

Australian Sea Lion Management Strategy

Southern and Eastern Scalefish and
Shark Fishery

Arrangements effective from 1 May 2013

Version 2.0 - updated July 2015



Australian Government

Australian Fisheries Management Authority

Contents

Executive summary	4
1 Introduction	5
1.1 Strategy objectives.....	6
2 Background	6
2.1 Historic impacts of sealing	6
2.2 Unique biology of the Australian sea lion.....	7
2.3 Population information	7
2.3.1 Population size	7
2.3.2 Pup counts	7
2.3.3 Population trends	7
2.4 Fishery history	8
2.5 Population risks	8
2.6 Bycatch of Australian sea lions	9
2.6.1 Population structure and regional management.....	10
3 The Australian Sea Lion Management Strategy.....	11
3.1 Spatial management – gillnet closures	11
3.2 Monitoring and reporting requirements.....	12
3.3 E-monitoring audit rates.....	12
3.4 Adaptive management system	12
3.4.1 Determination of bycatch trigger levels.....	13
3.5 Additional management measures	13
3.5.1 Additional area closures that protect sea lions.....	13
3.5.2 Bioregional marine planning.....	14
3.5.3 Review of gillnet restrictions.....	14
3.5.4 Gear restrictions	15
3.5.5 Education program	15
3.5.6 Identification guides.....	15
3.5.7 Bycatch and Discard Work Plans	15

3.5.8	Industry initiatives.....	16
3.6	Changes in gillnet fishing effort	16
3.6.1	Fishing effort reductions.....	16
3.6.2	Redistribution of effort - shifting to hook methods for catching sharks	16
3.7	Consultation and review of this Strategy- the Marine Mammal Working Group	17
	References.....	18
	Appendix 1	19
	Chronology of events	19
	Appendix 2	22
	Appendix 3	24

Figures

Figure 1. Location of three most recently identified breeding colonies (purple 4 nm closures) which were added to the Strategy in January 2013; Rocky South, Little Hummock, Cap Island NB extent of Little Hummock closure is incorporated within existing closures.	23
Figure 2. Gillnet closures for the protection of marine mammals in South Australia	24

Tables

Table 1. Adaptive management zone Australian sea lion bycatch triggers	13
Table 2. Australian sea lion colony positions in South Australia	22

Version history

#	Modified	Modified by	Document changes	Authorising officer
1.00	29/06/2010	Gillnet, Hook and Trap team, SESSF	Initial version	Glenn Hurry, CEO
2.00	15/07/2015	Andrew Trappett, Claire Taylor, AFMA	Revised to update policies, bycatch triggers, developments since 2010	John Andersen, Acting Executive Manager Fisheries

Document stakeholders

Name and position	Organisation	Responsibility
Gillnet, Hook and Trap team, SESSF	AFMA	Ensure document is up to date

Executive summary

AFMA's Australian Sea Lion Management Strategy (the Strategy) was first introduced in June 2010. The Strategy aims to monitor and minimise the impacts of interactions between Australian sea lions and gillnets used by Commonwealth shark fishers so as to enable breeding colonies of sea lions to recover.

To achieve these objectives the Strategy implements a range of long term management measures including:

- gillnet closures around all sea lion breeding colonies in South Australian waters spanning 18 500 km²
- 100 per cent monitoring of all gillnet fishing effort in South Australian waters
- the setting of Australia sea lion mortality limits that act to trigger additional closures if unacceptable levels of interaction occur
- an ongoing review of gillnet fishing practices, including allowing eligible gillnet operators to use hook fishing methods instead of gillnets
- an industry initiative to develop and implement a gillnetting code of conduct with assistance from AFMA and the Commonwealth Fisheries Association.

The Strategy has been developed, reviewed and revised in consultation with a range of stakeholders including industry, conservationists, other government departments and marine mammal experts who form the Gillnet Hook and Trap (GHAT) Marine Mammal Working Group. AFMA continues to work with industry and the Marine Mammal Working Group to ensure that the impacts of gillnets on Australian sea lions are minimised.

The Strategy revisions (**Appendix 1**) have included:

- increasing the level of monitoring
- increasing the size of colony closures
- reducing the bycatch triggers to a more precautionary level
- revising the boundaries of the adaptive management zones to better reflect colony location and available meta-population information.

To date, the Strategy has been highly effective at reducing the impacts of gillnetting on Australian sea lions, with ten mortalities occurring from July 2010 to March 2012, and two mortalities from May 2013 to 13 July 2015. The Recovery Plan for the Australian Sea Lion (Department of the Environment 2013) sets out the research and management actions under a strategic framework so that all relevant jurisdictions can work together to address threats to this species.

1 Introduction

The Australian sea lion population was significantly depleted by sealing activities in the 18th and 19th centuries. Sea lion distribution diminished, with breeding sites from Victor Harbour, South Australia to Mallacoota, Victoria and across the north coast of Tasmania disappearing (Campbell et al. 2008). The species was listed as threatened (vulnerable) under the *Environment Protection and Biodiversity Act 1999* (EPBC Act) in 2005.

The nature and extent of interactions between Australian sea lions and the gillnet sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) have historically been poorly understood. Due to this uncertainty Australian sea lions are assessed to be at high risk from the impacts of gillnet fishing during AFMA's ecological risk assessment (ERA) process.

To reduce uncertainty, AFMA and industry members supported additional research into fishery interactions with Australian sea lions. Industry members took marine mammal experts to sea onboard their vessels during fishing operations to observe and record interactions.

A report produced by the South Australian Research and Development Institute (SARDI) provided an assessment of the risks to Australian sea lion from the shark gillnet sector of the SESSF. The report predicted that high levels of bycatch mortality were limiting the recovery of most sea lion breeding colonies in South Australia (Goldsworthy et al. 2010).

In June 2010, AFMA implemented the Australian Sea Lion Management Strategy (the Strategy). The Strategy was developed in response to the SARDI research and aims to monitor and reduce the impacts of interactions between Australian sea lions and gillnets used by Commonwealth shark fishers in the area of the fishery off South Australia, so as to enable breeding colonies of sea lions to recover.

The management measures included in the Strategy were developed and refined in stages between 2010 and 2013. This document outlines management measures that have been in place since 1 May 2013.

The management measures of the Strategy include:

- gillnet closures around all sea lion breeding colonies in South Australian waters spanning 18 500 km²
- 100 per cent monitoring of all gillnet fishing effort in South Australian waters
- the setting of Australia sea lion mortality limits that act to trigger additional closures if unacceptable levels of interaction occur
- an ongoing review of gillnet fishing practices, including allowing eligible gillnet operators to use hook fishing methods instead of gillnets
- an industry initiative to develop and implement a gillnetting code of conduct with assistance from AFMA and the Commonwealth Fisheries Association.

