
Marine Parks

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Environmental, Economic and Social Values of the Gambier Islands Group Marine Park

PART 1



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Cite as:

Department of Environment and Natural Resources (2010), *Environmental, Economic and Social Values of the Gambier Islands Group Marine Park*, Department of Environment and Natural Resources, South Australia

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TABLE OF CONTENTS

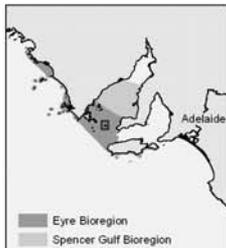
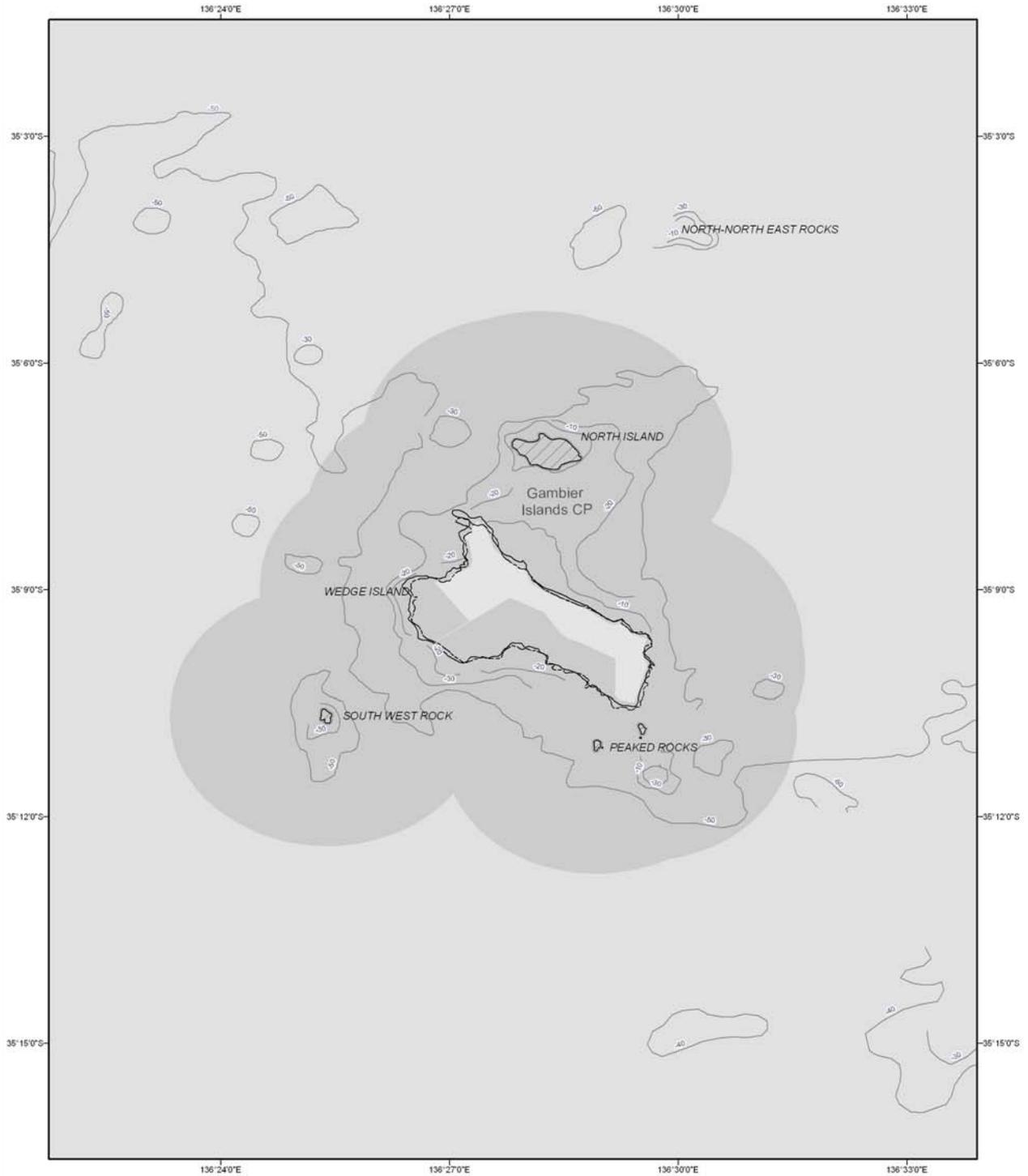
PART 1 VALUES STATEMENT

