughnessy, 1999). Australian sea lions typically travel up to about 60 km from their colony on each foraging trip, with a maximum distance of around 190 km when over shelf waters (Hamer, et al., 2011).

2.3 Distribution

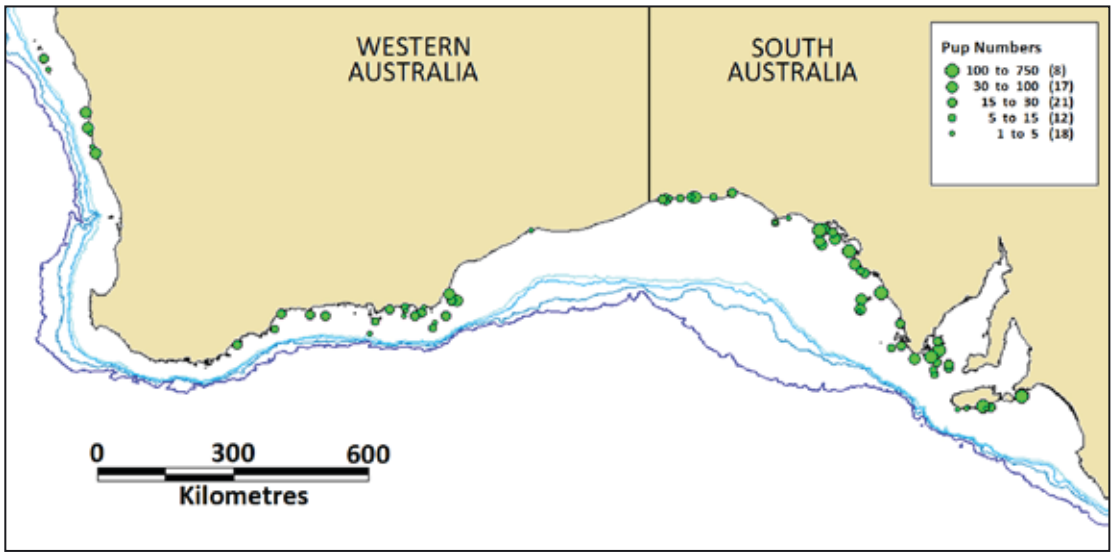
Breeding colonies for the Australian sea lion are found only in South Australian and Western Australian waters; however, the species is known to forage in Commonwealth waters adjacent to these states. The historical range for the species was thought to extend into Bass Strait but any breeding colonies there were likely eliminated through commercial hunting which took place during the late 18th, 19th and early 20th centuries (Ling, 1999). The species full historical range is unknown due to lack of accurate historical records.

The current breeding distribution of the Australian sea lion extends from the Houtman Abrolhos Islands on the west coast of Western Australia to the Pages Islands in South Australia (Figure 1). Australian sea lion pups have been recorded at 76 sites over the past 20 years, with 28 occurring in Western Australia and 48 occurring in South Australia. Of these sites, 58 are considered breeding colonies, following the currently accepted definition of a breeding colony for the Australian sea lion, which is, a colony at which more than five pups have been recorded (Goldsworthy & Page, 2009). For the purpose of this recovery plan, these 58 sites are considered habitat critical to the survival of the species (refer: Appendix 1) because they are used to meet essential life cycle requirements (i.e. breeding). The other 18 sites are considered to be haul-out sites with only occasional breeding. There are also another 151 locations which have been recorded as haul out sites — places where Australian sea lions will come ashore to rest — but as this is based on opportunistic observations, it is likely to be an under-estimate of the total number of haul out sites currently used (Shaughnessy, et al., 2011).

Of the known breeding colonies, the largest occur in South Australia. In South Australia, there are nine colonies where more than 100 pups have been recorded per season, which equates to 63 per cent of total pup production for the species. Of the remaining colonies across the species' range, most are small, with 51 colonies producing less than 30 pups per breeding season (DEWHA, 2010).

Adult males forage over the entire continental shelf, where they overlap with adult females, but adult males also forage in deeper waters further out to sea (Goldsworthy & Page, 2009). Biologically important areas for foraging by females and males have been identified through the Commonwealth South-west Marine Bioregional Planning process. Biologically Important Area maps and descriptions for foraging, haul-out and breeding sites are available in the Marine Bioregional Planning Conservation Values Atlas on the department's website at: www.environment.gov.au/coasts/marineplans/cva/index.html.

Figure 1: Breeding distribution of the Australian sea lion, indicating the location and approximate pup number range of the 76 sites where Australian sea lion pups have been recorded. The number of sites within each pup number range is given in parentheses. Depth contours of 200, 500, 1000 and 2000 m (light to dark blue) are indicated (updated from DEWHA, 2010).



2.4 Breeding colonies

The Australian sea lion breeds in colonies, mostly on islands but also on the Australian mainland. Preferred breeding habitat ranges from rocky platforms at the base of cliffs to low- lying limestone islands and sandy beaches.

The number of females in a colony varies among colonies. Recent genetic evidence suggests that females exhibit an extreme form of natal site fidelity, known as natal philopatry (Campbell, 2003; Campbell, et al., 2008a; Lowther, et al., 2012). This means that females will typically breed in the same colony in which they were born, with genetic differences in the female line being evident in colonies as close as 20 km apart. Males disperse further, but evidence suggests their dispersal range is limited to about 200 km (Hamer et al., 2013). The result of this extreme pattern of natal philopatry is that the Australian sea lion is unlikely to recolonise habitat or expand its range in the short to medium term.

2.5 Current abundance

Estimating the abundance of the Australian sea lion is difficult. Techniques used are based on estimates of pup production and the use of population models. Using these techniques, the best estimate for the 2011 population was approximately 14 700 Australian sea lions, with most (86 per cent) occurring in South Australian waters (Shaughnessy, et al., 2011).

2.6 Population trends

The analysis of population trends for the Australian sea lion requires reliable estimates of pup numbers over a number of breeding seasons. Unfortunately, reliable data of this type only exist for a number of the larger colonies, with few sources of information available for most of the smaller colonies. The colonies which have the most robust data sets are Seal Bay, North and South Page Islands and Dangerous Reef — all of which are in South Australia.

Seal Bay — The most comprehensive time-series data on population trends is from the Seal Bay colony. Data have been collected from this population by a range of people and agencies since 1962, with various collection methods being employed. In an attempt to estimate population trends at this site, a detailed data set was created using only post-1985 data, as earlier population counts were considered unreliable. These data show a decline of approximately 11 per cent over the period 1985 to 2007, with significant variability between breeding seasons (Shaughnessy, et al., 2006). These data also suggest that the decline is ongoing.

The Page Islands — Estimates of pup numbers at north and south Page Islands have been collected from 1986 to 2007 (Shaughnessy & Goldsworthy, 2007; Shaughnessy, et al., 2011). Like the Seal Bay population, numbers at north and south Page Islands have varied considerably between seasons ranging from 381 to 607. However, unlike the Seal Bay population, no clear trend in pup numbers is evident over the period of analysis and further counts are required to determine the population status at this colony (DEWHA, 2010).

