The state and trends of quality of habitats and communities – Coral reefs (<25m)

Hugh Sweatman, Russ Babcock, Scott Evans, James Gilmour, Andrew Heyward, Zoe Richards, Shaun Wilson

Name and contact details for two independent reviewers of this assessment.

Potential reviewers:
Peter Mumby p.j.mumby@uq.edu.au
Terry Hughes terry.hughes@jcu.edu.au

Main text

Please use the following subheadings:

Description of species/habitat/community/process (incl. spatial area of relevance) (68)

Hard corals occur in shallow waters all around tropical and subtropical Australia, forming both biogenic coral reefs and diverse communities of corals growing on rock. There are coral reefs in the World Heritage sites of Shark Bay, Lord Howe Is, Ningaloo Reef and the Great Barrier Reef (GBR). Many nearshore reefs in the north and northwest have been little studied and recent surveys have found surprisingly diverse communities.

Current state and recent trend (2011-2016) of species/habitat/community/process (refer to the key to grades for state, trend provided for consistency of language). (210)

The greatest area of shallow coral reefs is Queensland's GBR. This reporting period has seen a major study showing that average coral cover on GBR reefs has halved over 27 years to 2012, mainly attributed to cyclones and crown-of-thorns starfish (COTS). Reefs in general retain capacity to recover but frequent acute disturbances mean that recovery is incomplete. The GBR region has been exposed to a cluster of severe cyclones in the past decade and a new wave of COTS outbreaks is underway in the north. Direct human impacts from runoff and the consequences of coastal development principally affect nearshore reefs. The condition of GBR reefs generally is poor though reefs in many regions retain capacity to recover in periods of low disturbance. The El Niño conditions in 2016 are causing severe bleaching in the northern GBR, which is still being assessed. Reefs in the northwest experience frequent cyclones, and a recent sequence of high summer SSTs has caused varying degrees of bleaching and coral mortality in different regions, notably from Exmouth to the Abrolhos in 2011, and Exmouth & Dampier in 2013. Outbreak densities of COTS have been reported on reefs in the Pilbara, but not elsewhere and they have not been seen on the same scale as on the GBR. For these reasons, the condition of reefs varies greatly across NW Australia but is good on aggregate.

Main uncertainties and knowledge gaps associated with providing an assessment of current state and recent trend (42)

Ningaloo Reef, some offshore reefs in the NW and the GBR have ongoing monitoring programs, and other programs have been established very recently. Much of the north coast is very remote and rarely visited, so information for many locations is very limited.

Pressures/issues of importance and associated management (112)

The GBR Outlook report (2014) lists climate change, acting through thermal stress, ocean acidification and more severe weather as the greatest long-term threat to coral reefs, and this applies to all regions. Poor water quality from land-based run-off, impacts from coastal development, and some remaining impacts of fishing remain the major threats in the GBR. A large joint Federal and Queensland Government program to improve water quality through changing land use is showing some success. There is also a COTS control program to protect coral around high-value tourism sites in the North central GBR. Water quality is not an issue in arid NW Australia but industrial development affects reefs in some locations.

Outlook (72)

Coral reefs are dynamic systems that are subject to cycles of disturbance and recovery, and the balance of these determines the nature of reef communities. Disturbances in the form of severe weather and bleaching have occurred frequently in recent years, allowing limited time for reefs to recover. Chronic stresses such as poor water quality, higher water temperatures and ocean acidification are likely to impede reef recovery. The outlook for reefs is grim.

References (not included in 500 word limit)

Abdo DA, Bellchambers LM, Evans SN (2012) Turning up the Heat: Increasing Temperature and Coral Bleaching at the High Latitude Coral Reefs of the Houtman Abrolhos Islands. PLoS ONE 7(8): e43878. doi:10.1371/journal.pone.0043878

Ceccarelli, D. M., Richards, Z. T., Pratchett, M. S., & Cvitanovic, C. (2011). Rapid increase in coral cover on an isolated coral reef, the Ashmore Reef National Nature Reserve, north-western Australia. *Marine and Freshwater Research*, *62*(10), 1214-1220.

De'ath, G., Fabricius, K. E., Sweatman, H., & Puotinen, M. (2012). The 27–year decline of coral cover on the Great Barrier Reef and its causes. *Proceedings of the National Academy of Sciences*, *109*(44), 17995-17999.

Depczynski, M., Gilmour, J. P., Ridgway, T., Barnes, H., Heyward, A. J., Holmes, T. H., Moore, J. A. Y., Radford, B. T., Thomson, D. P., Tinkler, P., and Wilson, S. K. (2013). Bleaching, coral mortality and subsequent survivorship on a West Australian fringing reef. *Coral Reefs* **32**, 233–238. doi:10.1007/S00338-012-0974-0

Gilmour J, Smith L, Cook K, Pincock S (2013a) Discovering Scott Reef. Australian Institute of Marine Science, Perth. http://www.aims.gov.au/publications/discovering-scott-reef

Gilmour JP, Smith LD, Heyward AJ, Baird AH, Pratchett MS (2013b) Recovery of an isolated coral reef system following severe disturbance. Science 340:69-71

Great Barrier Reef Marine Park Authority 2014, *Great Barrier Reef Outlook Report 2014*, GBRMPA, Townsville.