1.1 Strategy objectives

This Strategy pursues AFMA's obligations under the *Fisheries Management Act 1991* (FMA) and the EPBC Act. The objectives include ensuring that the exploitation of fisheries resources consistent with the principles of ecological sustainable development including having regard to target and non-target species as well as the broader marine environment, and to maximise the net economic returns to the Australian community from the management of Australian fisheries.

Within this broader context the specific objectives of the Strategy are to significantly reduce the ecological risk the SESSF poses to Australian sea lions and enable their recovery.

Measures to achieve this are to:

1. implement long-term management measures, including closures and other actions, that will lead to a significant reduction of the impact of fishing activity on Australian sea lions. These measures will be clearly directed towards enabling recovery of the species, including all sub-populations; and
2. in consultation with marine mammal experts, continue to monitor and review the adequacy of management measures towards the objective of avoiding mortality of, or injuries to, Australian sea lions so as to enable the recovery of Australian sea lion populations, including all sub-populations.

2 Background

2.1 Historic impacts of sealing

During the 18th and 19th centuries Australia's colonial sealing industry hunted Australian fur seals (*Arctocephalus pusillus doriferus*), Australian sea lions (*Neophoca cinera*), New Zealand sea lions (*Phocarctos hookeri*), New Zealand fur seals (*Arctocephalus forsteri*) and Southern elephant seals (*Mirounga leonina*) (Ling 2002).

As sealing grounds were closely guarded secrets, the early sealers left few records of the identity, distribution and abundance of sea lion colonies from which to draw comparisons with the sea lion colonies today (Ling 2002).

Early writers often remarked on large numbers of fur seals or elephant seals to be seen at the various island haul-outs which they visited, but there do not appear to be any references to a great abundance of sea lions. The numbers harvested may therefore be as much a reflection of the small size of the original populations as of the low commercial value of the pelts (Ling 2002). Although the pre-harvested population size of Australian sea lions is unknown, the overall population is believed to be depleted relative to pre-European colonisation of Australia (Goldsworthy et al. 2010).

2.2 Unique biology of the Australian sea lion

Australian sea lions, *Neophoca cinerea*, are the only pinniped¹ species endemic to Australian waters and are one of the world's rarest sea lion species. Australian sea lions are unusual among pinnipeds as they are the only species that has a non-annual breeding cycle interval of 17 to 18 months. Breeding cycles are asynchronous across its range meaning different colonies do not breed at the same time (Gales et al. 1994). The gestation period is up to 14 months (the longest of any pinniped), a protracted breeding period is 4 to 7 months (the length of time which mating occurs over a breeding cycle) and a lactation period of 17.5 months.

2.3 Population information

2.3.1 Population size

Estimating the total population of Australian sea lions is extremely difficult as the species inhabits many remote offshore breeding sites and has an asynchronous breeding cycle. Estimates of population size rely on estimates of pup production and population modelling. The most recent estimate for the 2011 population was around 14 730 animals with the majority being found in South Australia (Shaughnessy et al. 2011).

Reliable census data are only available for a few of the 50 South Australian breeding colonies. While consecutive survey counts are available for a number of colonies, census methods are generally unreliable (Goldsworthy et al. 2009), and a number of colonies have not been surveyed in the last 20 years.

2.3.2 Pup counts

Pupping of Australian sea lions has been recorded at 78 breeding colonies along the coast and offshore islands between the Houtman Abrolhos Islands in Western Australia to the Page Islands in South Australia (51 breeding colonies in South Australia – **Appendix 2** - and 28 breeding colonies in Western Australia). Australian sea lions reproduce substantially slower than other pinnipeds such as fur seals. Only eight breeding colonies (all in South Australia) are known to produce more than 100 pups per breeding cycle. 21 breeding colonies are estimated to produce between 25-100 pup births per cycle with another 47 sites estimated to produce less than 25 pup births per cycle (Kirkwood and Goldsworthy 2013).

2.3.3 Population trends

Robust population trends are only available for the four largest colonies at Seal Bay, North and South Page Islands and Dangerous Reef. Pup production at the Dangerous Reef colony is known to be increasing by approximately five per cent per breeding season (data from 1975 to 2007). There appears to be no significant change to pup production at North and South Page Islands which have appeared to have had stable pup production from the mid-1980s to least 2010 (Kirkwood and Goldsworthy 2013). The most robust population trend data is available from the Seal Bay on Kangaroo Island. There has been an

¹ a group of animals comprising seals, sea lions and walruses

estimated 11 per cent decline in pup numbers at Seal Bay over a 22 year period (1985 to 2007) with significant variability between breeding seasons (Shaughnessy et al. 2006).

2.4 Fishery history

The SESSF is an important component of the Australian fishing industry, taking the largest tonnage and supplying fresh fish for markets in Sydney and Melbourne. The Gross Value of Production (GVP) for the SESSF was approximately \$92 million in 2012-13 financial year while the Shark Hook and Shark Gillnet sector of the SESSF recorded a GVP of \$15.7 million in 2012-13 (Georgeson et al. 2014). Approximately \$2.2 million of this value was derived from the shark gillnet sector in South Australia. The valuable gummy shark catch taken by the shark gillnet sector in South Australia provides the flake used for retail fish and chip shops throughout the region.

Shark fishing using monofilament gillnets became common in South Australian waters in the early 1970s with gillnet effort peaking in 1987 with nearly 43 000 km of net lifts. A variety of factors have significantly reduced the fishing effort in this region to the current levels of around 5000 km of net set in recent years. There are currently 61 statutory fishing rights to use a boat in the gillnet fishery. In addition there are three South Australian coastal waters gillnet fishing permits and 15 South Australian coastal waters gillnet and hook fishing permits authorised to use gillnets in the South Australian coastal waters of the SESSF.

In addition to the Commonwealth-managed SESSF, the Department of Primary Industries and Regions South Australia (PIRSA) managed Marine Scalefish Fishery (MSF) operates in all coastal waters of South Australia including gulfs, bays and estuaries (excluding the Coorong estuary), from the Western Australian border to the Victorian border. The MSF includes gillnet methods in areas overlapping with sea lion foraging areas. AFMA does not have jurisdiction over the area of the MSF which is managed by PIRSA. This strategy therefore does not apply to the area of waters of the MSF.

2.5 Population risks

Historically the main anthropogenic threat to the Australian sea lion was hunting and over-harvest through sealing. Although this activity was stopped more than 80 years ago, the sea lion population has not recovered to pre-exploitation levels. The current major anthropogenic threats are entanglement with marine debris and interactions with fisheries. In more recent times the largest sources of bycatch mortality included interactions with gillnets in the SESSF and lobster pots in the state managed southern and western rock lobster fisheries (Goldsworthy & Page 2007).