Dangerous Reef — Estimates of pup production from the Dangerous Reef population have been collected from 1975 to 2007. Like the other data sets, the methodologies used to collect the data over time have varied. The most recent analysis of the data suggests the population at Dangerous Reef underwent a period of growth (DEWHA, 2010). The beginning of the period of population growth at Dangerous Reef coincided with the 2001 introduction of restrictions on demersal gillnetting in the Spencer Gulf region, a key foraging ground for this colony.

3 CONSERVATION STATUS

The Australian sea lion was listed as vulnerable under the EPBC Act on 14 February 2005, as a threatened species and protected under the South Australian *National Parks and Wildlife Act 1972* in 2008, and as 'specially protected fauna' under the Western Australian *Wildlife Conservation Act 1950* — *Wildlife Conservation (Specially Protected) Fauna Notice 2003*. Internationally, the Australian sea lion was listed as endangered under the IUCN Red List in 2008. These listings used different criteria to assess the species, which is endemic to Australia.

4 REASONS FOR LISTING UNDER THE EPBC ACT

The current listing of the Australian sea lion as vulnerable under the EPBC Act is based on advice from the Threatened Species Scientific Committee (TSSC) that the species meets both Criterion 1 — the species has undergone, is suspected to have undergone or is likely to undergo in the immediate future a substantial reduction in numbers; and Criterion 3 — the estimated total number of mature individuals is limited and evidence suggests that the number will continue to decline at a substantial rate. The conservation assessment made by the TSSC is available on the department's website at: www.environment.gov.au/biodiversity/threatened/species/neophoca-cinerea.html.

The listing of the Australian sea lion as vulnerable under the EPBC Act was based on declining population trends, the life history characteristics of the species and the fact that the species was still under pressure from some sectors of the Australian commercial and recreational fishing industries at the time of listing. The Australian sea lion population underwent a massive decline in numbers caused by seal harvesting. At the time of listing the population appeared to have stabilised, although it had not recovered to its former abundance or range. While determining population trends in the Australian sea lion is difficult, the rates of mortality caused by interactions with humans (e.g. interactions with fisheries and entanglement in marine debris), combined with the species' naturally poor recovery abilities, indicated that the species may experience further reduction in numbers (TSSC, 2005).

5 THREATS

Historically, the main threat to the Australian sea lion was over-harvest due to commercial hunting. Although this activity no longer occurs, populations have not recovered to pre-exploitation levels. A range of anthropogenic factors have been identified which may be impacting on the recovery of the Australian sea lion. The cumulative impact of many of these threats varies across the range of the species, with some threats having more prominence in certain areas.

The principal threats to the Australian sea lion are outlined in the 2013 Issues Paper for the Australian Sea Lion, available at: www.environment.gov.au/coasts/species/seals/index.html

Interactions with the commercial gillnet fishing sector, mortality due to interactions with the rock lobster industry and deaths caused by fisheries-related marine debris are currently considered to be the primary threats to the recovery of the Australian sea lion. Other factors that may be contributing to the lack of recovery include habitat degradation and interactions with aquaculture operations; human disturbance to colonies; deliberate killings; disease; pollution and oil spills; prey depletion and climate change.

6 OBJECTIVES

The overarching objective of this recovery plan is to halt the decline and assist the recovery of the Australian sea lion throughout its range in Australian waters by increasing the total population size while maintaining the number and distribution of breeding colonies with a view to:

- improving the population status leading to the future removal of the Australian sea lion from the threatened species list of the EPBC Act
- ensuring that anthropogenic activities do not hinder recovery in the near future or impact on the conservation status of the species in the future.

The following specific objectives, relevant to colonies in both South Australia and Western Australia, have been identified.

The specific objectives of this recovery plan are to:

1. mitigate interactions between fishing sectors (commercial, recreational and Indigenous) and the Australian sea lion to enable the recovery of all breeding colonies
2. mitigate the impacts of marine debris on Australian sea lion populations
3. mitigate the impacts of aquaculture operations on Australian sea lion populations.
4. investigate and mitigate other potential threats to Australian sea lion populations, including disease, vessel strike, pollution and tourism
5. continue to develop and implement research and monitoring programs that provide outputs of direct relevance to the conservation of the Australian sea lion
6. increase community involvement in, and awareness of, the recovery program.

7 POPULATIONS THAT REQUIRE PROTECTIVE MEASURES

There is evidence that Australian sea lion populations have not recovered from past hunting and that populations at some breeding sites may be in decline.

The Australian sea lion has an unusual reproductive biology and life history, which complicates species recovery. Such characteristics are unlikely to be significantly contributing to population decline but are likely to exacerbate the effects of anthropogenic threats to populations and contribute to slow recovery of populations. Due to the extreme philopatry of females and limited dispersal of males between breeding colonies, the removal of only a few individuals annually may increase the likelihood of decline and potentially lead to the extinction of some of the smaller colonies. Extinction of breeding colonies has the potential to further reduce genetic diversity and the already limited genetic flow between colonies. This, in turn, may weaken the genetic resilience of the species and impact on its ability to cope with other natural or anthropogenic impacts. In addition, the extreme philopatry of females suggests that extinction of breeding colonies may lead to a contraction of the range of the species as re-colonisation of breeding sites via immigration is limited.

A total of 58 sites have been identified as breeding colonies and are considered to be habitat critical to the survival of the species because they are used to meet essential life cycle requirements (i.e. breeding). For the reasons outlined above, small breeding colonies are under particular pressure of survival from even low levels of anthropogenic mortality. This is particularly relevant as there are 33 breeding colonies (of the total of 58 breeding colonies) producing fewer than 30 pups per breeding season across the range of the Australian sea lion. It is therefore important to protect all 58 breeding colonies. Nevertheless, it may be necessary to prioritise monitoring of colonies on the basis of logistical ease of access and resilience of populations to potential disturbance from monitoring.

8 ACTIONS TO ACHIEVE THE OBJECTIVES

Actions identified for the recovery of the species covered by this plan are described below. Some of the objectives are long-term and may not be achieved during the life time of this recovery plan. Priorities assigned to actions should be interpreted as follows:

Priority 1: Taking prompt action is necessary in order to mitigate the key threats to the Australian sea lion and also provide valuable information to help identify long-term population trends.

Priority 2: Action would provide a more informed basis for the long-term management and recovery of the Australian sea lion.

Priority 3: Action is desirable, but not critical to the recovery of the Australian sea lion or assessment of trends in that recovery.

Objective 1: Mitigate interactions between fishing sectors (commercial, recreational and Indigenous) and the Australian sea lion to enable the recovery of all breeding colonies.