1	ENVIRONMENTAL VALUES	1
1.1	ECOSYSTEM SERVICES.....	1
1.2	PHYSICAL INFLUENCES	2
1.3	HABITAT VARIETY	2
1.4	MARINE SPECIES	2
1.4.1	<i>Plants and algae</i>	2
1.4.2	<i>Bony fish, sharks and rays</i>	3
1.4.3	<i>Marine mammals</i>	3
1.4.4	<i>Seabirds and local and migratory shorebirds</i>	3
1.4.5	<i>Marine invertebrates</i>	3
2	ECONOMIC VALUES	4
2.1	COMMERCIAL FISHING	4
2.2	TRANSPORT AND INFRASTRUCTURE	5
2.3	LOCAL TOURISM	5
3	SOCIAL VALUES	5
3.1	ABORIGINAL HERITAGE.....	5
3.2	EUROPEAN HERITAGE	5
3.3	RECREATIONAL ACTIVITIES IN THE MARINE PARK	6
3.3.1	<i>Recreational fishing</i>	6
3.3.2	<i>Diving, snorkelling and swimming</i>	6
	APPENDIX 1 SPECIES LIST	7
	REFERENCES AND SUGGESTED FURTHER READING	9

PART 2 AN ATLAS OF MAPS

An atlas of maps containing environmental, economic and social/cultural information for this marine park has been produced as Part 2 of the Values Statement. The maps provide details specific to this park in a user-friendly visual format and may be viewed and downloaded from <http://www.marineparks.sa.gov.au>.

Gambier Islands Group Marine Park



- Marine Park
- State Waters Jurisdiction
- Parks and Reserves
- Bathymetry Contours
- Roads
- Coastline (median high water)



Produced by Coast and Marine Conservation
 Department for Environment and Heritage
 GPO Box 1047 Adelaide SA 5001
www.marineparks.sa.gov.au

Data Source Marine Parks, NPWSA,
 Bathymetry, Topographic Data - DEH
 Marine Bioregions - SARDI
 State Waters Jurisdiction - Geoscience Australia
 1 February 2010

Compiled Projection Datum
 Geographic
 Geocentric Datum of Australia, 1994

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DEH MapID: 2010-3231

Gambier Islands Group Marine Park

Located within the Eyre Bioregion, the Gambier Islands Group Marine Park covers 120km² and is located in the waters of the mouth of Spencer Gulf. The Gambier Islands Conservation Park, including North Island, South West Rock and Peaked Rocks, is overlaid by the marine park. The park also overlays a large portion of Crown Land on the south-western side of Wedge Island.

1 ENVIRONMENTAL VALUES

1.1 Ecosystem services

Ecosystems provide many critically important services that people benefit from, often at no direct cost to us. Examples of ecosystem services provided by coastal and marine habitats are shown in the following table. It is important to ensure that ecosystem health and integrity are maintained so that ecosystems continue to provide these services to us all.

Table adapted from McLeod, K and Leslie, H (2009).

