



Australian Government



AUSTRALIAN INSTITUTE
OF MARINE SCIENCE

Long-term Reef Monitoring Program -
Annual Summary Report on coral reef condition for 2019

Mixed bill of health for the Great Barrier Reef

Summary

- Coral reefs are impacted by numerous disturbances including outbreaks of the corallivorous crown-of-thorns starfish (*Acanthaster c.f. solaris*), tropical cyclones and coral bleaching.
- Over the last five years, these collective disturbances have caused declines in hard coral cover to moderate (10-30%) levels across much of the Great Barrier Reef (GBR).
- Reef condition was variable both within and among regions.
- Reefs in the Northern and Central GBR have sustained impacts from multiple severe disturbances including mass coral bleaching, cyclones and crown-of-thorns starfish outbreaks.
- Reefs in the Southern GBR escaped major disturbances from 2009 until 2017, when a severe outbreak of crown-of-thorns starfish began that continued through to 2019.
- In response to these disturbances, average hard coral cover continued to decline in the Central and Southern GBR while stabilising in the Northern GBR in 2019.
- Hard coral cover on AIMS survey reefs in the Northern GBR increased slightly from 11% in 2017 to 14% in 2019, but remains close to the lowest levels recorded by the [AIMS Long-Term Monitoring Program](#) (LTMP) since 1985. This reflects the cumulative impacts of cyclones and two episodes of severe coral bleaching over the period 2014 to 2019. To date, recovery has been limited.
- Surveys in the Northern GBR in 2019 may overestimate regional hard coral cover; coral bleaching in 2016 caused the greatest mortality on inshore reefs, but few inshore reefs could be surveyed due to safety concerns.
- Reefs in the Central GBR sustained significant coral loss due to Severe Tropical Cyclone (STC) Debbie in 2017 and due to the continued southward spread of crown-of-thorns starfish outbreaks. Average hard coral cover declined slightly, from 14% in 2018 to 12% in 2019.
- Reefs of the [Capricorn-Bunker](#) sector in the Southern GBR continued to recover in 2019 while many of the southern [Swain](#) reefs suffered large coral losses due to intense crown-of-thorns starfish outbreaks. Overall, mean coral cover on reefs in the Southern GBR region continued to decline, albeit only slightly, from 25% in 2018 to 24% in 2019.
- Early indications from [additional detailed surveys](#) show that coral juveniles across the GBR occurred at densities favourable for recovery in the absence of further disturbances.

With reef surveys extending over more than 30 years, the [AIMS Long-Term Monitoring Program](#) provides an invaluable record of change by repeatedly surveying coral reef communities over a large area of the Great Barrier Reef.

This annual update of trends in hard coral cover across the whole GBR is based on [manta tows](#) surveys of coral reefs, mainly on the mid- and outer shelf (Figure 1). Sixty four reefs were surveyed from September 2018 to June 2019 (reported as '2019'). [Detailed reports](#) on the condition and trends of individual reefs are available shortly after completion of each survey trip. Data summaries are [available for download](#).

The dynamic nature of GBR coral reefs, and the considerable variation among regions in the rates of decline and recovery of hard coral cover in response to disturbances, are clear in the long-term record. Understanding the dynamics of the disturbance regime provides critical context for interpretation of long term monitoring data. For annual updates, the GBR Marine Park is divided into three regions (Figure 1), each showing different trajectories of change in hard coral cover over time in response to the cumulative impacts of severe tropical cyclones, outbreaks of the crown-of-thorns starfish and coral bleaching.