Action No.	Action	Priority	Performance Criteria	Responsibility
1.1	Implement appropriate management measures (monitoring, management response, compliance and review), such that incidental bycatch in the gillnet sector of the following commercial fisheries does not threaten any colony or sub-population of Australian sea lion: • The Gillnet, Hook and Trap sector of the SESSF. • The South Australian Marine Scalefish Fishery. • The West Coast Demersal Gillnet and Demersal Longline (interim) Managed Fishery. • The Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery.	1	• The AFMA Australian sea lion Management Strategy is periodically reviewed and amended as necessary. • Bycatch is kept within AFMA Australian sea lion Management Strategy trigger limits. • Reliable bycatch statistics are obtained. • Appropriate management strategies for interactions with Australian sea lions are in place in all jurisdictions (i.e. Commonwealth, Western Australian and South Australian).	Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC); AFMA; Department of Agriculture, Fisheries and Forestry (DAFF); Primary Industries and Resources South Australia (PIRSA); WA Department of Fisheries (DoF).
1.2	Implement appropriate management measures (monitoring, management response, compliance and review) in the South Australian Rock Lobster Fishery and Western Australian Rock Lobster Fishery such that incidental bycatch does not threaten any colony or sub-population of Australian sea lion.	1	• Bycatch of Australian sea lions from the Western Australian and South Australian rock lobster industries is monitored and reported annually to DSEWPaC. • Management practices reviewed and mitigation measures implemented, where required, to prevent threats to Australian sea lion populations.	DSEWPaC; PIRSA; WA DoF

Action No.	Action	Priority	Performance Criteria	Responsibility
1.3	Implement management controls in other fisheries (commercial, recreational and Indigenous) that have impacts on Australian sea lions by: • identifying any impacting fisheries. • implementing mitigation strategies for impacts on Australian sea lions in those fisheries where necessary.	2	• Bycatch in other fisheries monitored for presence of Australian sea lions and reported annually to DSEWPaC. • Management practices reviewed and mitigation measures implemented (where required) to alleviate threat to Australian sea lion populations.	DSEWPaC; AFMA; DAFF; PIRSA; WA DoF
1.4	Monitor the cumulative impact of fisheries on Australian sea lions including: • bycatch • prey depletion • restriction in habitat availability • entanglement in active (not discarded) fishing gear.	2	• Investigation into the cumulative impact of fisheries on the Australian sea lion is undertaken and reported annually to the DSEWPaC.	DSEWPaC; AFMA; DAFF; PIRSA; WA DoF

Objective 2: Mitigate the impacts of marine debris on Australian sea lion populations

Action No.	Action	Priority	Performance Criteria	Responsibility
2.1	Identify the sources of marine debris having an impact on Australian sea lion populations.	2	• Research conducted on the sources of marine debris impacting on Australian sea lion populations.	DSEWPaC; AFMA; PIRSA; SARDI; WA DoF; researchers
2.2	Assess the impacts of marine debris on Australian sea lion populations	2	• Research conducted on the impact of marine debris on Australian sea lion populations.	DSEWPaC; AFMA; PIRSA; SARDI; WA DoF; researchers
2.3	Develop and implement measures to mitigate the impacts of marine debris on Australian sea lion populations, noting the linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.	2	• Measures developed and implemented to mitigate the impacts of marine debris on Australian sea lion populations.	DSEWPaC; AFMA; PIRSA; WA DoF

Objective 3: Mitigate the impacts of aquaculture operations on Australian sea lion populations

Action No.	Action	Priority	Performance Criteria	Responsibility
3.1	Investigate the nature, extent and consequence of interactions between Australian sea lions and aquaculture activities and mitigate any impacts (e.g. restrictions in habitat availability).	2	• Research into the nature, extent and consequences of interactions between Australian sea lions and aquaculture activities is undertaken. • Management practices reviewed and mitigation measures implemented, where required, to prevent threat to Australian sea lion populations.	DSEWPaC; PIRSA; WA DoF

Objective 4: Investigate and mitigate other potential threats to Australian sea lion populations, including disease, vessel strike, pollution and tourism.

Action No.	Action	Priority	Performance Criteria	Responsibility
4.1	Improve the understanding of—and where necessary mitigate—the threat posed to Australian sea lion populations by illegal killings, vessel strike, pollution and oil spills. Actions to include: • develop protocols for collection of biological samples and ensure that a portion of each sample (including those already collected) is centrally archived • collect data on direct killings and confirmed vessel strikes • implement jurisdictional oil spill response strategies as required.	3	• Protocols for collection of biological samples have been developed. • Central database of biological samples is established and publically available. • Data on direct killings and vessel strikes is collected and centrally archived. • Management actions developed to mitigate impact of illegal killings, vessel strike, pollution and oil spills on Australian sea lion populations.	DSEWPaC; AFMA; PIRSA; SARDI; WA DoF; WA DEC; SA DENR; SA Museum; researchers

Action No.	Action	Priority	Performance Criteria	Responsibility
4.2	Improve understanding of the threat and importance of health related factors to Australian sea lion populations by: • developing protocols for collection of biological samples and ensuring that a portion of each sample (including those already collected) is centrally archived • undertaking research to better understand pup mortality due to disease and the variance between seasons and colonies • undertaking research on the effect of providing a broad spectrum treatment to kill parasites and whether this affects pup mortality • analysing the impacts of the bioaccumulation of toxins on the health of Australian sea lions.	3	• Protocols for collection of biological samples have been developed. Link to Action 4.1. • Central database of biological samples is established, current data are migrated to the database and publically available. Link to Action 4.1. • Research undertaken on pup mortality due to disease. • Research undertaken on the effectiveness and practicality of broad spectrum treatment to kill parasites in Australian sea lion pups. • Research undertaken on the impacts of bioaccumulative toxins on Australian sea lions.	PIRSA; SARDI; SA Museum; DSEWPaC; researchers; SA DENR; WA DEC
4.3	Develop and implement measures to mitigate the impact of any significant factors (identified in Action 4.2) affecting the health of Australian sea lion populations.	3	• Management actions developed to mitigate impact of significant factors (identified in Action 4.2) affecting the health of Australian sea lion populations.	SA DENR; SA Museum; WA DEC; DSEWPaC; researchers
4.4	Monitor and mitigate cumulative impacts of human interactions on Australian sea lion colonies.	3	• Management actions developed and implemented (where necessary) to mitigate impact of human interactions with Australian sea lions. • Management actions made available to the public, in particular distributed to tour operators. • Assessment of interactions of visitors (e.g. tourists and researchers) to Australian sea lion colonies conducted. • Research conducted on the cumulative impact of human interactions on Australian sea lion populations.	SA DENR; SA Museum; WA DEC; researchers; SA and WA Tourism Commissions.