	Life supporting services				Resources and products				Maintain earth's living space						Recreational and cultural services					
	Biogeochemical processes	Biophysical processes	Biodiversity	Nutrient cycling	Food	Fibre, fuel, shells etc	Non-biological materials (eg minerals)	Pharmaceuticals & nutraceuticals	Climate regulation	Waste processing	Flood/storm protection	Water flow/circulation	Erosion control	Water quality	Sediment quality	Cultural and amenity	Recreation and tourism	Aesthetics	Spiritual, religious, lifestyle	Education and research
Coastal, estuarine and marine habitat types																				
Bare Sand	x	x	x	x	x	x	x		x		x		x	x	x	x	x	x	x	x
Seagrass	x	x	x	x	x	x		x	x	x		x	x	x	x	x	x	x	x	x
Reef (granite, limestone, calcarenite or low profile platform reef)	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	x
Water column	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x
Bedrock platform	x	x	x	x	x	x	x	x	x	x			x			x	x	x	x	x
Cliffs	x	x	x	x	x	x	x				x					x	x	x	x	x
Sandy beaches (dunes, coarse sand, fine sand)	x	x	x	x	x	x	x			x		x	x		x	x	x	x	x	x
Saltmarsh	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

The Gambier Islands Group Marine Park will be designed to conserve examples of habitats and species found in the Eyre Bioregion. The Gambier Islands Group is located at the mouth of the Spencer Gulf and creates a connection between the western side of Spencer Gulf and the Neptune Islands and the eastern side of Spencer Gulf. Habitats, species and natural processes found here are summarised below.

1.2 Physical influences

Physical influences shape the type of habitats and species found in an area. Physical influences typical of this region include:

- high exposure to wind, wave and swell energy;
- transition from western warm waters to the cool temperate south eastern waters;
- mix of influences from the Leeuwin¹ and Flinders Currents²;
- saline waters flowing down the eastern side of Spencer Gulf along the seafloor and past the Gambier Islands group during the winter months.

1.3 Habitat variety

Table 1 Benthic (subtidal) habitats found in the Gambier Islands Group Marine Park

Benthic Habitat**	Area (km ²)*	% of park
Bare sand	1	1%
Dense seagrass	<1	<1%
Heavy limestone reef	2	1%
Low profile platform reef	14	13%
Unmapped	97	85%

* habitat areas have been rounded to the nearest whole number

**habitats included are those found from mapping at a resolution of 1:100,000

No shoreline class data is available for the Gambier Islands Group Marine Park.

Habitat types of the marine park include exposed cliffs with rocky shores below, and long sandy beaches on the north-eastern side of Wedge Island. Inshore habitats also include intertidal sand flats, subtidal rocky reefs and boulders, seagrass meadows and algae assemblages. The exposed cliffs on the northern shore of Wedge Island give way to a broad straight expanse of sandy beach. At the western end of Wedge Island the drainage patterns have formed salt marshes in an inland depression, in which their salt-crust mud supports shrubs of grey samphire. Adjacent to the western coast of Wedge Island there is a small area of sandy seafloor and close to shore on the east coast is a pocket of shallow water dense seagrass. Reefs surrounding the islands extend from the intertidal zone into deep water (greater than 50 metres on the south-western side of Wedge Island). Subtidal caves exist at the southern end of Wedge Island.

1.4 Marine species

The habitats located within the Gambier Islands Group Marine Park support a variety of marine and coastal species including fish, sharks, mammals, birds and invertebrates, some of which have been identified as ecologically important. Refer to Appendix 1 for a more detailed list of species.

1.4.1 Plants and algae

The abundance and species diversity of brown and red algae recorded around these islands is high. The moderately exposed waters around Wedge Island are dominated by large brown algae such as *Ecklonia*, *Scytothalia*, *Seirococcus*, and *Sargassum*. Small brown algae such as *Homeostrictus* and *Chlanidophora* are also present. The dominant red algae on this moderately exposed coast include *Plocamium* and *Phacelocarpus* species. The shallow sheltered waters of Wedge Island are home to a variety of brown, red and green algae. These include *Ecklonia*,

¹ The Leeuwin Current originates in the tropical Indian Ocean, flows south along the Western Australian coast, and turns east along the shelf break to the Great Australian Bight, bringing warm, relatively low nutrient waters (Middleton & Bye 2007).