AFMA has undertaken detailed ERAs for all major Commonwealth-managed fisheries as a key part of the move towards ecosystem-based fisheries management. ERAs assess the risks that fishing poses to the ecological sustainability of the marine environment. The main purpose of ERAs is to prioritise the management, research, data collection and monitoring needs for each fishery.

For the gillnet sector of the SESSF five pinniped species were assessed as high risk through the ERA process. These are the Australian fur seal, New Zealand fur seal, Australian sea lion, leopard seal and southern elephant seal. The Australian sea lion is of greatest concern because of its small population size and complex breeding populations in southern Australia. The Australian fur seal and New Zealand fur seal have much larger populations that appear to be increasing. The leopard seal and southern elephant seal are distributed over a very wide geographic range, with only very small proportions of their populations occurring within the range of the shark gillnet sector of the SESSF.

The gillnet sector of the SESSF is only one factor affecting Australian sea lion populations.

The Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (Department of the Environment 2013) lists a number of other factors including other fisheries such as the Western Australian and South Australian Rock Lobster fisheries, aquaculture, marine debris, disease, human disturbance, habitat degradation, pollution, climate change, competition for food and shark predation, that may impact on sea lion populations and play some role in inhibiting sea lion recovery. The plan establishes a strategic integrated framework so that all relevant jurisdictions work together to address threats to this species. The recovery plan sets out the research and management actions necessary to stop the decline of, and support the recovery of, the Australian sea lion 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.

The recovery plan is available on the Department of the Environment website at: www.environment.gov.au/resource/recovery-plan-australian-sea-lion-neophoca-cinerea.

2.6 Bycatch of Australian sea lions

A 2010 SARDI report assessed the risks to Australian sea lions from the gillnet sector of the SESSF in South Australia (Goldsworthy et al. 2010). The study estimated that approximately 374 (272-506 ± 95% CL) Australian sea lions were being removed as bycatch mortality each breeding cycle (approximately 17.5 months). Population viability analyses from these data indicated that both the likelihood of further declines and the capacity for the species to recover would be enhanced if the bycatch of adult females was reduced.

During development of the Strategy, AFMA's Shark Resource Assessment Group² (SharkRAG) raised some concerns regarding the modelling which underpinned the bycatch estimates in Goldsworthy et al. (2010). SharkRAG considered the tracking and

² AFMA's Shark Resource Assessment Group (SharkRAG): a committee of stakeholders who provide expert advice to AFMA on Commonwealth shark stocks and other scientific matters. SharkRAG membership includes scientists, fishery managers, economists, fishers and conservation sector representatives.

movement modelling work on sea lion foraging behaviour to be very good and the overlay of foraging areas with fishing effort to be appropriate in order to provide an idea of the risk of interactions between sea lions and fishing gear. However, concerns were raised that the observer coverage used to estimate interactions rates was unbalanced and primarily conducted in areas of low fishing effort (AFMA 2010). This resulted in significant uncertainty in the bycatch estimates.

To increase certainty of bycatch estimates, AFMA has increased its monitoring for Australian sea lions through both the AFMA scientific on board observer program and the implementation of an electronic monitoring program.

Electronic monitoring systems (consisting of sensors and cameras which record only fishing activity) have proven to be a reliable, cost-effective alternative to on-board observers and have assisted industry to demonstrate to the community they are fishing using sustainable practices. AFMA has audited video footage from all fishing trips conducted in the Australian Sea Lion Zones between 2011 and 2015 and confirmed that there were no cases where a fisher failed to report an Australian sea lion interaction.

Since implementation in 2010, the Strategy has been effective at minimising Australian sea lion bycatch. The observed level of sea lion interactions is lower than that predicted by the SARDI research. Quantifying this reduction has proven difficult due to the changed fishery circumstances since closures were implemented, coupled with the drop in the level of gillnet fishing in sea lion habitat. Public reports of fishery interactions of sea lions, and other protected species, are available on the AFMA website:

www.afma.gov.au/sustainability-environment/protected-species-management/protected-species-interaction-reports/.

2.6.1 Population structure and regional management

Given the unique biology and breeding ecology of the Australian sea lion, an understanding of the population structure and genetic relatedness between breeding colonies is crucial for effective conservation and management.

Campbell (2003) suggested a genetic differentiation between Australian sea lion colonies with a significant correlation between genetic differentiation and geographic distance. For South Australian colonies this infers that while there will be no, or very little, mixing between colonies with large distances in between, this is not necessarily the case for closer colonies. Some evidence exists to suggest that some nearby colonies share enough genetic relatedness and could be grouped together (Lowther et al. 2012).

Campbell (2003, and Campbell et al. (2008)) provide a rationale for regional management of sub-populations rather than management on an individual colony basis. Based on available data AFMA has deemed it more precautionary to assume complete genetic separation and manage all colonies separately while also accounting for the evidence suggesting a regional approach is appropriate. In recognition of this, Goldsworthy et al. (2009b) identified a number of meta-populations for Australian sea lions using a distance matrix as a proxy for genetic distance. AFMA has utilised a similar meta-population, or

regional approach, to form the basis for the regions used in the identification of closures and the adaptive management system of this Strategy.

3 The Australian Sea Lion Management Strategy

The Strategy aims to minimise Australian sea lion mortalities from gillnets and allow the population to rebuild. The Strategy consists of a multi-tiered system of management measures to meet the Strategy's objectives including:

- gillnet closures around all Australian sea lion breeding colonies in South Australian waters spanning 18 500 km²
- 100 per cent monitoring of all gillnet fishing effort in South Australian waters through independent onboard observers or electronic monitoring systems
- the setting of Australian sea lion mortality limits that act to trigger additional closures if unacceptable levels of interaction occur
- an ongoing review of gillnet fishing practices, including allowing eligible gillnet operators to use hook fishing methods instead of gillnets
- a suite of additional measures including identification guides, education programs and an industry gillnetting code of conduct.

3.1 Spatial management – gillnet closures

In order to protect Australian sea lion breeding colonies, the Strategy stipulates a range of area closures which prevent gillnets from being set in the areas of key sea lion habitat and in close proximity to breeding colonies.

Baseline closures are maintained around all 51 colonies in South Australia of at least four nautical miles (7.3 km). These areas close to colonies generally have higher sea lion foraging effort and are the areas that must be traversed each time sea lions leave to forage and come ashore to haul out. The 7.3 km baseline closures cover an approximate 3500 km² of sea lion foraging area around all colonies. These closures preclude fishing in the area in which approximately 40 per cent of all historically observed sea lion interactions have occurred.