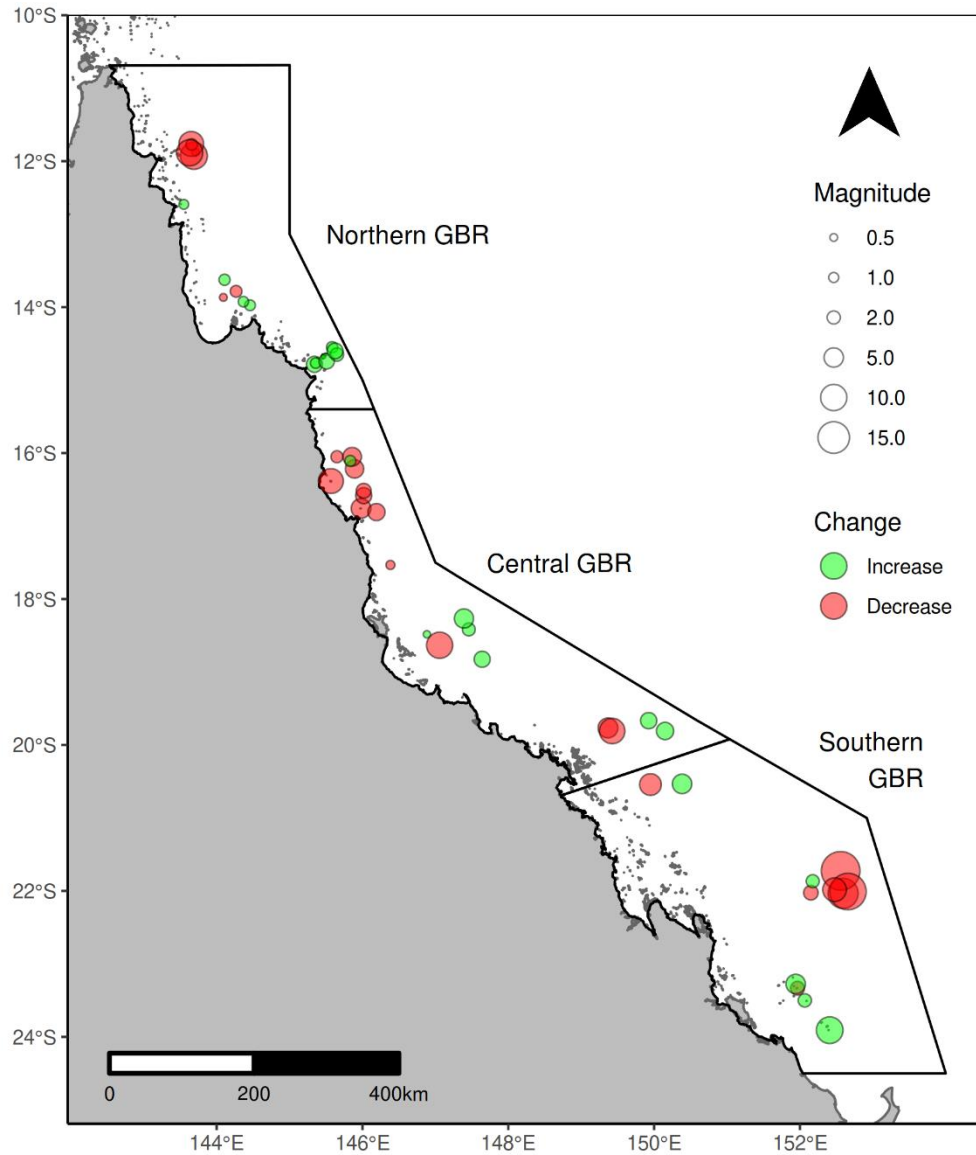


Figure 1. Boundaries of Northern, Central and Southern GBR used in the trend analyses (Figures 2, 4, 6) with the locations of the 64 reefs surveyed by manta tows between September 2018 and June 2019. Size and colour of the symbols represent the magnitude of the absolute annual change in reef-level percent hard coral cover between 2019 and the previous survey.

Coral cover summary to June 2019

The Northern region

Hard coral cover increased from the lowest levels yet recorded by the LTMP of 11% in 2017, to 14% in 2019 (Figure 2). However, hard coral cover in 2019 was still less than half of the peak level of 30% recorded in 1988 (Figure 2). Recent declines in hard coral cover followed a sequence of disturbances after 2013, including cyclones, outbreaks of crown-of-thorns starfish and mass coral bleaching (Figure 2). Surveys in 2019 found little evidence of crown-of-thorns starfish activity and very little coral disease. However, there were indications of continuing pressures on these reefs, for example, storm impacts from Tropical Cyclone Penny and low-level coral bleaching generally restricted to scattered individual corals.