² The Flinders Current is a deep south-east to west current which is thought to flow from the west Tasmanian shelf to Cape Leeuwin and increases in flow speed from south-east (5cm / second) to west (20cm / second). (Middleton & Bye 2007)

Cystophora species, *Sargassum* species, *Osmundaria* and *Caulerpa* species. The shallow moderate waters of the North Island are dominated by species of *Cystophora*.

Seagrass species although not dominant on Wedge Island are common at 10m. These species include *Posidonia* and *Heterozostera*. *Posidonia* dominates the deeper sites (10-15m) in the waters around North Island.

1.4.2 Bony fish, sharks and rays

A range of fish species, including many of commercial importance, inhabit areas around the islands including snapper, King George whiting, trevally, wrasse, Western Australian salmon, gummy shark, whaler shark and Australian herring (tommy ruff). Many of these fish species are believed to use the island habitats at several stages of their lives. For example juvenile snapper are mainly found in inlets, bays and shallow sheltered marine waters. As juvenile snapper get older they tend to move to deeper gulf and offshore waters in which they will remain until they reach 12 to 13 years of age and then return to inshore waters for the remainder of their lives.

The shortfin mako and porbeagle are known from this area and have recently been listed for protection under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). Other shark or ray species of conservation concern recorded in the area include the coastal stingaree, whitespotted spurdog, spotted wobblygong, bronze whaler, blue shark, smooth hammerhead, school shark and dusky whaler, which has been nominated for protection under the EPBC Act.

The western blue groper, identified as being of conservation concern, inhabits reefs of the Gambier Islands. These fish have been identified as a long-living, site attached species, which are particularly vulnerable to fishing pressure.

The leafy seadragon is recorded from the Gambier Islands along with various reef species which are of conservation concern. These include several wrasse species, harlequin fish and western blue devil.

1.4.3 Marine mammals

The nationally and state listed *vulnerable* Australian sea lion is known to haul out and breed on the islands located in the Gambier Islands group. New Zealand fur seals have been recorded on the islands although these sites are not known breeding areas. Nationally protected common dolphins are seen regularly in the region.

1.4.4 Seabirds and local and migratory shorebirds

The Gambier Islands provide habitat for a variety of seabirds such as the little penguin, short-tailed shearwater and white-faced storm petrel. The short-tailed shearwater feeds in the waters adjacent to the island. Shearwaters feed on krill squid and fish. The white-faced storm petrel, like the shearwaters, feed in the waters surrounding the islands. Other birds found on the islands include the state *rare* peregrine falcon, state *rare* rock parrot, state *endangered* osprey and the state *endangered* white-bellied sea eagle.

1.4.5 Marine invertebrates

In the waters surrounding Wedge Island, mixed communities of sponges, bryozoa and hydroid species are known to inhabit many of the reefs. Divers have also reported an abundance of ascidians, molluscs, sea stars and crustaceans surrounding the Island.

There is also a local abundance of soft corals and gorgonians, which are less common in shallow waters in South Australia.

For further environmental and social information refer to <http://www.marineparks.sa.gov.au>

2 ECONOMIC VALUES

The marine environment is an important source of wealth for South Australia and its coastal communities. Marine parks will be designed to accommodate existing economic activities wherever possible. The main economic activities in the Gambier Islands Group Marine Park are summarised below. Information in the Commercial fishing section has been provided by PIRSA.

2.1 Commercial fishing

The commercial fisheries that operate in the Gambier Islands Group Marine Park are:

- Central Zone Abalone Fishery;
- Northern Zone Rock Lobster Fishery;
- Marine Scalefish Fishery; and
- Spencer Gulf Prawn Fishery.

The value of each of these fisheries, including the direct and flow-on values, as well as the number of employees and export values, where available, are listed below. Note that the values provided below are for the entire area of the fishery and may not be specific to the Gambier Islands Group Marine Park.

Table 2 The 2008/09 economic value of fisheries operating in the marine park for relevant fishery areas (figures are not specific to the park area and include catches from outside the marine park boundary).

