The IUCN Red List of Ecosystems
Scope: Sub-global / Regional
Language: English

Seagrass Community of South Australia, Australia

Assessment by: Bonifacio R., & Pisanu P.

Overall risk category EN

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	COLLAPSED
NE	DD	LC	NT	VU	EN	CR	CO

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Citation:

Keith, D.A., Rodríguez, J.P., Rodríguez-Clark, K.M., Nicholson, E., Aapala, K., Alonso, A., ... Zambrano-Martínez, S 2013. Scientific Foundations for an IUCN Red List of Ecosystems.en. PLoS One 8. https://doi.org/10.1371/journal.pone.0062111

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Link:

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0062111

Keywords:

Biodiversity loss, Conservation Biology, Ecological communities, Environmental - chance, Extincion risk, Food-web perspective, Global synthesis, Habitat loss, Relative resilience, Vegatation classification

Ecosystem Description

Seagrasses are generally found on sandy or muddy areas in estuaries, coastal lagoons, gulfs and sheltered bays (EPA 2009). The majority of seagrasses inhabit the semi-enclosed bays of Gulf St. Vincent and Spencer Gulf, which form the most extensive seagrass meadows (5,000 km2) in South Australia (Shepherd and Robertson, 1989), but they are also found in embayments in the western part of the State, Kangaroo Island (Kinloch et al. 2007) and the South East. This Seagrass community is confined to a low nutrient environment, and its assemblage is of an alliance dominated by the genera Posidonia, as such they are sensitive to any increases in water turbidity as they require sunlight for growth. In these ecosystems, fauna is composed of tubeworms, ascidians, seastars, sea urchins, crabs and razorfish (Pinna spp.), Small shrimps (decapods), slaters (amphipods), sea lice (isopods) and snails, crabs and syngnathid fish (pipefish and seahorses), weedy whitings, scorpionfish and clingfish, plus the odd seastar, polychaete worm and sea cucumber (Kinloch et al. 2007).

Classification

IUCN Habitats Classification Scheme

- 9. Marine Neritic
  - 9.9. Marine Neritic - Seagrass (Submerged)

IUCN Global Typology

- Marine
  - M1. Marine shelf
    - M1.1 Seagrass meadows

Distribution

The majority of seagrass (82.7%) in South Australia is found in the waters of Gulf St. Vincent (Adelaide metropolitan area) and Spencer Gulf (Eyre Peninsula). They are also found in Streaky Bay and Smoky Bay (west of Spencer Gulf) with Fowlers Bay as the western most site containing extensive

seagrass meadows (Kirkman 1997). In the South East, the seagrass community is found in shallow sheltered bays of Lacepede Bay, Guichen Bay, Nora Creina, Stinky Bay, Rivoli Bay, Bucks Bay, Bungaloo Bay and in waters adjacent to the township of Port MacDonnell.

System

Marine

Biogeographic Realm

Australasian

Countries

Australia

Geographic Region

South Australia

Characteristic Native Biota

Thirteen species of seagrass are found in South Australia belonging to seven genera (Wear et al. 2006; Westphalen et al. 2004). The main seagrass species occurring in SA are Posidonia angustifolia, Posidonia australis, Posidonia coriaceae, Posidonia sinuosa, Amphibolis antarctica, Amphibolis griffithii, Heterozostera tasmanica, Halophila australis and Zostera muelleri (Larkum and den Hartog 1989). The seagrass communities in South Australia are considered as amongst the largest and most diverse in the world (Shepherd et al. 1989). The ecological community assessed here is the meadow forming seagrass species, which is usually dominated by ribbon weed or tape weed (Posidonia spp.) and wire weed (Amphibolis spp.) (Bryars et al. 2011; EPA 2008; EPA 2009; Miles and Peters 2011). Tubeworms, ascidians, seastars, sea urchins, crabs and razorfish (Pinna spp.) were found to be components of seagrass meadows in Gulf St Vincent (Shepherd and Sprigg 1976). At Kangaroo Island, seagrass meadows are dominated by "small shrimps (decapods), slaters (amphipods), sea lice (isopods), and snails, crabs and syngnathid fish (pipefish and seahorses), weedy whitings, scorpionfish and clingfish, plus the odd seastar, polychaete worm and sea cucumber" (Kinloch et al. 2007).