There was substantial variation in the condition of individual reefs in the Northern GBR. Reefs that were affected by recent severe disturbances such as mass coral bleaching and tropical cyclones remain in poor condition with low hard coral cover (<10%), while other reefs retained intact coral populations with moderate (10 to 30%) to high (30 to 50%) hard coral cover (Figure 3). Overall, hard coral cover has increased slightly on most survey reefs in the Northern GBR in 2019 (Figure 1).

The small increase in region-wide hard coral cover in the present surveys compared to 2018 may partially be explained by the exclusion of some survey reefs in 2019 that were previously visited. Inshore and mid-shelf reefs in the Northern GBR were among the [most severely impacted](#) by the mass coral bleaching events of 2016 and 2017. However, eight reefs that had been surveyed previously could not be resurveyed in 2019 due to safety concerns. The inclusion of four outer shelf reefs that escaped the worst of the bleaching and had not been previously surveyed also contributed to the small increase observed in hard coral cover across the region in the present surveys.

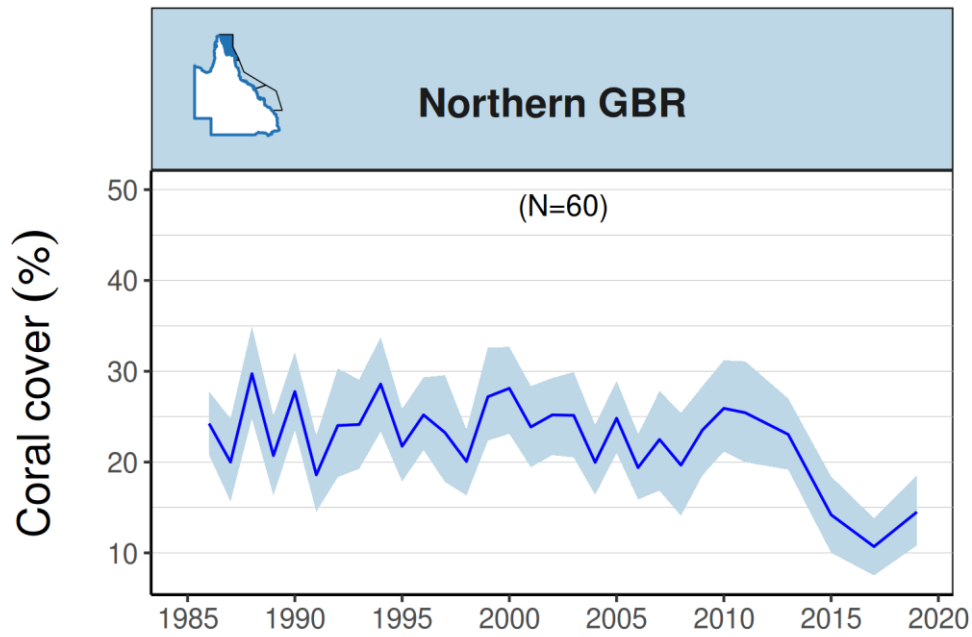


Figure 2. Trends in average hard coral cover for the Northern GBR based on manta tow surveys to June 2019. N indicates the number of reefs contributing to the analyses; blue shading represents 95% credible intervals. Note that many reefs in this region do not have a regular survey history and that in 2019, not all inshore reefs could be surveyed.