	Catch value(\$m)	Value of flow-on to other sectors (\$m)	Fishing (FTE) employment	Flow-on (FTE) employment
Abalone (State)	30	45.2	90	225
Abalone (Central Zone)	5.7			
Northern Zone Rock Lobster (Eyre Region)	19.3	14.5	155	77
Marine Scalefish (Spencer Gulf/Coffin Bay)	10.9	10.0	249	51
Prawn (Spencer Gulf & West Coast)	30.8	71.2	185	342

EconSearch 2010 a, b, c and d.

These fisheries are important to regional economies of the area both directly, through employment in each fishery, and indirectly, through a range of additional services such as processing, local transport, marketing, local retail and food services. Each of these activities generates flow-on effects to other sectors, through purchases of inputs and employment of labour.

The Abalone Fishery targets greenlip abalone and blacklip abalone. The park lies within the Central Zone Abalone Fishery, which produced 18% of the total State's abalone harvest in 2008/09.

The park is part of the Northern Zone Rock Lobster Fishery, which operates from November to May. The northern zone contributes around 20% of the \$105m state-wide catch of southern rock lobster.

The Marine Scalefish Fishery is a diverse multi-species, multi-gear fishery that operates across State waters, targeting four key species: snapper, King George whiting, southern garfish and southern calamari.

The Spencer Gulf Prawn Fishery is the largest of the three prawn fisheries in South Australia. Over 80% of South Australia's king prawn harvest comes from Spencer Gulf, with 1,800 tonnes taken from that region in 2008/09.

Fishing charters also operate in this region.

For further information or to view maps of the fishing regions visit:

http://www.sardi.sa.gov.au/_data/assets/pdf_file/0010/99739/No_305_South_Australian_Wild_Fishes_Information_and_Stats_report_200708_published.pdf

2.2 Transport and infrastructure

Transport and infrastructure provide an important economic contribution to the region, providing for maritime activities such as: shipping ports for import and export of goods; boat ramps for launching of recreational or commercial vessels; jetties for fishing; and breakwaters and groynes for coastal management. Due to the remoteness of these islands there is limited development or infrastructure located within the marine park. A jetty, lighthouse and an airstrip are located on Wedge Island.

2.3 Local tourism

Tourism activities in the area include recreational fishing and dive charters. Boat-based recreational fishing takes place in the waters around the islands. An airstrip is located on Wedge Island to facilitate tourism and local access. Charter trips to the island promote fishing, diving and sightseeing as popular activities. Dive charter trips to the wreck of the *Glenpark* and submarine caves at Wedge Island are popular with divers. Holiday accommodation, including a small tourist resort is located on the island.

3 SOCIAL VALUES

The marine environment is an important recreational and cultural asset for coastal communities. Marine parks will be designed to accommodate existing activities wherever possible. This section highlights the social values of Gambier Islands Group Marine Park and is separated into two parts:

- Aboriginal and European cultural heritage; and
- recreational activities.

3.1 Aboriginal heritage

Aboriginal people have interacted with the marine environment for thousands of years and their relationships with the sea remain strong through customs, laws and traditions. Traditional usage, Aboriginal cultural heritage, Native Title considerations and Indigenous Land Usage Agreements (ILUAs) will be taken into account in developing the management plan for the Gambier Islands Group Marine Park. The Gambier Islands are outside of the Narungga (fishing) ILUA and the Barnjarla Native Title claim.

Little is known about the Aboriginal heritage for the Gambier Islands Group Marine Park. However the Government is aware that there may be confidential Aboriginal heritage sites in South Australia's coastal areas. Where possible, these sites will be considered in the planning process. Future management plans will ensure these heritage sites are appropriately respected. Aboriginal aspirations for this area are not known by the Department of Environment and Natural Resources.

3.2 European heritage

Where possible, the management plan for the Gambier Islands Group Marine Park will recognise and complement sites of cultural and maritime heritage.