Heyward, A, et al. 2011; Monitoring Study S6B Corals Reefs, Montara: 2011 Shallow Reef Surveys at Ashmore, Cartier and Seringapatam Reefs. Final Report for PTTEP Australasia (Ashmore Cartier) Pty. Ltd. Australian Institute of Marine Science, Townsville. (163pp.).

[http://www.environment.gov.au/system/files/pages/bcefac9b-ebc5-4013-9c88-a356280c202c/files/2011-shallow-reef-surveys.pdf]

Lafratta, A., Fromont, J., Speare, P., Schonberg, CHL (2016) Coral bleaching in turbid waters of north-western Australia. Marine and Freshwater Research, http://dx.doi.org/10.1071/MF15314, 11pp.

Moore, J. A. Y., Bellchambers, L. M., Depczynski, M. R., Evans, R. D., Evans, S. N., Field, S. N., Friedman, K. J., Gilmour, J. P., Holmes, T. H., Middlebrook, R., Radford, B. T., Ridgway, T., Shedrawi, G., Taylor, H., Thomson, D. P., and Wilson, S.K. (2012). Unprecedented mass bleaching and loss of coral across 1268 of latitude in Western Australia in 2010–11. *PLOS ONE* **7**, e51807. doi:10.1371/JOURNAL.PONE.0051807

Richards ZT, Garcia RA, Wallace CC, Rosser NL, Muir PR (2015) A Diverse Assemblage of Reef Corals Thriving in a Dynamic Intertidal Reef Setting (Bonaparte Archipelago, Kimberley, Australia). PLoS ONE 10(2): e0117791. doi:10.1371/journal.pone.0117791

Richards, Zoe T., Alison Sampey, and Loisette Marsh. "Kimberley marine biota. Historical data: scleractinian corals." *Rec. West. Aust. Mus. Suppl* 84.11 (2014).

Speed, C. W., Babcock, R. C., Bancroft, K. P., Beckley, L. E., Bellchambers, L. M., Depczynski, M., Field, S. N., Friedman, K. J., Gilmour, J. P., Hobbs, J.-P. A., Kobryn, H. T., Moore, J. A. Y., Nutt, C. D., Shedrawi, G., Thomson, D. P., and Wilson, S. K. (2013). Dynamic stability of coral reefs on the west Australian coast. *PLOS ONE* **8**, e69863. doi:10.1371/JOURNAL.PONE.0069863

Wilson, Barry. *The biogeography of the Australian North West Shelf: environmental change and life's response*. Newnes, 2013.

Table/Figure captions (not included in 500 word limit)

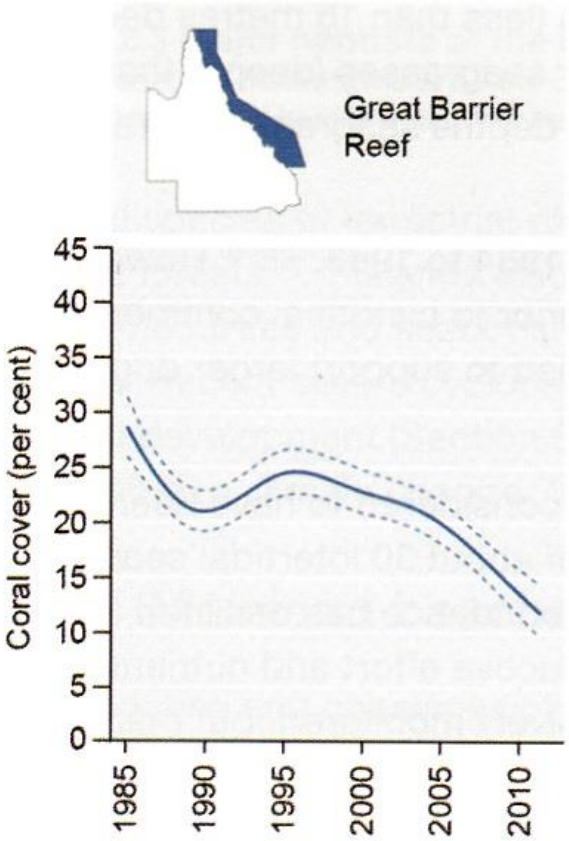

Figure 2.5 Hard coral cover, 1986–2012

The solid line represents modelled coral cover based on the analysis of data collected from 214 reefs across the Region; while the dashed lines either side represent the associated standard errors. Average hard coral cover in the Region has declined significantly since monitoring began in 1986. Declines have been most severe in the south. Source: De'ath *et al.* 2012[18]

[Figure from GBR Outlook Report 2014 p. 20]

Assessment summary

The average state of shallow reefs on NE coast is Poor and declining; on the NW coast it is Good and stable. In each case there is adequate high quality evidence and good confidence. The state of reefs in the North is assumed to be good and stable but with much less confidence.

Comparability: In 2011 the North and North Western reefs were considered to be in very good condition, since then, many NW reefs have been affected by bleaching.

Summary:

Severe storms and COTS have affected Eastern reefs while many regions in the NW have been affected by bleaching

Metadata

GBR:

- Marine Monitoring Program (GBRMPA/AIMS)
- AIMS Long-term Monitoring Program

NW Australia:

- WA DPAW unpublished data,
- CSIRO unpublished data.