In addition to these baseline closures, additional larger closures are in place around select colonies with higher predicted risk of fishery bycatch, low pup production and terminal extinction risk. These additional closures are in place around 17 colonies and push the radial closures from four nm to 11 nm surrounding these colonies.

The spatial closures cover a combined 18 500 km² and are designed to offer protection to all colonies with the greatest protection afforded to those that have the highest predicted female bycatch mortalities. This approach also ensures that both the large populations on a regional basis and individual colonies are afforded significant protection.

3.2 Monitoring and reporting requirements

The Strategy requires all gillnet fishing effort in South Australia (the extent of sea lion habitat in AFMA's jurisdiction) to be monitored through either onboard scientific observers or electronic monitoring systems.

To enable real time management of the fishery, concession holders are expected to immediately report any capture of Australian sea lions, either by advising any AFMA observer deployed on their vessel or by directly contacting AFMA by telephone (02 6225 5506 or 0427 016 859). If an interaction is not reported immediately the vessel or operator involved may be required to carry an AFMA observer at all times in future when fishing, rather than have the opportunity to use electronic monitoring systems.

Any pinniped captured in the Australian Sea Lion Management Zone will be treated as an Australian sea lion for the purpose of the trigger limits unless there is evidence to the contrary. This evidence may include, but is not limited to, detailed photographs or observer reports. The advice of AFMA should be sought on a case by case basis as practical when an animal is captured.

3.3 E-monitoring audit rates

From 1 July 2015 e-monitoring was implemented as a mandatory monitoring measure on all fulltime gillnets boats (those that fish more than 50 days per season). Across the gillnet sector, AFMA audits a minimum 10 per cent of video footage recorded on each boat and cross checks observed catch composition and protected species interactions with those reported by fishers in their logbooks. In cases where there is considered to be a higher risk of non-reporting, AFMA will audit more than 10 per cent.

In the Australian Sea Lion Zones AFMA has audited 100 per cent of footage recorded on boats fishing between 2011 and 2015 and detected no cases where an operator failed to report an interaction with an Australian sea lion.

Any boat fishing in the Australian Sea Lion Zones from 1 July 2015 will commence with 100 per cent audit rates to check for protected species interactions. However, if individual operators prove to have a good track record of reporting, AFMA will consider reducing audit levels for those boats.

3.4 Adaptive management system

The Strategy includes adaptive management zones which implement significant spatial closures if unacceptable levels of Australian sea lion interactions occur within a fishing season (1 May to 30 April).

Under the adaptive management system, South Australian waters are divided into seven management regions (**Appendix 3**). These regions were determined with assistance from the GHAT Marine Mammal Working Group using the level of fishing effort (km of net set), the number of colonies, the likely location of colonies relative to the fishery, total pup production and available population structure data.

The trigger for further closures in each region is a pre-set number of observed Australian sea lion mortalities (both male and female sea lions, Table 1). Both sexes are included in the trigger due to the difficulty in determining the sex of sea lions at sea, particularly if the animal cannot be landed aboard the vessel.

Table 1. Adaptive management zone Australian sea lion bycatch triggers

Adaptive management zone	Bycatch trigger per fishing season
A	1
B	2
C	2
D	1
E	2
F	2
G	5
TOTAL	15

If the interaction level is reached for a region within a fishing season, it will be closed for 18 months – being the length of the breeding cycle of the Australian sea lion.

3.4.1 Determination of bycatch trigger levels

Initially, AFMA determined that a 1.5 per cent bycatch rate (representing 1.5 per cent of the female breeding population during a breeding cycle equating to 52 female sea lions) was likely to be sufficiently precautionary in identifying trigger levels for the adaptive management zones.

Taking into account expert advice, AFMA determined that this bycatch rate could not be guaranteed to demonstrably protect each of the sub-populations (breeding colonies), several of which have been recognised as being at risk of becoming locally extinct.

AFMA therefore acted to implement a more precautionary approach and, based on expert advice, determined that an overall bycatch of 15 animals per year would be sufficiently precautionary in meeting the objectives of the Strategy.

3.5 Additional management measures

AFMA and industry have initiated a range of management measures in addition to the Strategy over time, that while not specifically directed at the conservation of sea lions, have afforded protection to the species. Some of these measures, for example reductions in total fishing effort and spatial closures, are likely to have substantially reduced the bycatch mortality of sea lions over time.

3.5.1 Additional area closures that protect sea lions

In addition to the closures of the Strategy, a large number of area closures have been implemented across the broader SESSF to protect a range of species. A number of these

closures were implemented through offshore constitutional arrangements (OCS) and also in response to the Ministerial Direction of 2005 to recover overfished stocks and manage the broader environmental impacts of fishing. The following existing closures afford some level of protection to Australian sea lion foraging areas:

- all internal waters of South Australia
- Murat Bay
- Seal Bay
- The Pages
- head of the Great Australian Bight
- Backstairs Passage
- Kangaroo Island
- Victor Harbour to the Victorian border
- all waters deeper than 183 m.

The total area of the gillnet sector in South Australia is approximately 592 000 km², the closures listed above cover approximately 415 000 km² or 69.1 per cent of the area available for fishing.

In addition to the closures implemented by AFMA, further areas are closed by the Great Australian Bight Marine Park. The Marine Mammal Protection Zone of this park, which is situated in the head of the Great Australian Bight, is closed from 1 May to 31 October every year www.environment.gov.au/topics/marine/marine-reserves/south-west/gab.

3.5.2 Bioregional marine planning

Marine bioregional plans have been developed for four of Australia's marine regions - South-west, North-west, North and Temperate East. Marine Bioregional Plans will help improve the way decisions are made under the EPBC Act, particularly in relation to the protection of marine biodiversity and the sustainable use of our oceans and their resources by our marine-based industries. The South West Region encompasses the area of distribution of Australian sea lions. For more information please see:

www.environment.gov.au/marine/marine-bioregional-plans.

3.5.3 Review of gillnet restrictions

AFMA in consultation with industry and the Marine Mammal Working Group has been assessing the ability of changes to current fishing gear requirements to mitigate against interactions of Australian sea lions. A range of mitigation measures have been identified to reduce the risk of entanglement and subsequently increase the chance of escapement such as adopting tighter slinging ratios to reduce the total amount of mesh in the water and to set gillnets in a way to reduce entanglement. AFMA is highly supportive of industry implementing best practices in setting their gear to minimise their sea lion bycatch. AFMA and industry have additionally been investigating the use of shark hooks as an alternative to gillnetting in sea lion habitat.