Taxa

Amphibolis antarctica, *Amphibolis griffithii*, *Amphibolis spp.*, *Caulerpa obscura*, *Halophila australis*, *Heterozostera tasmanica*, *Pinna spp.*, *Posidonia angustifolia*, *Posidonia australis*, *Posidonia coriaceae*, *Posidonia sinuosa*, *Posidonia spp.*, *Zostera muelleri*

Abiotic Features

Seagrasses are generally found on sandy or muddy areas in estuaries, coastal lagoons, gulfs and sheltered bays (EPA 2009). Seagrasses, particularly those found in South Australia, are confined to naturally low nutrient environments and as such they are sensitive to any increases in nutrient levels. They are also sensitive to increases in water turbidity as they require sunlight for growth.

Biotic Processes

Generally, seagrasses grow on sandy or muddy substrates and are dependent upon their rhizomes or underground stems for anchorage (Kirkman 1997). Seagrass meadows are not capable of withstanding great energy from swell and waves and thus are usually found in sheltered bays. The critical factors for seagrass growth and survival are light, temperature, dissolved carbon dioxide, nutrients and a suitable substrate for anchoring. The extensive root systems of seagrass meadows stabilise the underlying sediments (Fox et al. 2007). Seagrass ecosystems have been reported to contribute up to 15% of global ocean annual net carbon production (Duarte and Chiscano 1999), and have been ranked closely with coral reefs and mangrove habitats in terms of productivity (Short and Wyllie-Echeverria, 1996). This highly productive ecosystem provides habitats and nursery areas to a variety of marine invertebrates and vertebrates.

Threatening Processes

Urbanisation of coastal areas and near shore development has resulted in decline in water quality affecting seagrasses (Shepherd et al. 1989; Seddon, 2000), and disturbance of sea floor. Changes in water properties such as increases in temperature (climate change), pollutant levels and turbidity, as well as nutrient enrichment and altered salinity may negatively affect seagrasses. The secondary effect of increased epiphytic load as a result of high levels of nutrients in water (nutrients input) is also detrimental to seagrasses (Bryars et al. 2011). Sources of nutrients and pollutants in South Australia's marine environment are urban and rural runoff, sewage treatment plants, and some industrial sources. Other major threats for the ecosystem are sedimentation and erosion, and invasion of exotic species.

Collapse

For assessment of criteria A and B, the seagrass community was assumed to collapse if its mapped distribution declined to zero. Under criterion C, experimental work by Bryars et al. (2011) was used to set thresholds of collapse for seagrass due to high levels of ammoniacal and oxidized nitrogen concentration in the water column that result in high or total mortality of seagrass. It was assumed that the ecosystem would collapse when either inorganic form of nitrogen is maintained above the threshold levels 100% of the time throughout the distribution of the ecosystem.

Ecosystem Risk Assessment

Assessment Protocol	IUCN Red List of Ecosystems Category and Criteria	Last Assessed
IUCN RLE v2.0	Endangered A1	2013

Justification

An estimate of decline for the entire distribution of seagrass meadows in South Australia has never been done. However, the loss of seagrass meadows in the coastal waters of metropolitan Adelaide (Largs Bay to Aldinga) was estimated to be 40.86 km2 (32.8%) from 1949 to 1996 (Hart 1997). This change was inferred from the estimated increase of sand substrate from 26.26 to 67.12 km2 during that time period. Extrapolated to a full 50-year period, the estimated decline in distribution in this area was 33.3%. A particular site within this area (between Glenelg North and West Beach) was reported to have lost 50% of the seagrass meadow during the period 1949 to 1995 (Fox et al. 2007). Outside of Gulf St. Vincent in Rivoli Bay, South East, seagrass extent in 1951 was estimated to be 0.364 km2 (36.4 ha), but declined to just 0.077 km2 (7.7 ha) by 1997 (Seddon et al. 2003). This is a total loss of 0.287 km2 (28.7 ha) or 78.85% of seagrass area at northern Rivoli Bay in 46 years. Extrapolating to 50 years gives an estimated decline of 81.5%. Therefore, the threat status of this ecosystem is Endangered (plausible range Vulnerable to Critically Endangered) under subcriterion A1.

