

Technical information supporting the 2018 subtidal reefs (reef condition) trend and condition report card

DEW Technical note 2018/35



Government of South Australia

Department for Environment
and Water

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Summary

This document describes the indicators, data sources, analysis methods and results used to develop this report and the associated report card. The reliability of data sources for their use in this context are also described.

1 Introduction

1.1 Importance of South Australian reefs

The marine environment regulates our climate, supports regional tourism, commercial and recreational fishing, aquaculture and shipping, and has significant cultural value for Aboriginal people.

Globally, the marine environment such as reefs, seagrasses, mangroves and saltmarshes face a number of pressures including: population growth, coastal pollution and developments, fishing, habitat modification, mining exploration, pest species, climate change and human-animal interactions/disturbance.

Temperate reefs are known to be highly productive systems and support complex ecosystems containing macroalgae, and a high diversity of invertebrate and fish species. Coastal reef fishes in South Australia have historically been exploited by fishing pressure, while historic loss of macroalgal cover has occurred due to industrialisation and urbanization-related pollution (Shepherd and Brook 2003, EPA 2003).

The consequence of pressures such as excessive extraction and pollution results in the destruction of reef habitats and ecosystems, leading to a loss of marine biodiversity, ecosystem function and ecosystem services.

This report presents information on reef condition from underwater diver surveys. Surveys are conducted to assess macroalgal cover, fish and invertebrate size and abundance, species diversity, and the presence of invasive species. These elements are used to assess the overall condition of reef systems in South Australia. The report presents information primarily from reefs off the coastline of the Adelaide and Mt Lofty Ranges Natural Resources Management (NRM) Region. Reefs close to highly populated areas are more likely to be influenced by anthropogenic activity.

1.2 Natural resources management trend and condition reporting

The Minister for Environment and Water under the [Natural Resources Management Act 2004](#) is required 'to keep the state and condition of the natural resources of the State under review'. NRM Report cards are produced as a primary means for undertaking this review. Previous NRM trend and condition report card [releases](#) reported against the targets in the [South Australian natural resources management plan](#) (Government of South Australia 2012b) using the broad process outlined in the [NRM State and Condition Reporting Framework](#) (Government of South Australia 2012a).

As the State NRM Plan is currently under [review](#), NRM report cards in early 2018 will instead inform the next [South Australian State of the Environment Report \(SOE\)](#) due out in 2018. Again, there is a legislative driver to guide the development of SOE reporting. The [Environment Protection Act 1993](#), which is the legislative driver to guide the development of SOE reporting, states that the SOE must:

- Include an assessment of the condition of the major environmental resources of South Australia 112(3(a))
- Include a specific assessment of the state of the River Murray, especially taking into account the Objectives for a Healthy River Murray under the [River Murray Act 2003](#) 112(3(ab))
- Identify significant trends in environmental quality based on an analysis of indicators of environmental quality 112(3(b)).

NRM Trend and Condition report cards will be used as the primary means to address these SOE requirements.

1.2.1 NRM Trend and Condition Report Card Continual improvement

Key documents guiding the content of South Australian NRM Trend and Condition report cards are:

- [Trend and Condition Report Cards Summary Paper](#) (DEWNR 2017)
- [NRM State and Condition Reporting Framework](#) (Government of South Australia 2012a).

Both of these documents reference a process of continual improvement in the way NRM Trend and Condition report cards are produced and communicated. A review based on key stakeholder feedback ([O'Connor NRM 2015](#)) indicated five key learnings ([DEWNR 2017](#)):

1. Trend and Condition Report Cards are acknowledged as a useful communication tool. There is support for them to continue to be produced to highlight data gaps and reliability issues to a broad audience including: policy makers and investors; environmental managers; and the community.
2. There are issues with data availability, access, consistency and transparency, which will need to be addressed and improved over time in future Trend and Condition Report Cards
3. Indicators or measures reported on were based on those outlined in the State NRM Plan. Not all of these are considered to be the most appropriate or relevant for those assets. These will be reviewed as part of the current State NRM Plan review and a set of agreed measures will be determined for future Trend and Condition Report Cards.
4. Greater alignment of reporting relevant to project, regional, state, program and State of the Environment is seen as imperative
5. Better clarity is needed around target evaluation reporting, which should measure the impact or outcome of an investment at a project, regional, state or program scale. However the trend and condition reporting reflects the status of an environmental resource and its change based on impacts that affect its condition. In some cases, the same reporting can be used for both (e.g. soil erosion), and in others it cannot (e.g. threatened species).

As the process by which the NRM Trend and Condition report cards are produced evolves, there is an increased emphasis, in keeping with the Premier's [digital by default declaration](#), on the use of open data and reproducibility. This is one key response to help address the second key learning outlined above. The report cards being produced to inform the 2018 State of the Environment Report are at varying stages along this route to open data and reproducibility.

2 Methods

2.1 Indicator

The indicator used for the reefs report card is subtidal reef condition.