3.5.4 Gear restrictions

The gillnet sector is also subject to a number of gear restrictions which limit the size and type of gillnets used. These gear restrictions are designed for the net to select sub-adult gummy sharks without capturing the adults and juveniles. Commonwealth operators are restricted to the use of 4200 m of net in waters off South Australia with further restrictions on the height of nets to ensure the total net area is also restricted. While a broad range of mesh sizes have been permitted in the past, over time the mesh size restriction has been refined and only a narrow range is now permitted. Previously fishers were permitted to use nets of up to 200 mm, however to reduce the capture of larger sharks fishers are now restricted to nets with a mesh size between 150 mm and 165 mm in width. Advice from SharkRAG has indicated that the decrease in mesh size would likely reduce the risk of sea lion bycatch mortality. Commonwealth fishers targeting shark in state waters, such as those holding coastal waters permits, are further restricted to 1800 m of net.

3.5.5 Education program

AFMA has been working with gillnet fishers to highlight the importance of avoiding interactions with threatened, endangered and protected (TEP) species, including Australian sea lions. Australian sea lions are often confused with fur seals as they all inhabit similar areas and have similar overall appearance. Marine mammal experts have briefed all AFMA scientific observers on the identification and sexing of Australian sea lions and the two fur seal species to aide them in making accurate reports. AFMA management has sent identification material to gillnet fishers to aide species identification.

3.5.6 Identification guides

In 2005 AFMA produced a Protected Species ID Guide with funding support from the Australian Government through the Natural Heritage Trust to help industry with identification of all TEP species which was distributed to all Commonwealth vessels at the time. Numerous education campaigns, including port visits, have also been conducted to improve the recording of interactions with TEP species.

3.5.7 Bycatch and Discard Work Plans

Bycatch and Discard Work Plans have been developed for the gillnet sector of the SESSF. These work plans identify the specific bycatch issues in each sector based on the outcomes of the ERAs and detail actions required to address those issues. The primary focus for the work plans is to mitigate the impact of fishing on high risk species, TEPs as listed under the EPBC Act, and reduce overall levels of bycatch and discarding. These work plans are integrated into the management arrangements for the fishery to enable actions outlined, to be implemented. The work plans were first implemented in July 2009 and are reviewed every 12 months and formally renewed every two years, in line with AFMA's Program for Addressing Bycatch and Discarding in Commonwealth fisheries: an Implementation Strategy at www.afma.gov.au/sustainability-environment/bycatch-discarding/bycatch-discard-workplans/.

The bycatch work plans outline management actions to assist in addressing the impact of fishing on them. However, whilst consistent with the bycatch work plans, the actions

outlined in this Strategy are more developed and focused than those currently outlined in the work plans.

3.5.8 Industry initiatives

South Australian industry representatives have developed a Gillnetting Code of Conduct with assistance from AFMA and Commonwealth Fisheries Association. The Code of Conduct addresses the following issues: reducing the length of net soak times; increasing awareness of skippers to move on if they observe sea lions in the vicinity of their boat or they are in high scalefish areas; introducing guidelines regarding the retention of marine debris and offal management; and working with scientists to retain samples if possible to help gather important information about sea lions.

3.6 Changes in gillnet fishing effort

3.6.1 Fishing effort reductions

Gillnet fishing effort in South Australian waters peaked in 1987 at approximately 43 000 km of net set. Changes to management arrangements implemented since this time, including limited entry, gear restrictions and the move to manage the SESSF through output controls such as quota have seen this effort reduced to levels of approximately 17 000 km of net set per year (as of 2010). Following the introduction of the Strategy in 2010, further reduction in gillnet fishing effort has occurred in South Australia to around 5000 km of net set in 2014. This has likely been due to some fishers changing to the hook fishing method or moving their fishing practices to alternative grounds outside of sea lion habitat.

The Australian Government *Securing our Fishing Future* voluntary fishing concession buyback initiated in 2005 resulted in the removal of 26 shark gillnet boat statutory fishing rights and 17 South Australian coastal waters permits. This structural adjustment package reduced the number of vessels fishing with gillnets in South Australia by 27 per cent.

A chronology of management changes in the gillnet sector in South Australia is at **Appendix 1**.

3.6.2 Redistribution of effort - shifting to hook methods for catching sharks

In recognition of the large spatial closures in South Australia and in order to allow fishing businesses flexibility in fishing their shark quota, AFMA has granted eligible operators permits to fish inside gillnet closures using the shark hook fishing method instead of gillnets. To be eligible shark fishers must have a history of fishing in waters off South Australia.

To date, there has been a significant increase in gummy shark quota taken using shark hooks in South Australia since this option was offered. SharkRAG have been providing AFMA with advice on how this increase in hook caught gummy shark may affect the stock assessment. Current gillnet techniques are very selective for target and bycatch species designed to target only four sub-adult and maturing year classes (4-7 year old) of gummy shark, avoiding adult age classes (Punt 2000). This selectivity underpins the sustainability of the fishery and substantial changes to selectivity may cause a reduction in the

productivity of the stock. Increased amounts of hook caught gummy shark may decrease selectivity for both target and non-target species (catching more fish outside these year classes, generally juveniles and larger pupping females). AFMA currently has reliable data on the non-target species bycatch associated with gillnet methods; a significant increase in shark hook fishing would need to closely monitor any shift in the species being captured. A revised shark hook ERA is planned for the 2015-16 fishing season.

Shark fishers have reported to AFMA on a number of associated issues in moving from gillnets to hooks. These issues include the high costs involved in purchasing and modifying their boat setup, reduced profit in some instances due to costs associated with skippers learning a new method of fishing and needing to buy bait and hire an additional crew member to assist with baiting, setting and hauling gear. AFMA continues to work with fishers in addressing these issues.

3.7 Consultation and review of this Strategy- the Marine Mammal Working Group

This Strategy has been developed and refined in consultation with members of the fishing industry, scientists, conservation groups and representatives from various State and Commonwealth government agencies.

Since implementation, the measures and efficacy of the Strategy have been subject to ongoing review by the GHAT Marine Mammal Working Group. This working group has assisted AFMA in reviewing the effectiveness of the Strategy by providing expert advice and critically reviewing how the Strategy has met its objectives.

Taking into account advice provided by the Marine Mammal Working Group and other stakeholders, AFMA has acted to revise the strategy over time to better pursue its objectives.

These Strategy revisions (**Appendix 1**) have included:

- increasing the level of monitoring
- increasing the size of colony closures
- reducing the bycatch triggers to a more precautionary level
- revising the boundaries of the adaptive management zones to better reflect colony location and available meta-population information.

Annual reports on the implementation of the Strategy have been included in the Annual Status Report of the SESSF required under the Wildlife Trade Operation for the SESSF which are available the Department of the Environment website.

The Recovery Plan for the Australian Sea Lion is to be reviewed no later than five years from when implemented (2013). The review is to be co-ordinated by the Department of the Environment in association with AFMA, the Marine Mammal Working Group and other relevant stakeholders.