Action No.	Action	Priority	Performance Criteria	Responsibility
4.5	Develop and provide information for tourists and tourism operators to promote an understanding of Australian sea lion conservation issues and to emphasise the importance of minimising disturbance of Australian sea lion colonies during visits. Link to Action 4.4.	3	• Information material, such as pamphlets, website material and social media material, on human interaction with Australian sea lion developed and distributed to tourism operators.	DSEWPaC; SA and WA Tourism Commissions, WA DEC

Objective 5: Continue to develop and implement research and monitoring programs that provide outputs of direct relevance to the conservation of the Australian sea lion

Action No.	Action	Priority	Performance Criteria	Responsibility
5.1	Develop and apply a quantitative framework to assess the population status and potential recovery of the Australian sea lion across its range. • Ensure sufficient and effective abundance and distribution monitoring is in place to adequately understand population size and trends at representative sites across the range of the Australian sea lion, including at the fringes of the species' range.	1	• Monitoring program developed and implemented, at agreed representative sites and results reported annually to DSEWPaC.	DSEWPaC; PIRSA; SARDI; WA DoF; WA DEC; SA DENR; researchers
5.2	Assess and facilitate the continuation of population demographic surveys at Seal Bay in South Australia.	2	• Continuation of population demographic surveys at Seal Bay, as appropriate.	SARDI; SA DENR

Action No.	Action	Priority	Performance Criteria	Responsibility
5.3	Improve the information base on behavioural ecology, trophic interactions and foraging ecology — particularly in areas important to the survival of the species — and at scales relevant to human activities that can be managed. Actions include: • improve knowledge of foraging range at a colony level to help determine the spatial overlap with commercial fisheries • better determine the key ecological characteristics of preferred foraging sites • determine the drivers for variance in pup production and mortality across seasons (including apparent seasonal cycles) • undertake dive and tracking studies in Western Australia to help determine specific foraging patterns and requirements.	2	• Research conducted on behavioural ecology, trophic interactions and foraging ecology of Australian sea lions. • Foraging range and habitats identified and spatially overlapped with fishery data. • Research conducted on drivers for variance in pup production and mortality. Link to Actions 4.2 & 4.3. • Dive and tracking studies conducted in Western Australia. • Update information on Biologically Important Areaswithin DSEWPaC's Marine Bioregional Plans as new information about foraging areas becomes available.	DSEWPaC; PIRSA; SARDI; WA DoF; researchers
5.4	Improve the information base on population structures of the Australian sea lion. This should include finer scale structuring, utilising genetic techniques and morphological studies, where data of such scale might improve practical management options. Actions include: • opportunistically undertaking further research on population structure. Using genetic techniques on current and opportunistically gathered biological material to determine the extent of male and female dispersal • using genetic and morphological data to determine any sub-speciation of Australian sea lion populations throughout their range.	3	• Research conducted on Australian sea lion population structures, including genetic techniques. • Identification of any sub-speciation of Australian sea lion populations in their range.	DSEWPaC; PIRSA; SARDI; WA DoF; WA DEC; researchers

Action No.	Action	Priority	Performance Criteria	Responsibility
5.5	Improve understanding of juvenile dispersal and foraging behaviours by: • undertaking research on juvenile (2–4 year olds) dispersal and foraging patterns • assessing dive depths of juveniles, with a focus on assessing the need to include Australian sea lion exclusion spikes on pots in deep water (> 20 m).	3	• Research conducted on juvenile dispersal and foraging behaviours that facilitates greater understanding of juvenile behavioural ecology, trophic interactions and foraging ecology.	DSEWPaC; PIRSA; SARDI; WA DoF; researchers
5.6	Assess the indirect impacts of fishing on Australian sea lion populations by conducting research. Research should include: • determining the impact of fishing on prey species of Australian sea lions • assessing the impact of fishing gear on preferred habitat of Australian sea lions.	3	• Research undertaken on the indirect impacts of fishing on Australian sea lion populations.	DSEWPaC; PIRSA; SARDI; WA DoF; researchers

Objective 6: Increase community involvement in, and awareness of, the recovery program

Action No.	Action	Priority	Performance Criteria	Responsibility
6.1	Provide advice, education and support to fishers, community members, local governments and regional natural resource management organisations by measures including: • ensuring that the Recovery Plan for the Australian Sea Lion is publicly available in electronic format • ensuring online information regarding the recovery plan is relevant and up-to-date • promoting the recovery plan to target groups, such as commercial and recreational fishers and tour group operators • conducting presentations and workshops, where appropriate • involving community groups and tour operators in research and monitoring programs, where practical.	2	• The Recovery Plan for the Australian Sea Lion is publically available in electronic format. • Target groups are contacted and provided access to the recovery plan. • The requirement for additional public awareness campaigns is assessed and, where required, awareness campaigns are conducted. • Opportunity for involvement of community groups in research and monitoring programs assessed and if applicable assistance requested.	DSEWPaC; AFMA; PIRSA; SARDI; WA DoF; WA DEC; SA DENR
6.2	Consult relevant Indigenous organisations within the species' range regarding the implementation of the Recovery Plan for the Australian Sea Lion.	2	• Indigenous organisations within the species' range are consulted on the implementation of the Recovery Plan for the Australian Sea Lion, as appropriate.	DSEWPaC; PIRSA; SARDI; WA DoF; WA DEC

9 CURRENT MANAGEMENT ARRANGEMENTS

Management arrangements to support the recovery of the Australian sea lion include provisions under both Commonwealth and state government legislation. Arrangements in place at the time of making this recovery plan are outlined below.

9.1 National level

The Australian sea lion is protected under the EPBC Act, as such, it is an offence to kill, injure, take, trade, keep or move any individual without a permit in Commonwealth waters. In addition, all listed threatened species are considered matters of national environmental significance (MNES) and any actions that are likely to have a significant impact on a MNES must be referred to the minister responsible for the environment for assessment and approval.

The environmental performance of Commonwealth, state and the Northern Territory-managed wild harvest fisheries is assessed under the EPBC Act. The EPBC Act requires that:

- all Commonwealth-managed and state wild capture marine fisheries with an export component be assessed to ensure they are being managed in an ecologically sustainable way
- all Commonwealth-managed fisheries are also assessed to determine the impact of actions taken under a fishery management plan on matters of national environmental significance
- all Commonwealth-managed fisheries and any state-managed fisheries that operate in Commonwealth waters must also be assessed to determine the impacts of fishing operations on cetaceans; listed threatened species and ecological communities; migratory species and listed marine species under the EPBC Act.

The assessments consider the impacts of the relevant fishery on target and non-target species caught and the impacts of fishing activities on the broader marine environment.

As part of this fisheries assessment process, the Commonwealth has developed a set of regulations that minimise Australian sea lion by-catch in the SESSF. The Australian Sea Lion Management Strategy (AFMA, 2010) was released in June 2010 and included measures such as formal spatial closures covering 6300 square kilometres of the SESSF in high risk areas around colonies; trigger levels for additional closures; increased observer coverage; trials of modified fishing gear and a trial of hook fishing methods to assess the impact of a large scale shift from gillnets to hooks in South Australia.