Criterion A EN

Summary

Based on analyses of more than 45 years in sites assumed to be representative of the overall pressures and decline on seagrass community in South Australia, there was an estimated decline of 33 - 98%. Thus, the threat status of this ecosystem is Endangered (plausible range Vulnerable - Critically Endangered) under subcriterion A1.

Risk Category EN

Subcriterion	Category	Justification
A1	EN	The status of the community can be based on the analyses of more than 45 years in two sites (Largs Bay to Aldinga and Rivoli Bay), assuming that these sites are representative of the overall pressures and decline on seagrass community in South Australia. This produces an estimated decline of 33 - 82%. Weighted average declines across all three sites produce an estimate of 56 - 98% decline, depending on whether a lower or upper bound is used for the third site. The threat status therefore of this ecosystem is Endangered (plausible range Vulnerable - Critically Endangered) under subcriterion A1. **Key Indicators in detail** Evidence of Continuing Decline: Decreasing Evidence of Threatening Processes: Yes **Indicator Variable:** Change in distribution Extent (%): 33-98 Mapped distribution Year: 2012
A2a		It is well recognised that factors critical for seagrass growth (light, temperature, CO2, nutrients and suitable substrate) are

DD

affected by climate change (Conolly, 2009). The loss of 127.17 km2 of near-shore seagrasses in Spencer Gulf from 1987 to 1994 (Seddon et al. 2000) may represent the potential impact of climate change to seagrasses due to increased ambient temperature. However, there are no studies nor modelling conducted for possible decline in seagrass meadows in South Australia using factors associated with climate change as independent variables. Also, there is no predictive modelling of seagrass extent based on current rate of decline. The status of the community is therefore Data Deficient under subcriterion A2a.

Key Indicators in detail

Evidence of Continuing Decline: Unknown
Evidence of Threatening Processes: Unknown

A2b NE

This subcriterion was not assessed.

Key Indicators in detail

Evidence of Continuing Decline: Unknown
Evidence of Threatening Processes: Unknown

A3 VU

Given the paucity of data in historical decline of seagrass meadows in South Australia, the estimated 29% decline in global seagrass meadow area between 1879 and 2006 (Waycott et al. 2009) is recommended to be used as surrogate measure representing the lower bound of estimated historic decline, with the upper bound the same as the upper bound of current decline (98%). The use of this estimate is warranted since it is an average global estimate and there is evidence of continuing decline in South Australia's seagrass community (EPA 2008). The status of the ecosystem under subcriterion A3 therefore is likely to be at least Vulnerable (plausible range Near Threatened - Critically Endangered).

Key Indicators in detail

Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: Change in distribution

Extent (%): 29-98

Mapped distribution
Year: 2012

Criterion B LC

Summary

The Extent of occurrence is estimated to be 167,913 km2, the Area of occupancy is 278 10x10km cells and the number of locations for this ecosystem, this is below the minimum threshold to assign a risk category; thus, the ecosystem is classified as Least Concern (LC) under criterion B.

Risk Category LC

Subcriterion	Category	Justification
B1	LC	The extent of occurrence of the seagrass meadow of South Australia is estimated to be 167,913 km2. The decline in the extent of seagrass community is continuous (EPA 2008) and threats such as nutrient enrichment and other types of pollution still exist. The status of the ecosystem therefore is classified as Least Concern under subcriterion B1.

Key Indicators in detail

Number of Threat-defined Locations: more than 5
Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: EOO

Mapped distribution
Year: 2012
Mapped distribution (km2): 167,913

B2 LC

The ecosystem is present within 326 10 x 10 km grid cells, of these, 48 grid cells contains less than 1 km2 of the community (i.e. less than 1% of the area of a grid cell). Excluding these small occurrences, the ecosystem is therefore estimated to occupy 278 10 x 10 km grid cells. The assessment places the community under Least Concern for subcriterion B2.