References

- AFMA, 2010. *Shark Resource Assessment Group 15-16 April 2010 meeting minutes*. Australian Fisheries Management Authority, Canberra.
- Campbell, R.A., 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. and Baker, C.S., 2008. Islands in the sea: extreme female natal site fidelity in the Australian sea lion, *Neophoca cinerea*. *Biology Letters*, 4: 139–142.
- Department of the Environment, 2013. Issues paper for the Australian Sea Lion (*Neophoca cinerea*). www.environment.gov.au/system/files/resources/1eb9233c-8474-40bb-8566-0ea02bbaa5b3/files/neophoca-cinerea-issues-paper.pdf.
- Department of the Environment, 2013. Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*). www.environment.gov.au/resource/recovery-plan-australian-sea-lion-neophoca-cinerea.
- Gales, N.J., Shaughnessy, P. D. and 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.
- Georgeson, L., Stobutzki, I. & Curtotti, R., (eds), 2014. Fishery Status Reports 2013-14, Australian Bureau of Agricultural and Resource Economics, Canberra.
- Goldsworthy, S.D. and Page, B., 2007. A risk-assessment approach to evaluating the significance of seal bycatch in two Australian fisheries. *Biological Conservation* 139: 269-285.
- Goldsworthy, S.D., Page, B., Lowther, A, Rogers, P. and Shaughnessy, P.D., 2009a. Pup production assessment of the Australian sea lion, *Neophoca cinerea* at Dangerous Reef and English Island, South Australia. Report to the Department for Environment and Heritage, Wildlife Conservation Fund Project No. 0259. SARDI Aquatic Sciences Publication Number F2009/000088-1. SARDI Research Report Series No. 338.
- Goldsworthy, S.D., McKenzie, J., Shaughnessy, P.D., McIntosh, R.R., Page, B., Campbell, R., 2009b. An update to the Report: Understanding the Impediments to the Growth of Australian Sea Lion Populations. Report to the Department of the Environment, Water Heritage and the Arts. SARDI Publication Number F2008/00847-1, SARDI Research Report Series No. 356.
- Goldsworthy, S.D., Page, B., Shaughnessy, P.D. and Linnane, A., 2010. Mitigating seal interactions in the SRLF and the gillnet sector SESSF in South Australia. SARDI Aquatic Sciences Publication Number F2009/000613-1. SARDI Research Report Series No. 405.
- Kirkwood, R. and Goldsworthy, S., 2013. *Fur Seals and Sea Lions*. Australian Natural History Series, CSIRO Publishing.
- Ling, J.K., 2002. Impact of colonial sealing on seal stocks around Australia, New Zealand and subantarctic islands between 150 and 170 degrees East. *Australian Mammalogy* 24: 117-126.
- Lowther, A.D., Stow, A., Harcourt, R.G., Goldsworthy, S.D., 2012. Population structure of adult female Australian sea lions driven by fine-scale foraging site fidelity. *Animal Behaviour*, 83: 691-701.
- Punt, A.E., 2000. Assessments of the populations of Gummy Shark of South Australia and New South Wales. SharkRAG Document 2000/12.
- Shaughnessy, P.D., Goldsworthy, S.D., Hamer, D.J., Page, B., and McIntosh, R.R., 2011. Australian sea lions *Neophoca cinerea* at colonies in South Australia: distribution and abundance: 2004 to 2008. *Endangered Species Research* 13: 87–98.
- Shaughnessy, P.D., McIntosh, R.R., Goldsworthy, S.D., Dennis, T.E., and Berris, M., 2006. Trends in abundance of Australian sea lions, *Neophoca cinerea*, at Seal Bay, Kangaroo Island, South Australia in Trites, A. W., Atkinson, S. K., DeMaster, D. P., Fritz, L. W., Gelatt, T. S., Rea, L. D., and Wynne K. M. (eds) *Sea Lions of the World*, pp. 325–351. Fairbanks, Alaska, USA: Alaska Sea Grant College Program, University of Alaska.

Appendix 1

Chronology of events

1798 – 1920	Sealing activities reduce Australian sea lion populations.
1927	Shark fishing in southern Australia was first recorded with fishers targeting sharks with demersal longlines.
1927 – 1960	The shark fishery develops in line with increased demand for shark meat and vitamin A from shark liver oil.
1970s	Monofilament gillnet methods replace demersal longline and shark fishery begins targeting Gummy Shark.
1987	Gillnet fishing effort in South Australian waters peaks at nearly 43 000 km net set.
1987 – 2000	Management measures reduce fishing effort to current levels
1997	Large mesh nets removed from fishery, shark operators restricted to 150-165 mm mesh
2000	Management of shark fishing being ceded to the Commonwealth government under Offshore Constitutional Settlement (OCS). All internal waters of South Australia closed to shark fishing.
2001	Shark fishery moves to quota, total allowable catch (TAC) set Gummy Shark and School Shark.
2005	Australian Government <i>Securing our Fishing Future</i> voluntary fishing concession buyback initiated, results in the removal of 26 shark gillnet boat statutory fishing rights and 17 South Australian coastal waters permits.
2007	Commonwealth Fisheries Harvest Strategy Policy is implemented, results in a move towards the target of Maximum Economic Yield (MEY) in Commonwealth managed fisheries.
2007	Closures to inshore areas implemented throughout South Australia.
Dec 2009	Interim closures implemented around 48 Australian sea lion colonies (the number of colonies then recognised). Sea lion specific scientific observation procedures commence.
Apr 2010	SARDI report released estimating 374 sea lion mortalities per breeding cycle (17.5 months) due to gillnet fishing