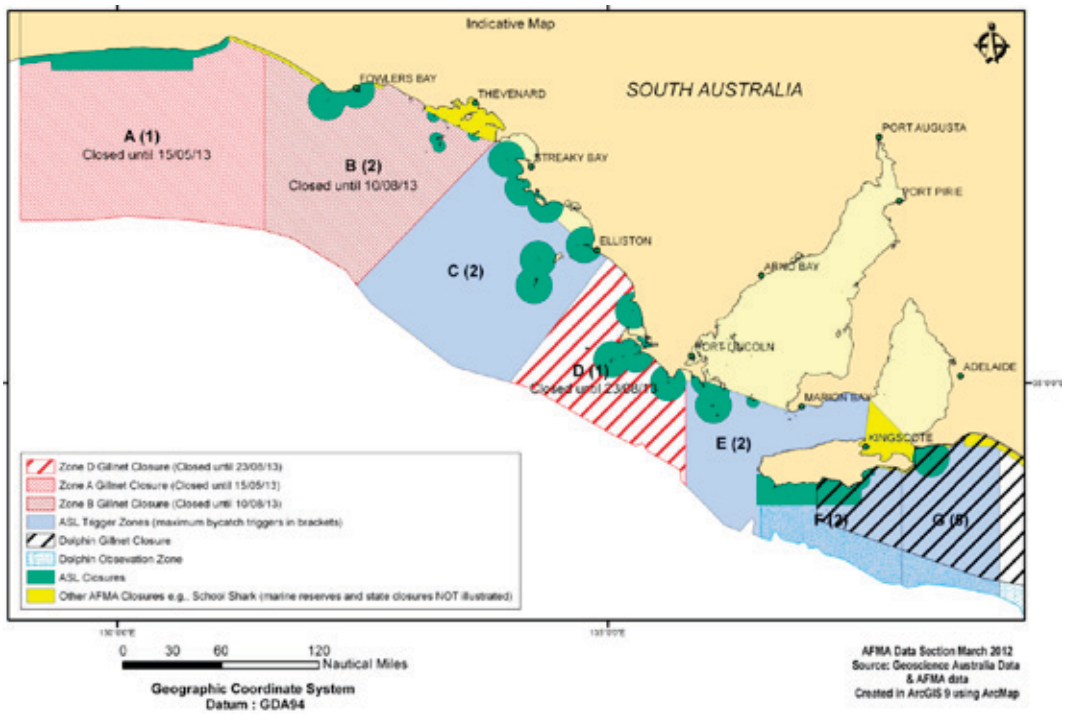
These measures were strengthened in April 2011 (AFMA, 2011) to include additional spatial closures around a further 31 colonies, bringing the total level of closures to 18 500 square kilometres. In addition, more precautionary trigger limits were put in place and independent observer coverage was increased to 100 per cent for all gillnet fishing off South Australia and 10 per cent for gillnet fishing elsewhere in the fishery. Under the April 2011 arrangements, if the trigger limits are reached in any of the seven management zones then that zone would be closed for a full Australian sea lion breeding cycle (18 months). A cumulative total of 52 female mortalities across all zones was introduced as a trigger, such that all zones would be closed if this trigger was reached.

In January 2012, the closure triggers were further tightened in order to ensure that they provide adequate protection for Australian sea lion sub-populations. More information is available at:www.afma.gov.au/australian-sea-lion-management-strategy-reset-maximum-bycatch-trigger-limits An overall trigger level of 15 animals was adopted. Under this overall limit, two management zones were restricted to a single animal trigger level, four zones to a two animal trigger level and one zone to a five animal trigger level (Table 1). These numbers reflect the associated colony size and sub-population genetics within the zone. Zone boundaries were also changed to ensure appropriate trigger limits would be assigned to those colonies likely to be genetically distinct or more vulnerable to fishing mortality. If the trigger limit is reached in any of the seven management zones, then that zone will be closed for a full Australian sea lion breeding cycle (18 months). Since the introduction of the Australian Sea Lion Management Strategy there have been three zones closed (Table 1; Figure 2, current at 1 July 2012).

Table 1: Maximum bycatch trigger limits reviewed under the strategy and reset for the new 2012/13 SESSF season starting on 1 July 2012

ASL Zone	Seasonal Trigger	Remaining Trigger
A	1	Closed until 15/05/13
B	2	Closed until 10/08/13
C	2	2
D	1	Closed until 23/08/13
E	2	2
F	2	2
G	5	5
Total	**15**	**11**

Figure 2: SESSF Australian sea lion Management Strategy: current closures and bycatch trigger limits (as of 1 May 2012; AFMA, 2012).



The Commonwealth Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life has the potential to contribute to reducing the impact of marine debris on the Australian sea lion. Although the implementation of the plan is intended to directly contribute to the protection of marine species described in the key threatening process listing, the plan will have broader benefits for marine species — such as the Australian sea lion — impacted by marine debris. The marine debris threat abatement plan is available on the department's website at: www.environment.gov.au/biodiversity/threatened/publications/tap/marine-debris.html

9.1.1 Marine Bioregional Plans

Commonwealth 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. As part of the marine bioregional planning process, the Australian sea lion has been identified as a regional priority for the South-west Marine Region. In addition, Schedule 2 of the South-west Marine Bioregional Plan includes guidance for people planning to undertake actions which have the potential to impact on Australian sea lions within the region. Further information on Commonwealth marine bioregional planning is available at: www.environment.gov.au/coasts/marineplans/index.html

DSEWPaC, as the Australian Government department responsible for administering the EPBC Act, maintains a suite of interactive tools that allow users to search, find and generate reports on information and data describing matters of national environmental significance, including the Australian sea lion. The Conservation Values Atlas linked to each Commonwealth Marine Bioregional Plan shows the location and spatial extent of conservation values (where sufficient information exists) and is available at: www.environment.gov.au/coasts/marineplans/cva/index.html. Further information about the Australian sea lion is available on the Species Profile and Threats Database (SPRAT) at: www.environment.gov.au/cgi-bin/sprat/public/sprat.pl This database includes links to conservation value report cards which were developed to support the information provided in each Marine Bioregional Plan.

As part of the Commonwealth marine bioregional planning process, Biologically Important Areas (BIAs) have been identified for a number of species, including the Australian sea lion. BIAs are areas that are particularly important for the conservation of protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. The presence of the observed behaviour is assumed to indicate that the habitat required for the behaviour is also present. BIAs have been identified using expert scientific knowledge about species' distribution, abundance and behaviour in the region, and BIA maps and descriptions for the Australian sea lion are available in the conservation values atlas at: www.environment.gov.au/coasts/marineplans/cva/index.html

9.1.2 Commonwealth marine reserves

Marine reserves (also known as marine protected areas or marine parks) are parts of the ocean that are managed primarily for the conservation of their ecosystems, habitats and the marine life they support. Forty new Commonwealth marine reserves were declared around Australia in November 2012. They have added to and integrated existing marine reserves, to form the Commonwealth component of Australia's National Representative System of Marine Protected Areas, comprising of five regional networks of Commonwealth Marine Reserves (South-east; South-west; North-west; North and Temperate east) and the Coral Sea Commonwealth Marine Reserve. Considered together, the new Commonwealth marine reserves networks and the Coral Sea reserve protect examples of all of Australia's different marine ecosystems and habitats. Commonwealth marine reserves are managed according to management plans made under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A single management plan is being developed for each regional marine reserves network and for the Coral Sea Commonwealth Marine Reserve. Draft management plans are available on the deparmtnet's website at: www.environment.gov.au/marinereserves/index.html Transitional management arrangements are in place until management plans come into effect, which is expected to be in July 2013 for the South-east Commonwealth Marine Reserves Network and 1 July 2014 for all other networks and the Coral Sea reserve.