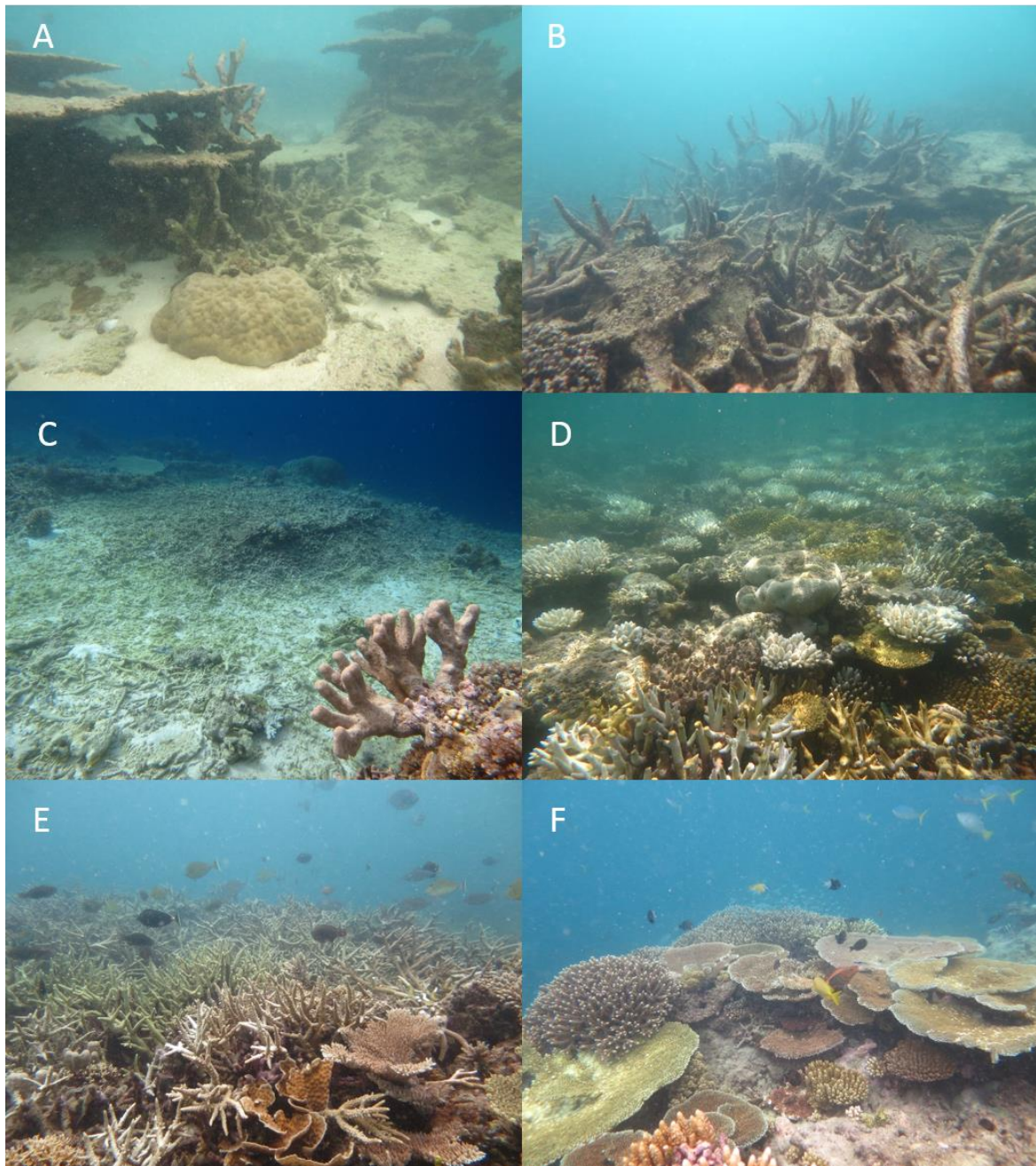


Figure 3. Photos showing the variable condition of reefs in the Northern GBR. Some reefs had been severely impacted by recent mass coral bleaching (A, B – [Reef 11-049](#)), with low hard coral cover and dead standing skeletons covered in turf algae. Other reefs showed evidence of ongoing disturbances such as cyclones (C – [Lagoon Reef](#)), and coral bleaching (D – [Rodda Reef](#)), while several reefs had intact and seemingly healthy coral populations (E – [Ashmore Banks 2](#), F – [Ashmore Banks 3](#)).

The Central region

Since 1985, hard coral cover on reefs in the Central GBR has generally been lower than in the Northern and Southern GBR. Cover in the Central GBR decreased to the lowest level on record in 2012, following the impact of STC Yasi in 2011 (Figure 4). Hard coral cover then recovered rapidly to the highest average regional cover in the LTMP record in 2016 (22%). Since 2016, hard coral cover has declined continuously to 12% in 2019 (Figure 4). This decline was due to repeated mass coral bleaching in 2016 and 2017, increasing activity of the crown-of-thorns starfish as the current wave of outbreaks moves south and the passage of STC Debbie in 2017.

