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Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

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information sheet 4
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Published in October 2011

Climate Change and the Marine Environment: South Australia

The marine waters of South Australia are highly diverse and include kelp forests, deep water sponge gardens, rocky coasts, offshore islands, cliff and mangrove systems. These regions support over 6000 invertebrates, 1200 algae, 350 fish species, 16 breeding seabird species, 33 mammal species, and 12 seagrass species. Of these 75% of red algae, 85% of the fish species and 95% of the seagrass are found nowhere else in the world [1, 2, 3].

Climate change predictions for South Australia include an increase in annual temperature of from 1 – 6°C in the north and 0.6 – 4.4°C in the south by 2070, a decrease in average rainfall between 20 – 40% by 2070, and an increase in both the frequency of extreme temperatures and droughts by the end of the century. Already changes have been observed including a rise in the average temperature by 0.96°C between 1910 and 2005. Sea surface temperatures in the Spencer Gulf and the Great Australian Bight have risen by 0.05°C per decade and 0.11°C per decade respectively[4,5,6].

The projected impact on these marine environments will be large and negative. While there is much we still do not know about the impacts of climate change on the marine environments of South Australia, current events highlight change is happening. For example, seamounts off South Australia's shelf break and its extensive inverse estuaries could receive pulses of corrosive waters that will preclude or reduce many calcareous species. Increases in temperature might be responsible for the southward movement of kelp forests and other temperate reef species causing community and ecosystem shifts. Species such as the leafy sea dragon *Phycodurus eques*, the emblem of South Australia, are very susceptible to disturbance and likely to suffer in storm events and from habitat degradation caused by ocean warming, acidification, or sea level rise.

Australian Sea Lion *Neophoca cinerea* © Simon Goldsworthy

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Great Australian Bight

The Great Australian Bight, which stretches from the Eyre Peninsula in South Australia and also bounds the southern coastline of Western Australia, is a region of high marine and coastal biodiversity and endemism. It is influenced by two currents - the warm, low nutrient Leeuwin current from Western Australia and the westward Flinders Current from the east, which provides higher nutrient inputs. Important species include red algae, ascidians, bryozoans, 300 species of fish and populations of the southern right whale *Eubalaena australais*, and the Australian sea lion *Neophoca cinerea*. Many of these species are affected by the currents, especially the Leeuwin. Climate models predict that the Leeuwin Current will weaken slowly which will have implications for the biodiversity of species in South Australia[7]. Observations show that since the 1970's the current has weakened, and since the 1960's its temperature has risen by about 0.6 degrees centigrade. Studies have indicated that such a rise in temperature might have influenced the decrease in size at maturity and migration of western rock lobsters *Panulirus cygnus* off the coast[8].

The Australian Sea Lion

The Australian sea lion *Neophoca cinerea* – the only pinniped species that is endemic to Australia - has an estimated population of less than 10,000 individuals, 80% of which occurs in South Australia[9]. Sea Lions feed on squids, fish, rock lobsters, sea birds and shark. They are not migratory animals. Ocean warming as a result of climate change is a major threat to the Australian Sea Lion. This is because prey availability is expected

to reduce, due to a general reduction in marine ecosystem productivity caused by the warming. Warming may also enhance spread of disease which in turn could stress animals already suffering from rising temperatures[10]. Rising sea levels have the potential to cause disruption to the sea-lion's key habitat which may affect the female's ability to return to the same site to breed. For example, based on the Intergovernmental Panel on Climate Change's (IPCC) third assessment report, a sea level rise of 9-88cm by the end of the 21st century is predicted for this region[11]. Consequently many island and mainland breeding sites in South Australia are expected to be altered or maybe lost[10].

Common kelp *Eklonia radiata* © Graham Edgar

Kelp

Kelp forests are very diverse and productive ecosystems. However, recent evidence shows that the distribution of several kelp species, such as the common kelp *Ecklonia radiata*, crazyweed *Phyllospora comosa* and giant kelp *Macrocystis pyrifera* are contracting southward and in some cases disappearing from urban areas like Adelaide due to ocean warming[12]. Further, the combined impacts of the combination of increasing temperature and CO^2 on non-calcifying organisms such as kelp may be profound[13,14]. They point to historical and continuing deforestation of algal canopies world-wide being exacerbated by climate change and the replacement of kelp canopies with turf. Climate change enables turf mats to persist and expand beyond their scope while inhibiting the recruitment and regeneration of kelp forests. Ultimately it is the interaction between, or combination of, both CO^2 and temperature that proportionately affects the percentage of recruitment of turf-forming algae into available (previously kelp dominated) space as a greater percentage occurs when each variable operates independently.

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This information sheet was prepared with advisory support from Professor Corey Bradshaw and Dr Bryan McDonald (Department for Environment & Heritage DEH, Coast and Marine, South Australia).

About the Marine Adaptation Network

The Adaptation Research Network for Marine Biodiversity and Resources (aka. the Marine Adaptation Network) is hosted by the University of Tasmania and convened by Assoc Prof Neil Holbrook. The Network is supported by 14 partner institutions nation-wide. It comprises a holistic framework of interconnecting marine themes that cross-cuts climate change risk, marine biodiversity and resources, socio-economics and policy. This interdisciplinary network aims to build adaptive capacity and adaptive response strategies for the effective management of marine biodiversity and living marine resources under climate change. For more information on the Marine Adaptation Network, or to subscribe to become a member of the Network, please visit <www.nccarf.edu.au/marine/>