29 Jun 2010	<p>AFMA's Australian Sea Lion Management Strategy implemented:</p> <ul style="list-style-type: none"> • 6300 km² of closures around colonies • Observer coverage increased to 11 per cent in Australian sea lion habitat • Interaction trigger system and adaptive management zones introduced with cumulative trigger of 52 mortalities.
28 Apr 2011	<p>AFMA implements <i>SESSF Temporary Order No. 1, 2011</i> for 1 May 2011, to strengthen strategy:</p> <ul style="list-style-type: none"> • closures increased to 18 500 km² to encompass two thirds of observed interactions (strip closures, 4 nm closures and 11 nm closures implemented) • revised interaction trigger system (52 mortalities) • monitoring increased to 100 per cent of gillnet operations in South Australian (onboard observers or electronic monitoring) and 10 per cent monitoring of gillnet and shark hook operations in the rest of the fishery outside of SA • prohibition on the discharge of offal from gillnetters in whole fishery • provision to support a change from gillnets to hook fishing method for South Australian gillnet operators.
1 Nov 2011	<p><i>SESSF Closure Direction No. 2 2011</i> implemented to roll over measures of the then expiring <i>Temporary Order No. 1 2011</i> into a longer term legislative instrument.</p>
1 Dec 2011	<p>Boundaries of adaptive management zones (A to G) are amended to better reflect state of knowledge of population structure, protect smaller colonies. Bycatch trigger limits for adaptive management are reduced from 52 to 15 mortalities following advice from experts that previous sea lion bycatch limits would not guarantee the protection of all sea lion breeding colonies or sub-populations, several of which are recognised as being at significant risk.</p>
6 Feb 2012	<p>Following the bycatch trigger (1x sea lion) being met, adaptive management zone A is closed to gillnetting for 18 months through <i>SESSF Closure Direction No. 1 2012</i> to ensure no further mortality prevents colonies in this zone from rebuilding.</p>
5 Mar 2012	<p>Following the bycatch trigger (2x sea lions) being met, adaptive management zone B is closed to gillnetting for 18 months through <i>SESSF Closure Direction No 2 2012</i> to ensure no further mortality prevents colonies in this zone from rebuilding.</p>

7 April 2012	Following the bycatch trigger (1x sea lion) being met, adaptive management zone D is closed to gillnetting for 18 months through <i>SESSF Closure Direction No 3 2012</i> to ensure no further mortality prevents colonies in this zone from rebuilding.
1 May 2013	<i>SESSF Closure Direction No. 7 2013</i> implemented with two additional radial closures to protect three newly described breeding colonies: Cap Island, Rocky Island (South) and Little Hummock Island (Appendix 2, Figure 1). <i>NB Little Hummock Island closure area is encompassed by existing closures from nearby colonies – no new closure implemented to protect this colony.</i>
15 May 2013	Adaptive management zone A reopens to gillnetting following 18 month closure to protect breeding colonies.
10 Aug 2013	Adaptive management zone B reopens to gillnetting following 18 month closure to protect breeding colonies.
23 Aug 2013	Adaptive management zone D reopens to gillnetting following 18 month closure to protect breeding colonies.
July 2015	Strategy updated to include policy changes made since June 2010.

Appendix 2

Table 2. Australian sea lion colony positions in South Australia

Location	Latitude			Longitude		
Bunda Cliffs 'B9'	31°	38.8	S	129°	18.68	E
Bunda Cliffs 'B8'	31°	38.38	S	129°	22.86	E
Bunda Cliffs 'B7'	31°	37.5	S	129°	30.63	E
Bunda Cliffs 'B6'	31°	36.56	S	129°	45.71	E
Bunda Cliffs 'B5'	31°	35.11	S	130°	1.84	E
Bunda Cliffs 'B4'	31°	35.14	S	130°	3.67	E
Bunda Cliffs 'B3'	31°	34.94	S	130°	7.55	E
Bunda Cliffs 'B2'	31°	35.17	S	130°	34.85	E
Bunda Cliffs 'B1'	31°	31.05	S	131°	3.67	E
Nutys Reef (west)	32°	7.12	S	132°	7.88	E
Nutys Reef (east)	32°	8.32	S	132°	8.48	E
Point Fowler	32°	0.65	S	132°	26.27	E
Purdie Island	32°	16.19	S	133°	13.7	E
West Island	32°	30.65	S	133°	15.08	E
Fenelon Island	32°	34.86	S	133°	16.9	E
Lounds Island	32°	16.38	S	133°	21.94	E
Breakwater Island	32°	18.96	S	133°	31.8	E
Gliddon Reef	32°	19.32	S	133°	33.66	E
Blefuscu Island	32°	28.02	S	133°	38.64	E
Lilliput Island	32°	26.04	S	133°	41.58	E
Olive Island	32°	43.15	S	133°	58.19	E
Nicolas Baudin Island	33°	0.94	S	134°	7.98	E
Point Labatt	33°	9.14	S	134°	15.64	E
Jones Island	33°	11.12	S	134°	22.03	E
Dorothee Island	34°	0.3	S	134°	14.7	E
Pearson Island	33°	57.72	S	134°	16.02	E
Ward Island	33°	44.45	S	134°	17.1	E
West Waldegrave Island	33°	35.77	S	134°	45.69	E
Four Hummocks (North) Island	34°	45.46	S	135°	2.53	E
Little Hummock Island	34°	78	S	135°	0.03	E
Cap Island	33°	94.5	S	135°	11.72	E
Rocky Island (North)	34°	15.52	S	135°	15.63	E
Rocky Island (South)	34°	81	S	134°	71.72	E
Price Island	34°	42.46	S	135°	17.37	E
Liguanea Island	34°	59.9	S	135°	37.19	E
Lewis Island	34°	57.42	S	136°	1.9	E
North Neptune (East) Island	35°	13.68	S	136°	4.62	E

Location	Latitude			Longitude		
South Neptune (Main) Island	35°	19.82	S	136°	6.71	E
Albatross Island	35°	4.12	S	136°	10.88	E
English Island	34°	38.27	S	136°	11.75	E
Dangerous Reef	34°	48.9	S	136°	12.72	E
North Island	35°	7.24	S	136°	28.57	E
Peaked Rocks	35°	11.1	S	136°	28.92	E
North Casuarina Island	36°	4.09	S	136°	42.15	E
Cape Bouguer	36°	2.5	S	136°	54.53	E
Cave Point	36°	1.55	S	136°	57.44	E
Seal Bay	35°	59.7	S	137°	19.02	E
Black Point	36°	2.29	S	137°	24.38	E
Seal Slide	36°	1.54	S	137°	32.17	E
South Pages Island	35°	46.63	S	138°	17.5	E
North Pages Island	35°	45.54	S	138°	18.07	E