Hard coral cover on the majority of reefs in the Central GBR has declined since the previous surveys (Figure 1) but reefs were in variable condition dependent on recent disturbances. For example, some outer-shelf reefs offshore from the [Whitsundays](#) had small annual increases in hard coral cover (Figure 1) and retained moderate to high hard coral cover despite the passage of STC Debbie, while inshore and mid-shelf reefs were more severely impacted and had low hard coral cover (Figure 5 A, B). Similarly, many Central GBR reefs have had outbreaks of crown-of-thorns starfish, particularly in the [Cairns](#), [Innisfail](#) and [Townsville](#) sectors. Hard coral cover has declined as a result (Figures 1, 5 C, D).

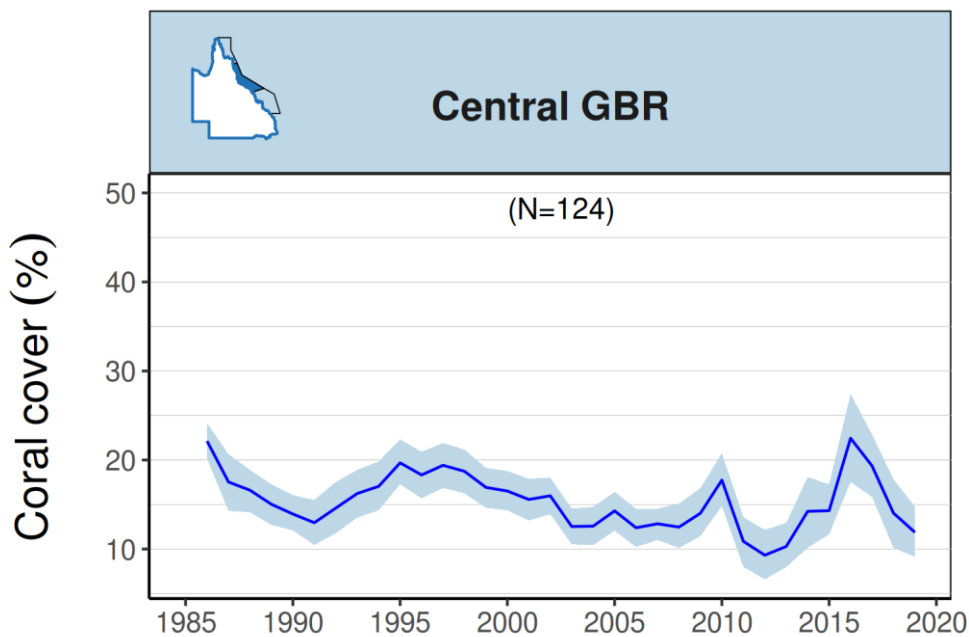


Figure 4. Trends in average hard coral cover for the Central GBR based on manta tow surveys up to June 2019. N indicates the number of reefs contributing to the analyses; blue shading represents 95% credible intervals.