2.2 Data sources

Subtidal reef health (condition) data were taken directly from reports published between 2007 and 2014 (Turner et al. 2007; Collings et al. 2008; Department for Environment and Heritage 2008; Westphalen 2009; Westphalen 2011, Brook and Bryars 2014). Subtidal reef condition scores that are presented in Figure 1 as “good, caution, bad” are based on the most recent available data for that site collected between 2005 and 2014.

2.3 Data collection

Subtidal reefs condition is assessed by underwater diver surveys. Expert divers collect specific data related to fish and invertebrate abundance, indicator species, site attached fish, invasive species and aquatic flora (see Table 2.1). For a detailed description of the methods and indicators used, refer to Turner et al. 2007; Collings et al. 2008; Department for Environment and Heritage 2008; Westphalen 2009; Westphalen 2011.

Table 2.1. Dive survey categories used to assess reef condition in the Northern and Yorke and Adelaide and Mt. Lofty Natural Resource Management Regions

Indicators used	2005		2006		2007		2009		2010		2013	
	AMLR	YP	AMLR	YP	AMLR	YP	AMLR	YP	AMLR	YP	AMLR	YP
Percentage cover of canopy forming macroalgae	x	x	No survey	x	x	No survey	x	No survey	x	No survey	x	No survey
Percentage cover of turfing macroalgae	x	x	No survey	x	x	No survey	x	No survey	x	No survey		No survey
Percentage cover of mussel mats	x	x	No survey	x	x	No survey	x	No survey	x	No survey		No survey
Percentage cover of bare substrate	x	x	No survey	x	x	No survey	x	No survey	x	No survey		No survey
Size and abundance of blue throated wrasse	x	x	No survey	x (abundance only)	x	No survey	x	No survey	x	No survey	x	No survey
Abundance of site attached fish	x	x	No survey	x	x	No survey	x	No survey	x	No survey	x	No survey
Abundance of mobile invertebrate predators	x	x	No survey	x	x	No survey	x	No survey	x	No survey	x	No survey
Presence of invasive taxa	x	x	No survey	x	x	No survey	x	No survey	x	No survey	x	No survey
Sedimentation	x	x	No survey	x	x	No survey		No survey		No survey		No survey
Species richness (macroalgae)	x	x	No survey	x	x	No survey		No survey		No survey	x	No survey
Species richness (mobile invertebrates)	x	x	No survey	x	x	No survey		No survey		No survey	x	No survey

2.4 Analysis

2.4.1 Trend

The mean subtidal reef health condition score (presented in Figure 3.1) was calculated by averaging condition scores collected for all reefs sampled within a particular year and NRM region (regions were AMLR and NY only). Actual trends are unable to be calculated as the same locations are not surveyed regularly. The graphed average condition of any particular year may not match the locations averaged in other years.

Table 2.2. Definition of trend classes used

Trend	Description
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence
Stable	Over a scale relevant to tracking change in the indicator it is neither improving or declining in status
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence
Unknown	Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above trend classes

2.4.2 Condition

Subtidal reef condition scores are calculated from a combination of reef health indicators; the number of indicators measured varies between survey periods undertaken from 2005–07, 2009–10 and 2012–13 (Table 2.1).

Table 2.3. Definition of condition classes used

Condition	Description	Threshold
Very good	The natural resource is in a state that meets all environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for all processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)	Reef condition score >99
Good	The natural resource is in a state that meets most environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for only some processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)	Reef condition score >65–99
Fair	The natural resource is in a state that does not meet some environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from many processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)	Reef condition score 35–65 (caution)
Poor	The natural resource is in a state that does not meet most environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from most processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)	Reef condition score <35

Unknown	Data are not available to determine the state of this natural resource, based on this indicator	-
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above condition classes	-

2.4.3 Limitations

Trends are unable to be calculated for all NRM Regions except Adelaide and Mt Lofty Ranges. The data for Northern and Yorke is too old and not enough years are available to accurately determine a trend. The trend calculation is based on a representative sample of reefs during a given period of time. It does not represent the trend in the condition of the same reefs over time.

2.4.4 Reliability

Information is scored for reliability based on the average of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 2.4 for currency, Table 2.5 for applicability and Table 2.6 for spatial representation.

Table 2.4. Guides for applying information currency

Currency score	Criteria
1	Most recent information >10 years old
2	Most recent information up to 10 years old
3	Most recent information up to 7 years old
4	Most recent information up to 5 years old
5	Most recent information up to 3 years old

Table 2.5. Guides for applying information applicability

Applicability score	Criteria
1	Data are based on expert opinion of the measure
2	All data based on indirect indicators of the measure
3	Most data based on indirect indicators of the measure
4	Most data based on direct indicators of the measure
5	All data based on direct indicators of the measure

Table 2.6. Guides for applying spatial representation of information (sampling design)

Spatial score	Criteria
1	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown
2	From an area that represents less than 25% the spatial distribution of the asset within the region/state
3	From an area that represents less than half the spatial distribution of the asset within the region/state
4	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified
5	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design

3 Results

3.1 Trend

Trends are allocated as unknown at the statewide level. Not enough data is available to make an accurate assessment of the statewide trend in reef condition. Most data exists for the Adelaide and Mt Lofty NRM Region where the condition of the reefs sampled have been getting better Figure 3.1. Data for Northern and Yorke Region is too old, and over too short of a timeframe to assign it a trend.