Wedge Island, the largest in the group, was descriptively named (due to its shape, it looks like a wedge from its low lying northern coast to the 202m heights of the south coast) by Matthew Flinders in February 1802. The island has been used for pastoral activities for over 130 years, with sheep, cattle and horses being run on the island. Crops were also grown and guano mining was also carried out. Relics of settlement history remain on the island.

During the Second World War a RAAF radar base was established on the island and a jetty was built by the RAAF in the 1940s. An automatic lighthouse has been built on the highest point of the island.

The *Stranger* (1898) was wrecked on the north shore of Wedge Island. It is protected but not yet located. Other vessels such as the *Albatross* (1937) were also wrecked near Wedge Island. The *Glenpark* was wrecked on the north side of the North Islet.

The smaller islands around Wedge Island are included in the Gambier Islands Conservation Park which is also listed on the Register of the National Estate.

3.3 Recreational activities in the marine park

Due to the remoteness and difficulty in accessing much of this park, there are limited recreational activities undertaken here. Those activities that are known to occur in this marine park are listed below.

3.3.1 Recreational fishing

Recreational fishing is a popular past time in South Australia. Recreational fishers collectively harvest significant proportions of the total catch for a number of key species. The total number of recreational fishers for the Gambier Islands region (region 7) during 07/08 was 15,244 which amounted to 47,936 days of fishing. (Note figures relate to regions used for reporting fishing activities and include catches from outside the marine park boundary). King George whiting, snapper, southern garfish, southern calamari and blue swimmer crab were the most frequently caught species for the Southern Spencer Gulf region.

Access to the island is by boat or aircraft. Both charter and private fishing boats regularly visit this area, particularly Wedge Island, which also provides a sheltered anchorage for cruising yachts. Beach fishing occurs from the island.

3.3.2 Diving, snorkelling and swimming

Swimming and snorkelling occurs from the main beach and other access points. Wedge Island is well known by recreational divers who come to view the variety of habitats and species surrounding the area such as the caves, shelves and drop-offs surrounding the island, as well as the wreck of the *Glenpark*.

APPENDIX 1 SPECIES LIST

This list of some of the species identified in the Gambier Islands Group Marine Park indicates the diversity of species found there.

Plants and algae

grey samphire *Tecticornia australasica*

Bony fish, sharks and rays

Australian herring *Arripis georgianus*
blue shark *Prionace glauca*
bronze whaler *Carcharhinus brachyurus*
coastal stingaree *Urolophus orarius*
dusky whaler *Carcharhinus obscurus*
gummy shark *Mustelus antarcticus*
harlequin fish *Othos dentex*
King George whiting *Sillaginodes punctata*
leafy seadragon *Phycodurus equus*
porbeagle *Lamna nasus*
school shark *Galeorhinus galeus*
shortfin mako *Isurus oxyrinchus*
smooth hammerhead *Sphyrna zygaena*
snapper *Pagrus auratus*
southern garfish *Hyporhamphus melanochir*
spotted wobblygong *Orectolobus maculatus*
trevally *Pseudocaranx georgianus*
Western Australian salmon *Arripis truttaceus*
western blue devil *Paraplesiops meleagris*
western blue groper *Achoerodus gouldii*
whaler shark *Carcharhinus brachyurus*
whitespotted spurdog *Squalus acanthias*
wrasse Labridae

Marine mammals

Australian sea lion *Neophoca cinerea*
common dolphin *Delphinus delphis*
New Zealand fur seal *Arctocephalus forsteri*

Seabirds and local and migratory shorebirds

little penguin *Eudyptula minor*
osprey *Pandion haliaetus*
peregrine falcon *Falco peregrinus*
rock parrot *Neophema petrophila*
white-bellied sea eagle *Fregetta grallaria grallaria*
white-faced storm petrel *Pelagodroma marina*