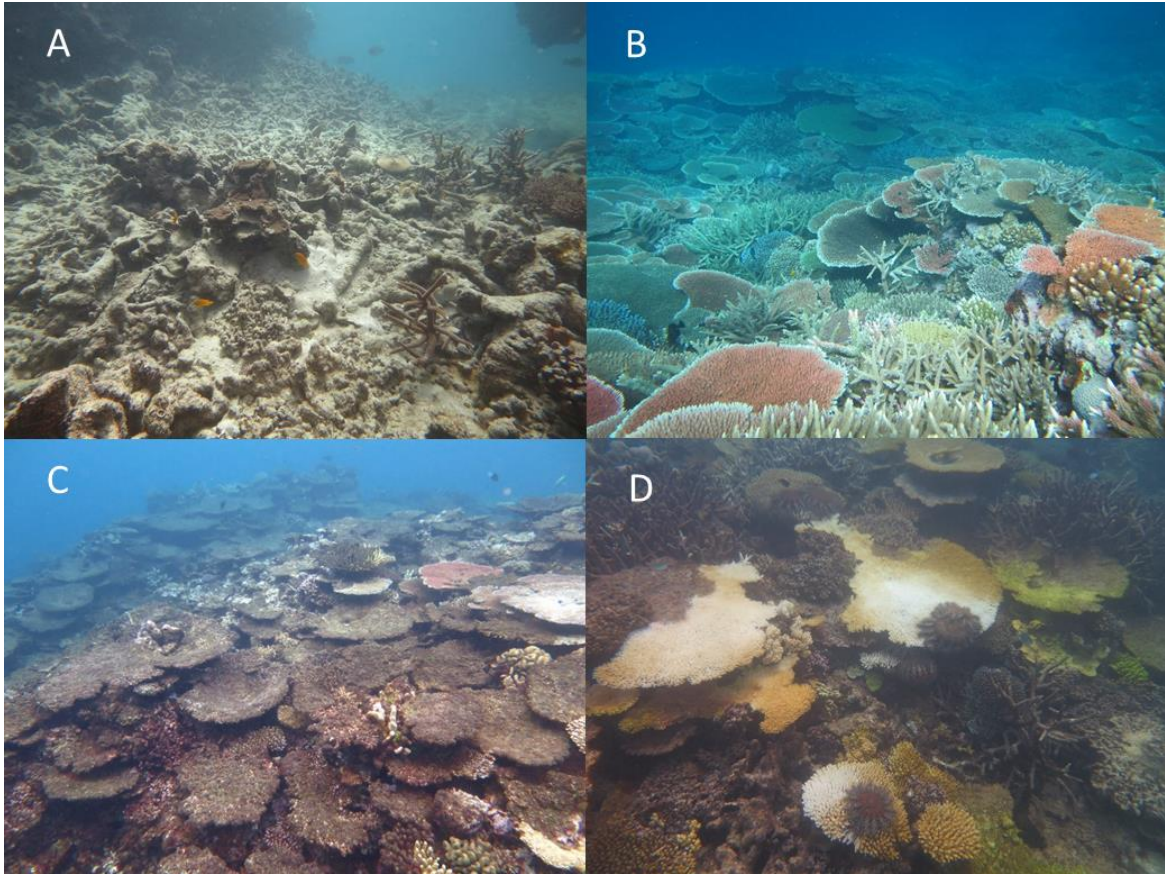


Figure 5. Some areas of the Whitsunday region of the Central GBR were heavily damaged by STC Debbie in 2017 (A – [Reef 19-131](#)), while others escaped the brunt of the storm (B – [Rebe Reef](#)). Outbreaks of crown-of-thorns starfish continue to degrade many reefs in the Central GBR (C – [John Brewer Reef](#), D - [Farquharson Reef](#)).

The Southern region

STC Hamish swept across much of the Southern GBR in 2009, causing extensive damage. Average hard coral cover in the Southern region dropped sharply as a result (Figure 6). From 2009-2017 there were no severe cyclones and few recorded outbreaks of crown-of-thorns starfish on the Southern GBR and hard coral cover increased to 34%. From 2017 to 2019 there was a decline in average hard coral cover across the southern GBR and in 2019 the region-wide average was 24%, primarily as a result of the emergence of a severe crown-of-thorns starfish outbreak in the [Swain](#) sector of the Southern GBR (Figure 6).

Reefs in the Southern GBR [were not exposed](#) to the extreme sea surface temperatures that led to the 2016 or 2017 mass coral bleaching events on the central and northern GBR but in 2017 an outbreak of crown-of-thorns starfish was recorded at [Chinaman Reef](#). In December 2017 the effects of outbreaks were seen during LTMP surveys at [Jenkins Reef](#). Broad-scale surveys by the [GBRMPA-QPWS Field Management Team](#) found that the majority of south-western Swain Reefs had outbreaks, some very severe. Some AIMS survey reefs in the Swains were similarly affected, resulting in declines in hard coral cover on a number of reefs up to 2019 (Figure 1). In 2019, degradation from crown-of-thorns starfish outbreaks continued on many reefs in the [Swains](#) (before and after photos from Horseshoe Reef in 2017, Figure 7A, and 2019, Figure 7C).