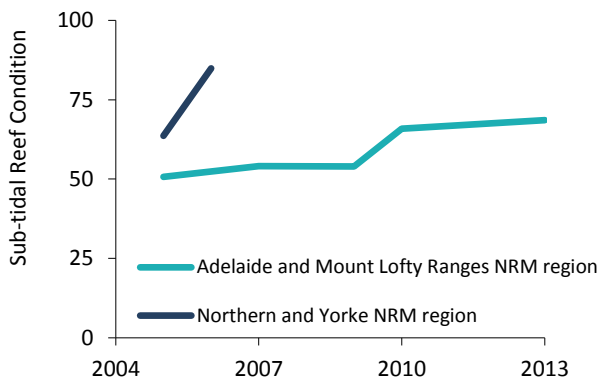


Figure 3.1. Average subtidal reef condition for reefs sampled in a particular year Condition

Condition is allocated as unknown at the statewide level. Not enough data is available to make an accurate assessment of the condition of reefs at this scale. Most data exists for Northern and Yorke and the Adelaide and Mt Lofty NRM regions. Subtidal reefs in the Northern and Yorke NRM region were in good condition in 2006 with a score of 85 out of 100 (100 represents pristine, undisturbed condition). In the Adelaide and Mount Lofty Ranges NRM region, subtidal reefs were in good condition in 2013, with a condition score of 69 out of 100, despite the relatively degraded condition of some reefs near metropolitan Adelaide (Figure 3.2).

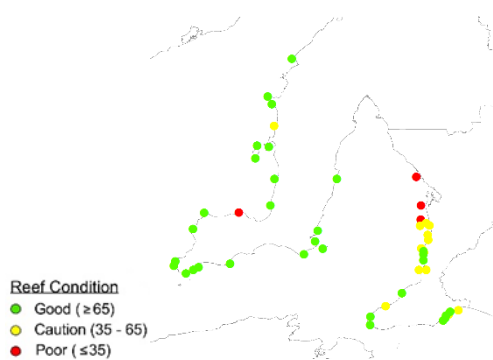


Figure 3.2. Site level condition of reefs up to 2013

3.2 Reliability

The overall reliability score for this report card is 3.3 (rounded to 3), based on Table 3.1

Table 3.1. Information reliability scores for reef trends

Indicator	Applicability	Currency	Spatial	Accuracy	Reliability
Subtidal reef condition: AMLR	4	5	2		3.67
Subtidal reef condition: N&Y	2	5	2		3.0
Subtidal reef condition: Rest of state	NA	NA	NA		NA

3.2.1 Notes on reliability

The report card has been given the score of 3 out of 5 and a reliability of good. The most recent data collected for this report was recorded in 2013 and was only for Adelaide and Mt Lofty NRM region. The data that we do have is of good quality but not a representative sample of the whole state.

4 Discussion

4.1 Trend and condition

Condition along the Adelaide metropolitan coast ranges from poor to good. On average the condition of reefs in the AMLR is classified as being good. Over the time period presented in this report, the reefs sampled had an average condition score of 50 or over. In the AMLR, there is a north–south condition gradient that corresponds with the level of urbanisation and human activity. Figure 3.2 shows that the reefs in the northern AMLR are in poorer condition than those in the south of the region. The cover of larger brown algae on reefs is an indicator of good health. Assessments of reefs in the northern AMLR exposed to higher pollution levels shows a reduction in large brown algae and an increase in opportunistic turf algae. Recent improvements in the quality of pollution inputs into the Gulf St Vincent may result in improvements to reef condition along this coast, but increases in turfing algae and the establishment of invertebrates like bivalves on reefs that previously had good cover of brown algae make it difficult for brown algae to re-establish (EPA 2003).

Condition and trend of reefs in Northern and Yorke NRM Region between 2005–06 indicated generally good condition. However, two data points is not sufficient time to accurately report on trend of reefs in this region, particularly given the age of the data and was not used to determine state wide trends.

4.2 Future reporting

Trend and condition for the whole-of-state reef condition has been labelled unknown. Additional data on reef characteristics are collected in a standardised manner through the Reef Life Survey program. Currently more data has been collected than is presented in this report but this data has yet to be analysed. The data covers parts of the Eyre Peninsula, Kangaroo Island, Yorke Peninsula and Adelaide and Mt. Lofty region NRM Regions. The assessment of South Australia’s reef condition is undergoing review and workshops will be run in 2018 to help determine a more appropriate method of scoring reef condition from available reef databases. New information will be available for a more comprehensive assessment of South Australia’s reefs in future reports.

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