Marine invertebrates

ascidian Ascidiacea
blacklip abalone *Haliotis rubra*
bryozoa Bryozoa
gorgonian Alcyonacea
greenlip abalone *Haliotis laevigata*
hydroid Hydroida
king prawn *Melicertus latisulcatus*
King scallop *Pecten fumatus*
sea star Asteroidea
soft coral Alcyonacea

southern calamari
southern rock lobster
sponge

Sepioteuthis australis
Jasus edwardsii
Porifera

REFERENCES AND SUGGESTED FURTHER READING

- A National Approach to Addressing Marine Biodiversity Decline Report to the Natural Resource Management Ministerial Council:
<http://www.environment.gov.au/coasts/publications/marine-diversity-decline/index.html>
- Baker, J. L. (2004). *Towards a System of Ecologically Representative Marine Protected Areas in South Australian Marine Bioregions* - Technical Report. Prepared for Coast and Marine Conservation Branch, Department for Environment and Heritage, South Australia.
<http://marineparkssa.ning.com/page/publications-reports#technical>
- Department for Environment and Heritage. (2009). *A technical report on the outer boundaries of South Australia's marine parks network*: 21-26. Department for Environment and Heritage, South Australia. <http://marineparkssa.ning.com/page/publications-reports#technical>
- EconSearch. (2010a). *Economic Indicators for the South Australian Abalone Fishery, 2008/09*. Report prepared for Primary Industries and Resources South Australia, Adelaide.
- EconSearch. (2010b). *Economic Indicators for the South Australian Marine Scalefish Fishery, 2008/09*. Report prepared for Primary Industries and Resources South Australia, Adelaide.
- EconSearch. (2010c). *Economic Indicators for the South Australian Northern Zone Rock Lobster Fishery 2008/09*. Report prepared for Primary Industries and Resources South Australia, Adelaide.
- EconSearch. (2010d). *Economic Indicators for the Spencer Gulf and West Coast Prawn Fisheries of South Australia, 2008/09*. Report prepared for Primary Industries and Resources South Australia, Adelaide.
- For further information on fisheries economic indicators visit:
http://www.pir.sa.gov.au/fisheries/commercial_fishing/abalone_fishery/economic_performance_indicators
- Edyvane K.S. (1999). *Conserving Marine Biodiversity in South Australia – Part 2 – Identification of areas of high conservation value in South Australia*. South Australian Research and Development Institute, Aquatic Sciences, Adelaide.
http://www.sardi.sa.gov.au/aquatic/marine_environment_and_ecology_program/environmental_assessment_mitigation_and_rehabilitation_subprogram/marine_biodiversity
- Goldsworthy S.D. and Page B. (2009) *A review of the distribution of seals in South Australia*. Report to the Department for the Environment, Water, Heritage and the Arts. SARDI Aquatic Sciences Publication Number: F2009/000368-1. SARDI Research report Series Number: 373.
- Jones K. (2009). *South Australian Recreational Fishing Survey*. PIRSA Fisheries, Adelaide, South Australian Fisheries Management Series Paper No 54.
- McLeod K. and Leslie H. (ed) (2009). *Ecosystem-based Management for the oceans*. Island Press Washington.
- Middleton J.F. and Bye A.T. (2007). A review of the shelf-slope circulation along Australia's southern shelves: Cape Leeuwin to Portland. *Progress in Oceanography*, 75: 1-41.
http://www.flinders.edu.au/science_engineering/biology/our-school/staff-postgrads/research_pages/middleton/circ-sthrn.cfm
- NatureMaps: an interactive online mapping tool <http://www.naturemaps.sa.gov.au/>
- Policy commitments relating to activities such as fishing, aquaculture and mining can be found at:
<http://marineparkssa.ning.com/page/fact-sheets>
- Robinson, A.C., Canty, P., Mooney, P. & Rudduck, P. (1996). *South Australia's Offshore Islands*. Australian Heritage Commission and Department of Environment and Natural Resources, South Australia.
- Shaughnessy, P.D. and Goldsworthy S.D. (2007). *Population assessment of fur seal and sea lions at some colonies in South Australia, 2006-2007*. 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, 43pp.
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
- State of the Environment Report 2008: <http://www.epa.sa.gov.au/soe>