Declines in hard coral cover in the Swains were offset by continued recovery on reefs of the [Capricorn-Bunker](#) sector from STC Hamish (Figure 1), where reefs retain high (30 to 50%) to very high (50 to 75%) hard coral cover. The net result has been a slight decline of hard coral cover across the Southern GBR between 2018 and 2019, but with substantial variation around the estimate (Figure 6).

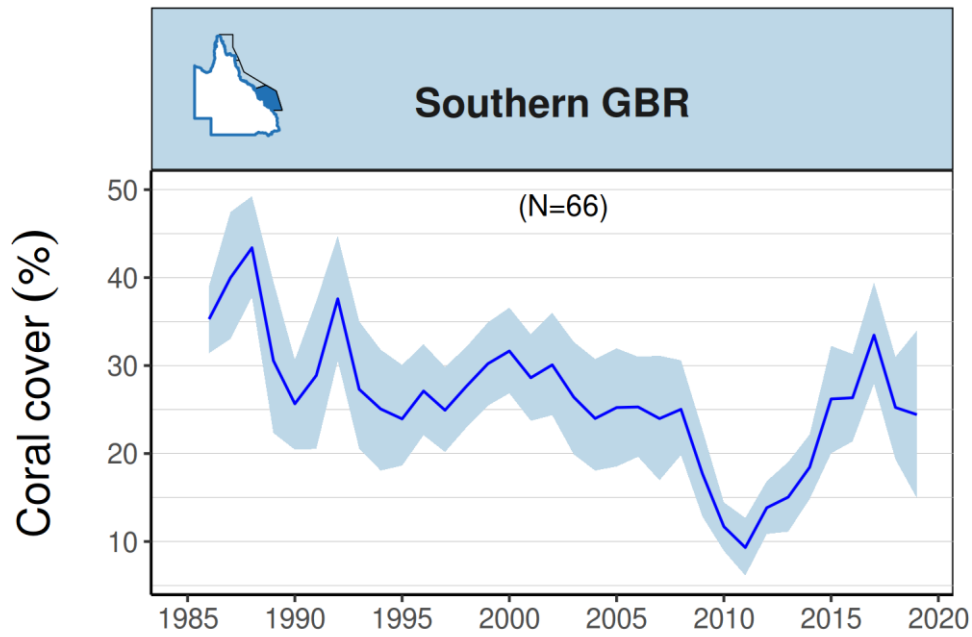


Figure 6. Trends in average hard coral cover for the Southern GBR based on manta tow surveys up to June 2019. N indicates the number of reefs contributing to the analyses; blue shading represents 95% credible intervals.