The Commonwealth marine reserves networks protect habitats important for protected species, including the Australian sea lion. Many of the Commonwealth marine reserves intersect with Biologically Important Areas (BIAs) for the Australian sea lion, as identified in the Marine Bioregional Plans In particular, 11 of the 14 Commonwealth Marine Reserves in the South West Marine Reserves Network intersect with BIAs for foraging by the Australian sea lion, while the Twilight Commonwealth Marine Reserve protects further foraging habitat because it is adjacent to an Australian sea lion haul-out site at Twilight cove.

9.2 South Australia

The Australian sea lion was listed in 2008 as a threatened species under the South Australian *National Parks and Wildlife Act 1972*, and is also protected under the South Australian *Fisheries Management Act 2007* with respect to offence provisions relating to marine mammals. The South Australian Government is also in the process of planning and declaring Marine Protected Areas. As a threatened species, Australian sea lion habitat protection forms a key environmental value likely to be included in the South Australian Marine Protected Areas.

9.3 Western Australia

The Australian sea lion was listed as 'specially protected fauna' under the *Wildlife Conservation Act 1950 — Wildlife Conservation (Specially Protected) Fauna Notice* in 2003. A number of breeding and haul out islands are protected as nature reserves, and existing marine parks further protect marine areas of Australian sea lion habitat. The Western Australian Government has implemented several initiatives to support the recovery of the Australian sea lion, including the use of sea lion exclusion devices (e.g. spikes in pots) to mitigate this incidental mortality within the area of known interaction in the Western Australian Rock Lobster Fishery since the 2006/2007 fishing season (Campbell, et al., 2008b). The potential levels of interaction of the Australian sea lion with demersal gillnet fisheries off Western Australia is also being investigated.

10 EFFECTS ON OTHER NATIVE SPECIES OR ECOLOGICAL COMMUNITIES

Minimising threats to the Australian sea lion may benefit other marine species that share the same breeding and/or foraging habitat.

Actions to reduce fisheries interactions may have benefits for other species listed under the EPBC Act that potentially interact with fisheries including other pinnipeds (seals), cetaceans (whales, dolphins and porpoises), seabirds, sharks and some marine turtles.

Habitat protection resulting from this plan may also benefit species that share habitat with the Australian sea lion, for example the Australian fur seal *(Arctocephalus pusillus doriferus)* and the New Zealand fur seal *(Arctocephalus forsteri).*

Implementation of this plan could have implications for little penguin *(Eudyptula minor)* colonies within the range of foraging Australian sea lions. The recent recovery of New Zealand fur seal populations has been reported to coincide with a reduction in numbers of little penguins at some colonies. Although both Australian sea lions and New Zealand fur seals are known to hunt little penguins, they have only been occasionally reported in the diet of Australian sea lions (McIntosh et al. 2006; Wiebkin, 2011).Therefore, a recovery in Australian sea lion populations is unlikely to place further pressure on little penguin colonies. Little penguins are a listed marine species under the EPBC Act.

11 DURATION AND COST OF THE RECOVERY PROCESS

It is anticipated that the recovery process will not be achieved prior to the scheduled five year review of the recovery plan. The Recovery Plan for the Australian Sea Lion will therefore remain in place until such time that the population has improved to the point that it no longer meets threatened species status under the EPBC Act.

The cost of implementation of this plan should be incorporated into the core business expenditure of the affected organisations and through additional funds obtained for the explicit purpose of implementing this recovery plan. It is expected that state and Commonwealth agencies will use this plan to prioritise actions to protect the species and enhance its recovery, and that projects will be undertaken according to agency priorities and available resources. Actions which cross jurisdictional boundaries (i.e. states and Commonwealth) may be funded jointly on agreement by relevant parties.

12 AFFECTED INTERESTS

Organisations likely to be affected by the actions proposed in this plan include: Commonwealth and state government agencies — particularly those involved with environmental and fisheries concerns — commercial and recreational fishers; researchers; tourism operators; conservation groups; wildlife interest groups and proponents of coastal development in the vicinity of important habitat areas.

13 CONSULTATION

The Recovery Plan for the Australian Sea Lion has been developed through extensive consultation with a broad range of stakeholders and affected interests, including a scientific workshop held in November 2011 and a broader stakeholder workshop held in April 2012. Groups consulted include other Commonwealth agencies, in particular DAFF and AFMA; state government agencies including the fisheries, scientific and conservation departments within the South Australian and Western Australian governments; researchers; conservation groups; the DSEWPaC Indigenous Advisory Committee; commercial and recreational fishing representative groups; tourism operators and the TSSC.

The draft version of the plan and the 2010 Australian Sea Lion Technical Issues Paper was open to public consultation in April 2010 for a period of three months and the final version of the plan was approved by the TSSC on 6 September 2012 before being made by the Minister.

14 BIODIVERSITY BENEFITS

The Commonwealth South-west Marine Bioregional Plan is available for download at: www.environment.gov.au/coasts/marineplans/index.html It identifies the Australian sea lion as a regional priority because of the species' conservation status, the significance of the region to their recovery and the pressures impacting the population in the region. This recovery plan is likely to benefit the protection of non-target native species that occur within the same habitat as the Australian sea lion such as the Australian fur seal and the New Zealand fur seal. Evidence suggests that pinniped colonies are areas where white sharks can aggregate or frequently revisit to feed and are therefore most likely areas of habitat critical to the survival of white sharks (Bruce, et al., 2005). Actions to reduce fishing impacts and fishing related marine debris in areas occupied by Australian sea lions may also have benefits for a range of other marine species that interact with fishing practices.

15 SOCIAL AND ECONOMIC CONSIDERATIONS

15.1 Ecotourism

The Australian sea lion is of economic value for ecotourism (land-based and boat-based tourism). Over the last 15 years, pinniped tourism has experienced a rapid growth in the Southern Hemisphere, particularly in Australia and New Zealand. For example, Seal Bay in South Australia attracts more than 100 000 visitors per year. Measures put in place to manage the impacts of human interactions, if necessary, may affect ecotourism operators. Such measures may also impact on the social value to tourists of enjoying the natural amenity of an Australian sea lion colony.

15.2 Commercial and recreational fishing

Commercial gillnet fishing and commercial and recreational rock lobster fishing interact with Australian sea lions because these operations overlap with the foraging habitats of this species. These fishing operations may be affected by the management measures put in place to protect the Australian sea lion through closures of fishing areas or the requirement to use sea lion excluder devices (SLEDS) in the rock lobster fisheries.