Key Indicators in detail

Number of Threat-defined Locations: more than 5
Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Indicator Variable: AOO

Mapped distribution
Year: 2012
Mapped distribution (10x10-km grid cells): 278

B3 LC

Based on the distribution map and the community's AOO, the seagrass meadow of South Australia occurs in 278 10 × 10 km grid cells, which could be interpreted as independent locations. If larger clusters of contiguous cells were interpreted as independent locations, there would be no fewer than ten. The status of the community is therefore Least Concern under subcriterion B3.

Key Indicators in detail

Number of Threat-defined Locations: more than 5
Evidence of Continuing Decline: Decreasing
Evidence of Threatening Processes: Yes

Criterion C EN

Summary

The principal mechanism of environmental degradation is through decline in water quality caused by agricultural runoff, land-based pollution and changes in the optimal conditions for seagrasses due to natural events. Data are available for nutrient levels, physico-chemical properties of water and other pollutants but are limited to specific sites and short periods of time (less than 15 years). Therefore, the status of the ecosystem is classified as Endangered (plausible range Vulnerable to Endangered) under subcriterion C1.

Risk Category EN

Subcriterion	Category	Justification
C1	EN	It can be surmised that the concentration of nutrients in the coastal waters of the South Australia fluctuate as opposed to being present at a continuous chronic level. This can be attributed to high rainfall events that flush nutrients and other pollutants from land base sources and the result of efforts by the government regulating agencies to reduce the amount of pollutants entering the coastal waters through more efficient treatment facilities. If nitrogen levels become less frequently below the thresholds in future, then the risk status of the ecosystem will improve. Using values for ammoniacal nitrogen, the average severity of environmental degradation across 100% of the ecosystem extent is 53±8% (plausible bounds 45-61%). The status of the community is therefore Endangered (plausible range Vulnerable - Endangered) under subcriterion C1. However, this could be a conservative estimate since data were available extend back to 1998 only and environmental conditions would have been worse in earlier years (Fox et al. 2007; EPA 2008).

Key Indicators in detail

Indicator Variable: Ammoniacal nitrogen

Extent (%): 100
Relative Severity (%): 53±8

calculated
Year: 2008

C2a DD

There are no available data to estimate the parameter under this subcriterion. The status of the community is therefore Data Deficient under subcriterion C2a.

Key Indicators in detail

C2b NE

This subcriterion was not assessed.

Key Indicators in detail

C3 DD

There are no available data to estimate the parameter under this subcriterion. The status of the community is therefore Data Deficient under subcriterion C3.

Key Indicators in detail

Criterion D DD

Summary

Changes in the biotic component of seagrass communities have been observed. The increase in epiphytic load and shift in composition may have been factors contributing to the decline of seagrass biomass and density due to decreased light availability. However, such changes in the biotic component of this ecological community have never been quantified. Thus, the status of the ecosystem is classified as Data Deficient under criterion D.

Risk Category DD

Subcriterion	Category	Justification
D1	DD	In a study by Bryars et al. (2011), elevated levels of ammoniacal and oxidised nitrogen resulted in the increase in epiphytic load and changes in epiphytic composition. The increase in epiphytic load and shift in composition may have been factors contributing to the decline of seagrass biomass and density due to decreased light availability. As these have not been quantified, the status of the community is therefore Data Deficient under subcriterion D1.
D2a	DD	There are no available data to estimate the parameter under this subcriterion. The status of the community is therefore Data Deficient under subcriterion D2a.
D2b	NE	This subcriterion was not assessed.
D3		There are no available data to estimate the parameter under this subcriterion. The status of the community is therefore

Key Indicators in detail

Key Indicators in detail

Key Indicators in detail

DD

Data Deficient under subcriterion D3.

Key Indicators in detail

Criterion E DD

Summary

No quantitative analysis has been carried out to assess the risk of ecosystem collapse for Seagrass Community of South Australia. Therefore, the ecosystem is classified as Data Deficient for criterion E.

Risk Category DD

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