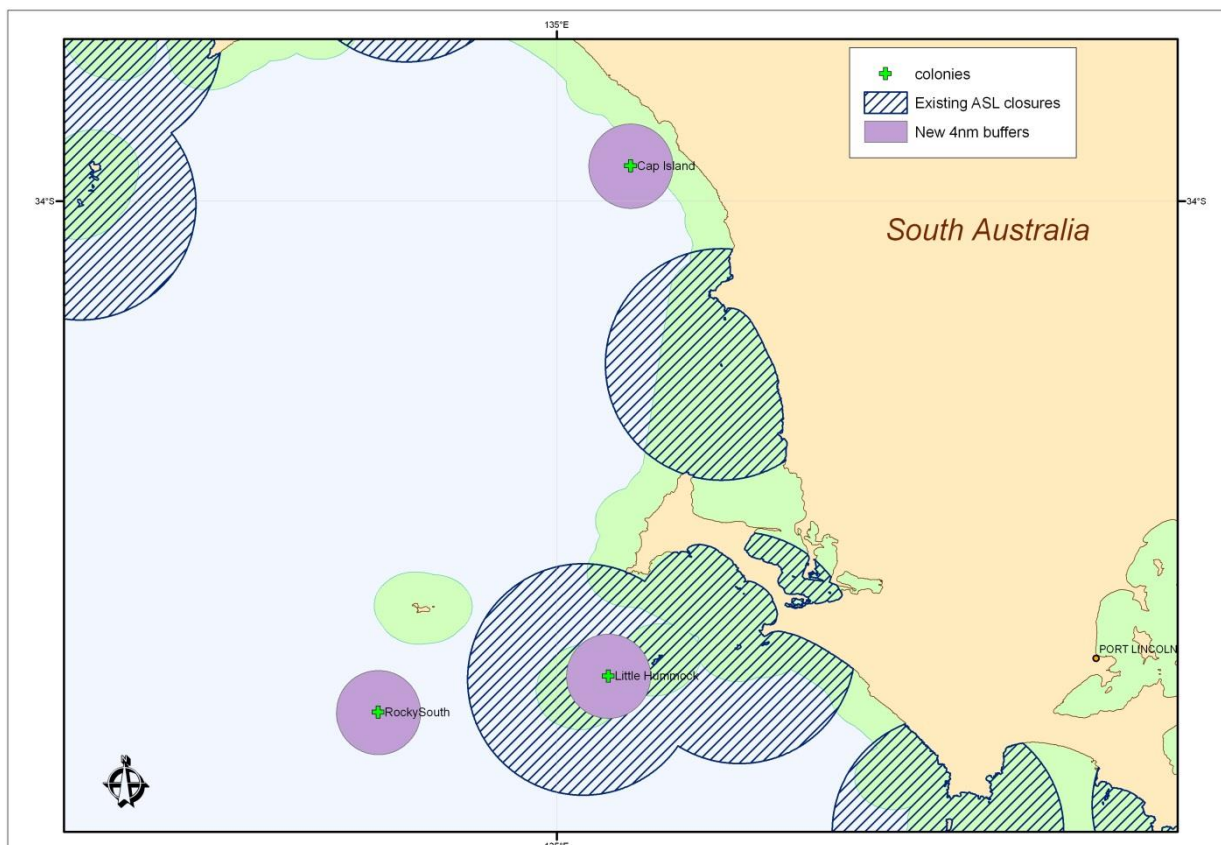


Figure 1. Location of three most recently identified breeding colonies (purple 4 nm closures) which were added to the Strategy in January 2013; Rocky South, Little Hummock, Cap Island NB extent of Little Hummock closure is incorporated within existing closures.

Appendix 3

Gillnet Closures for the Protection of Marine Mammals in South Australia

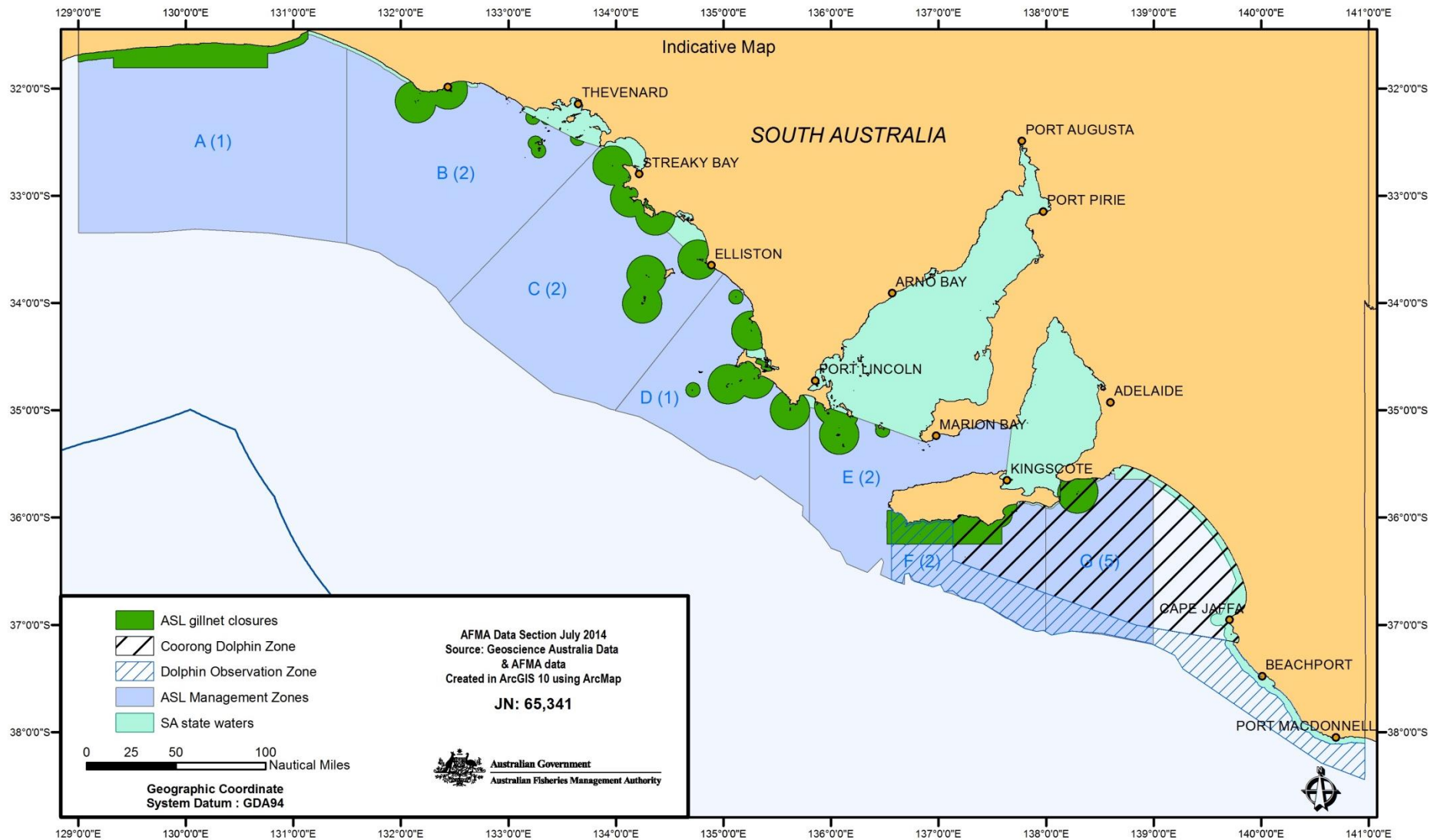


Figure 2. Gillnet closures for the protection of marine mammals in South Australia