15.3 Aquaculture

Aquaculture operations may impact on Australian sea lions by displacing them from suitable habitat, altering natural foraging behaviour and leading to potential conflict between aquaculture operators and the species. Measures put in place to manage impacts of aquaculture operations, if necessary, may affect aquaculture operators.

16 EFFICIENT AND EFFECTIVE USE OF RESOURCES

In order to maximise the conservation outcomes and cost effectiveness of this plan, the actions proposed complement those of other threatened marine species recovery plans — such as the white shark and marine turtles recovery plans and the threat abatement plan for the impacts of marine debris on vertebrate marine life, which also identifies actions to minimise the impacts to marine fauna from marine debris.

17 ORGANISATIONS / PERSONS INVOLVED IN EVALUATING THE PERFORMANCE OF THE PLAN

This plan should be reviewed no later than five years from when it was endorsed and made publicly available. The review will determine the performance of the plan; whether the plan continues unchanged; is varied to remove completed actions and include new conservation priorities or whether a recovery plan is no longer necessary for the species as either conservation advice will suffice or the species is removed from the threatened species list.

The review will be coordinated by DSEWPaC in association with relevant Commonwealth government and state agencies and key stakeholder groups, such as the commercial and recreational fishing sectors, non-government organisations, tourism operators and scientific research organisations.

Key stakeholders who may be involved in the review of the performance of the Recovery Plan for the Australian Sea Lion, including organisations likely to be affected by the actions proposed in this plan include:

Australian Government

Australian Fisheries Management Authority

Department of Agriculture, Fishing and Forestry

Department of Resources, Energy and Tourism

Department of Innovation, Industry, Science, Research and Tertiary Education

Department of Sustainability, Environment, Water, Population and Communities

Indigenous Land Corporation

Industry and non-government organisations

Commercial fishers and associations
Conservation groups
Indigenous Land Councils and communities
Local communities
Nature-based tourism industry
Oil and gas exploration and production industry
Marine/ocean energy industry
Recreational fishers and associations
Universities and other research organisations
Whale-watching industry and associations
Recreational boating

State / territory governments

Department of Environment and Conservation, WA
Department of Environment and Natural Resources, SA
Department of Primary Industries and Resources, SA
Fisheries agencies
Museums
South Australia Research and Development Institute.

18 REFERENCES

AFMA. (2010). *Australian Sea Lion Management Strategy.* Available on the internet at: http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/southern-and-eastern-scalefish-and-shark-fishery/notices-and-announcements/australian-sea-lion-management-strategy-and-sessf-closure-direction-no-3/

AFMA. (2011). *Changes in the Gillnet, Hook and Trap Sector of the Southern and Eastern Scalefish and Shark Fishery.* Available on the internet at: http://www.afma.gov.au/managing-our-fisheries/fisheries-a-to-z-index/southern-and-eastern-scalefish-and-shark-fishery/notices-and-announcements/changes-in-the-gillnet-hook-and-trap-sector-of-the-southern-and-eastern-scalefish-and-shark-fishery/

AFMA. (2012). *Australian Sea Lion Management Strategy – reset maximum bycatch trigger limits.* Available on the internet at: http://www.afma.gov.au/australian-sea-lion-management-strategy-reset-maximum-bycatch-trigger-limits/

Baylis, A.M.M., Hamer D.J., & Nichols P.D. (2009). Assessing the use of milk fatty acids to infer diet of the Australian sea lion *(Neophoca cinerea). Wildlife Research 36*, 169–176.

Bruce, B.D., Stevens, J.D., & Bradford, R.W. (2005). *Site fidelity, residence times and home range patterns of white sharks around pinniped colonies.* Final Report to the Australian Government Department of the Environment and Heritage by CSIRO Marine and Atmospheric Research: Hobart (pp. 40). Available on the internet at: http://www.environment.gov.au/coasts/publications/white-shark-pinniped/index.html.

Campbell, R. (2003). *Demographic and population genetic structure of the Australian sea lion*, Neophoca cinerea. PhD Thesis. University of Western Australia, Perth, WA.

Campbell, R.A., Gales, N.J., Lento, G.M., & Baker, C.S. (2008a). Islands in the sea: extreme female natal site fidelity in the Australian sea lion, *Neophoca cinerea*. Biology Letters 4, 139–142.

Campbell, R.A., Holley, D., Christianopoulos, D., Caputil, N., & Gales, N. (2008b). Mitigation of incidental mortality of Australian sea lions in the west coast rock lobster fishery. *Endangered Species Research 5*, 345–358.

DEWHA (Department of Environment, Water, Heritage and the Arts). (2010). *Recovery Plan for the Australian Sea Lion* (Neophoca cinerea), *Technical Issues Paper*. Australian Government, Canberra.

DSEWPaC (Department of Sustainability, Environment, Water, Population & Communities). (2012). *South-west Marine Region Bio-regional Plan, Schedule 2*. Available on the internet at: http://www.environment.gov.au/coasts/mbp/south-west/consultation/index-%20background

Gales, N.J., & Cheal, A.J. (1992). Estimating diet composition of the Australian sea lion *Neophoca cinerea* from scat analysis: an unreliable technique. *Wildlife Research 19*, 447–456.

Gales, N.J., Cheal, A.J., Pobar, G.J., & Williamson, P. (1992). Breeding biology and movements of Australian sea-lions, *Neophoca cinerea*, off the west coast of Western Australia. *Wildlife Research 19*, 405–416.

Gales, N.J., Shaughnessy, P.D., & Dennis, T.E. (1994). Distribution, abundance and breeding cycle of the Australian sea lion, *Neophoca cinerea* (Mammalia: Pinnipedia). *Journal of Zoology, London 234*, 353–370.

Goldsworthy, S.D., Lowther, A., Shaughnessy, P.D., McIntosh, R.R., & Page, B. (2007a). *Assessment of pup production and the maternal investment strategies of the Australian sea lion* Neophoca cinerea *at Dangerous Reef in the 2006–07 breeding season*. Report to the Department for Environment and Heritage, Wildlife Conservation Fund South Australia. SARDI Aquatic Sciences Publication Number F2007/000929-1. SARDI Research Report Series No 249 (pp. 58). Available on the internet at: http://www.sardi.sa.gov.au/__data/assets/pdf_file/0014/111911/No_249_Assessment_of_pup_production..._Dangerous_Reef_final_report.pdf

Goldsworthy, S.D., & Page, B. (2009). *A review of the distribution of seals in South Australia*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, SARDI Publication No. F2009/000368-1 (pp. 21). Available on the internet at: http://www.sardi.sa.gov.au/__data/assets/pdf_file/0019/115723/No_373_Review_of_the_Distribution_of_seals_in_SA.pdf

Goldsworthy, S.D., Page, B., Shaughnessy, P.D., & Linnae A. (2010). *Mitigating Seal Interactions in the SRLF and the Gillnet Sector SESSF in South Australia*. Report to the Fisheries Research Development Corporation. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000613-1. SARDI Research Report Series No. 405 (pp. 213).