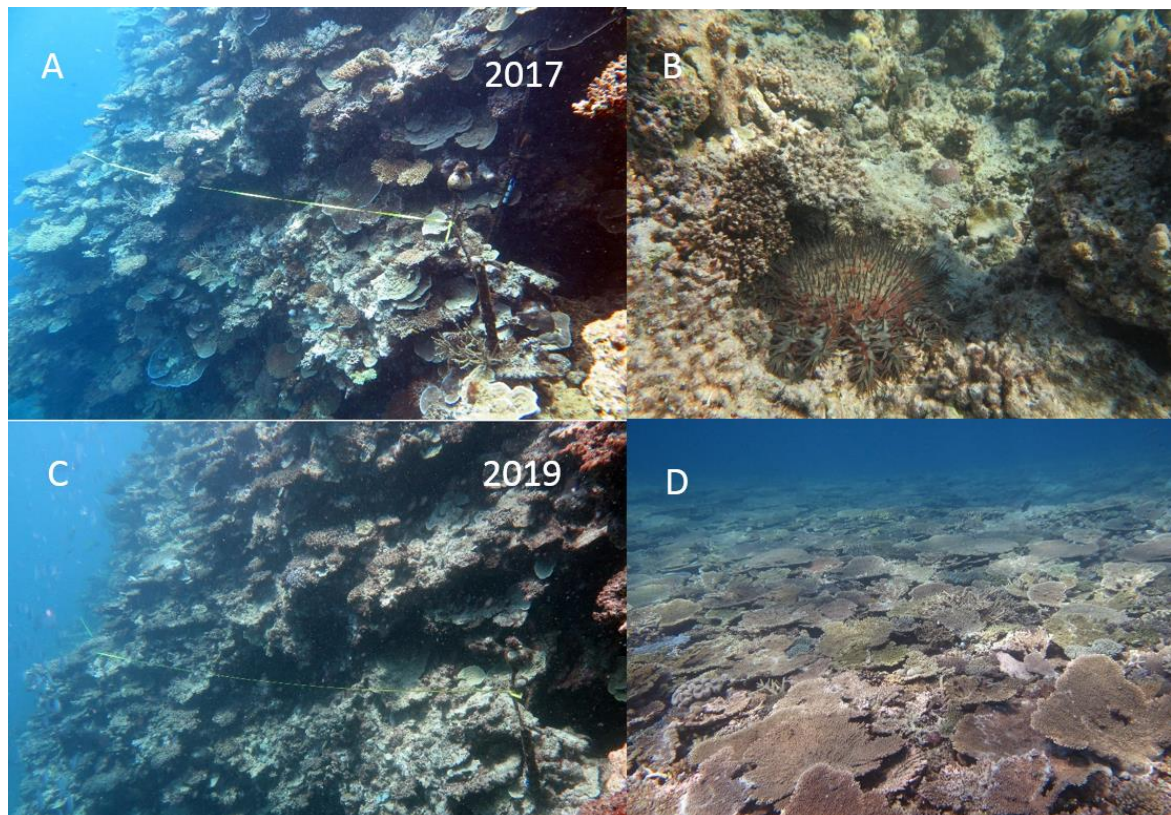


Figure 7. Variable disturbance regimes in the Southern GBR. Outbreaks of crown-of-thorns starfish decimate coral populations on many reefs in the Swain sector (A to C – [Horseshoe Reef](#)),

while reefs in the Capricorn-Bunker sector have experienced no significant disturbance since 2009 and retain healthy coral populations with high to very high hard coral cover (D – [Wreck Island](#)).

Assessing the long-term health of the Great Barrier Reef

The GBR has been subjected to a period of intense disturbance activity in the last five years. A fourth wave of crown-of-thorns starfish, coupled with a cluster of severe tropical cyclones and major bleaching events have caused widespread coral declines on a spatial scale which is unparalleled in the history of LTMP surveys. Over the 30+ years of monitoring by AIMS, GBR reefs have shown their ability to recover after disturbances, but such 'resilience' clearly has limits. The predicted consequences of climate change include more powerful storms and more frequent, more intense mass coral bleaching events. More intense disturbances result in greater damage to reefs, so recovery must take longer even if the growth rate remains the same. At the same time, chronic stressors such as [high turbidity](#), [higher ocean temperatures](#) and changing ocean chemistry can all negatively affect rates of recovery, while more frequent acute disturbances mean that the intervals for recovery are becoming shorter.

The geographic scale of recent mass coral bleaching and crown-of-thorns starfish outbreaks means that [breeding populations of corals](#) have been decimated over large areas, reducing the potential sources of larvae to recolonise reefs in the near future.

Hard coral cover in the Northern and Central GBR continues to be close to, or at, the lowest levels recorded in the 30+ years of the LTMP. Reefs in the Southern GBR have moderate hard coral cover but have [limited genetic connection](#) to reefs further north. This limits their capacity to serve as a major source of coral larvae to support reef recovery elsewhere.

The prognosis of more frequent disturbances, each causing greater damage to reefs, combined with slower rates of recovery will inevitably lead to less living coral on reefs of the GBR.

Measuring and understanding the process of coral reef recovery will be a major focus of AIMS' research and monitoring over the next years.

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11th July 2019

The report is available online at <https://www.aims.gov.au/reef-monitoring/gbr-condition-summary-2018-2019>

Additional detailed surveys in the Northern region in 2019 were funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.