Goldsworthy, S.D., Shaughnessy, P., & McIntosh, R. (2004). Plasticity in gestation length in response to environmental conditions in Australian sea lions *Neophoca cinerea*: new hypotheses to an enigmatic life history. In *Abstracts of the 22nd Wakefield Fisheries Symposium, Sea lions of the world: Conservation and research in the 21st century*, Anchorage, Alaska, USA (p. 5). Available on the internet at: http://seagrant.uaf.edu/conferences/sealions/abstracts.pdf

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M.P., Swift, R., & Thompson, D. (2003). A review of the effects of seismic surveys on marine mammals. *Marine Technology Society Journal 37*, 4.

Hamer, D.J., Ward, T.M., Shaughnessy, P.D., & Clark, S.R. (2011). Assessing the effectiveness of the Great Australian Bight Marine Park in protecting the endangered Australian sea lion *(Neophoca cinerea)* from by-catch mortality in shark gill-nets. *Endangered Species Research 14*, 203–216.

Higgins, L.V. (1993). The nonannual, nonseasonal breeding cycle of the Australian sea lion, *Neophoca cinerea. Journal of Mammalogy 74*, 270–274.

Ling, J.K. (1999). Exploitation of fur seals and sea lions from Australian, New Zealand and adjacent subantarctic islands during the eighteenth, nineteenth and twentieth centuries. *Australian Zoologist 31*, 323–350.

Ling, J.K., & Walker, G.E. (1978). An 18-month breeding cycle in the Australian sea lion? *Search 9*, 464–465.

Lowther, A.D., Harcourt, R.G., Goldsworthy, S.D., & Stow, A. (2012). Population structure of adult female Australian sea lions is driven by fine-scale foraging site fidelity. *Animal Behaviour 83*, 691–701.

McIntosh, R.R. (2007). *The life history and population demographics of the Australian sea lion*, Neophoca cinerea. PhD thesis, La Trobe University, Bundoora, Victoria (pp. 367).

McIntosh, R.R., Page, B., & Goldsworthy, S.D. (2006). Dietary analysis of regurgitates and stomach samples from free-living Australian sea lions. *Wildlife Research 33,* 661–669.

Shaughnessy, P.D. (1999). *The action plan for Australian seals*. Environment Australia, Canberra. Available on the internet at: http://www.environment.gov.au/coasts/publications/seals-action-plan.html

Shaughnessy, P.D., Goldsworthy, S.D., Hamer, D.J., Page, B., & McIntosh, R.R. (2011). Australian sea lions *Neophoca cinerea* at colonies in South Australia: distribution, abundance and trends, 2004 to 2008. *Endangered Species Research 13*, 87–98.

Shaughnessy, P.D.,& Goldsworthy, S.D. (2007). *Population assessment of fur seals and sea lions at some colonies in South Australia, 2006–07*. Final report to the Department for Environment and Heritage, South Australia and the South Australian Wildlife Conservation Fund. SARDI Aquatic Sciences Publication Number: F2007/000750-1. SARDI Research Report Series Number: 236 (pp. 43). Available on the internet at: http://www.sardi.sa.gov.au/__data/assets/pdf_file/0017/113480/No_236_Population_assessment_of_fur_seals_and_sea_lions_at_some_colonies_in_South_Australia,_2006-07.pdf

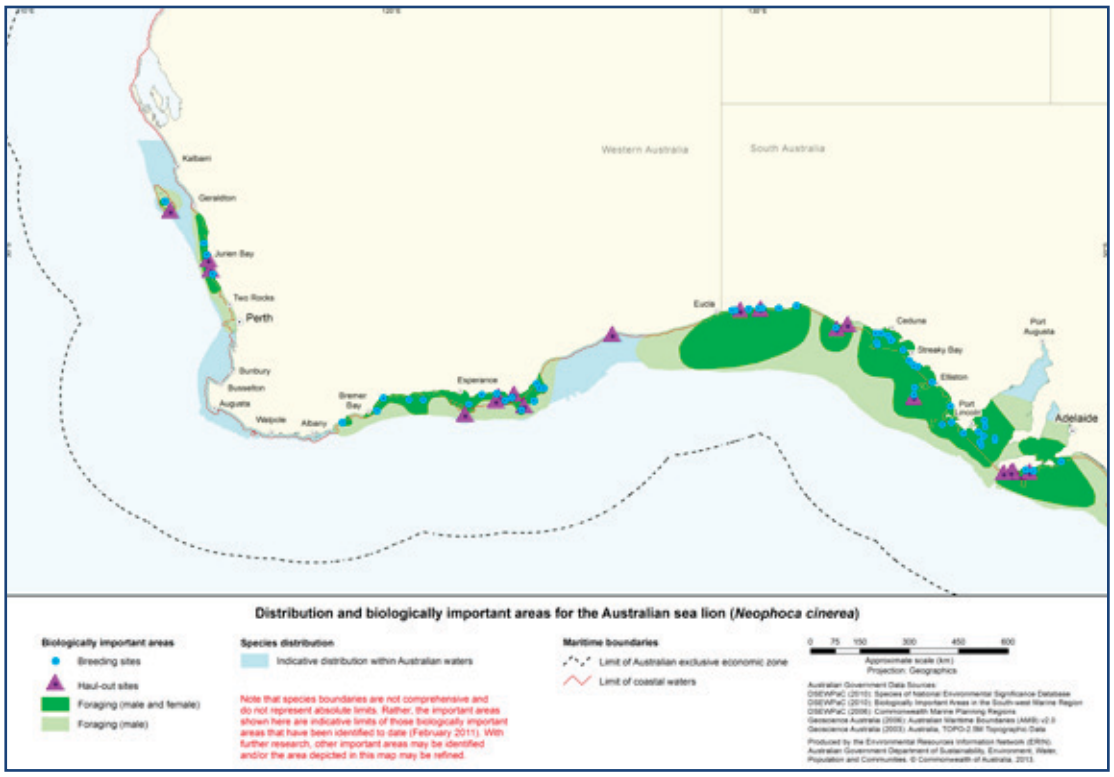
Shaughnessy, P.D., McIntosh, R.R., Goldsworthy, S.D., Dennis, T.E., & Berris, M. (2006). Trends in abundance of Australian sea lions, *Neophoca cinerea*, at Seal Bay, Kangaroo Island, South Australia. In A.W. Trites, S.K. Atkinson, D.P. DeMaster, L.W. Fritz, T.S. Gelatt, L.D. Rea, & K.M. Wynne, *Sea Lions of the World. Alaska Sea Grant College Program* (pp. 325–351). University of Alaska: Fairbanks, Alaska.

Wiebkin, A. S. (2011) *Conservation management priorities for little penguin populations in Gulf St Vincent.* Report to Adelaide and Mount Lofty Ranges Natural Resources Management Board. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000188-1. SARDI Research Report Series No.588. 97pp.

19 APPENDICES

Appendix 1: Biologically important areas

Figure 3: Distribution and biologically important areas for the Australian sea lion (DSEWPaC, 2012). The 58 breeding sites are considered habitat critical to the survival of the species.



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