

REEF SNAPSHOT

SUMMER 2021-22



Australian Government
Great Barrier Reef
Marine Park Authority



Australian Government



AUSTRALIAN INSTITUTE
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We acknowledge the continuing sea country management and custodianship of the Great Barrier Reef by Aboriginal and Torres Strait Islander Traditional Owners, whose rich cultures, heritage values, enduring connections and shared efforts protect the Reef for future generations.

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This snapshot draws on various types of information, including:

Climate time series data (<http://www.bom.gov.au/climate/change>)

Cyclone wave damage predictions (www.nature.com/articles/srep26009)

eReefs GBR1 rivers 2.0 model data (http://dapds00.nci.org.au/thredds/catalogs/fx3/catalog.html?dataset=gbr1_2.0_rivers)

Eye on the Reef program data (www.gbrmpa.gov.au/our-work/eye-on-the-reef)

Long-term Monitoring Program survey reports (www.aims.gov.au/docs/research/monitoring/reef/latest-surveys.html)

ReefTemp data (www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml)

Aerial survey methods (<https://www.aims.gov.au/docs/research/monitoring/reef/sops.html>)

About this snapshot

Summer is a critical time for the health of coral. This snapshot provides a summary of conditions on the Great Barrier Reef (the Reef) throughout summer, how these conditions impact coral and actions underway to help coral reefs. The snapshot focuses on coral. The health of other habitats or species are not assessed, although they may be added in future snapshots.

Each year, towards the end of summer, the snapshot is prepared by the three main Australian Government agencies responsible for Reef management and science: the Great Barrier Marine Park Authority (Reef Authority), Australian Institute of Marine Science (AIMS), and CSIRO.

This snapshot is based on the latest information available at the time of writing. It does not take the place of ongoing rigorous reporting by all agencies. It sets the scene for the more comprehensive reports released later in the year, such as the mid-year Long-term Monitoring Program reports by AIMS and reports from the Marine Monitoring Program managed by the Reef Authority.



Summary for 2021-2022

- Above average water temperatures led to a mass coral bleaching event late in the summer. Bleaching was observed over a large spatial area and varied in severity, with some areas being heavily bleached, whilst others showed no signs of bleaching.
- Cyclone Tiffany was the only tropical cyclone that tracked across the Reef. Its potential to cause widespread catastrophic damage to reefs was assessed as low.
- While there was heavy rainfall in some catchments, flood levels in waterways near the Reef were generally not major or sustained.
- Crown-of-thorns starfish remain at outbreak or potential outbreak levels in parts of the northern, central and (particularly) southern regions of the Reef. The Crown-of-thorns Starfish Control Program continues to work in all three regions to cull starfish down to non-outbreak levels.
- Compared to previous summers, cumulative impacts were limited this summer, with one major pressure, a marine heatwave, dominating.

Coral monitoring programs

AIMS has been monitoring the length and breadth of the Reef for more than 35 years.

The [Long-term Monitoring Program](#) is the most comprehensive record of coral reef condition available for the Reef, with a focus on the long-term trends in coral decline and recovery. There are 93 representative reefs that are routinely monitored as part of the program.

A further 32 inshore reefs are monitored as part of the [Marine Monitoring Program](#).

Additional observations are gathered by the multiple organisations and people contributing to the [Eye on the Reef Program](#), including through the Reef Joint Field Management Program.



What has the Reef experienced?

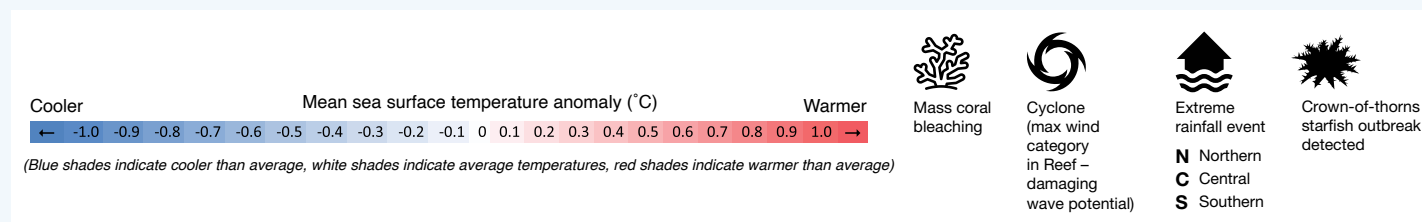
Just like any natural system, the Reef goes through cycles of disturbance and recovery. Given the Reef is very large, disturbances affect it at a range of local and regional scales. This means conditions on the Reef can be variable across different locations.

Reef monitoring before summer showed the Reef was in a 'recovery window' with coral cover increasing across all three regions. However, during summer coral bleaching was observed at multiple reefs across all three regions, confirming a mass bleaching event. This was the fourth bleaching event since 2016 and the first one during a La Niña year, where conditions are typically cooler. It is important to note that bleached corals are alive, but stressed. Low or moderately bleached corals have a higher likelihood of recovering, provided there are minimal impacts in the following years. Severely bleached corals have higher mortality rates. Underwater surveys following this stress event will be critical to understanding the fate of bleached coral.

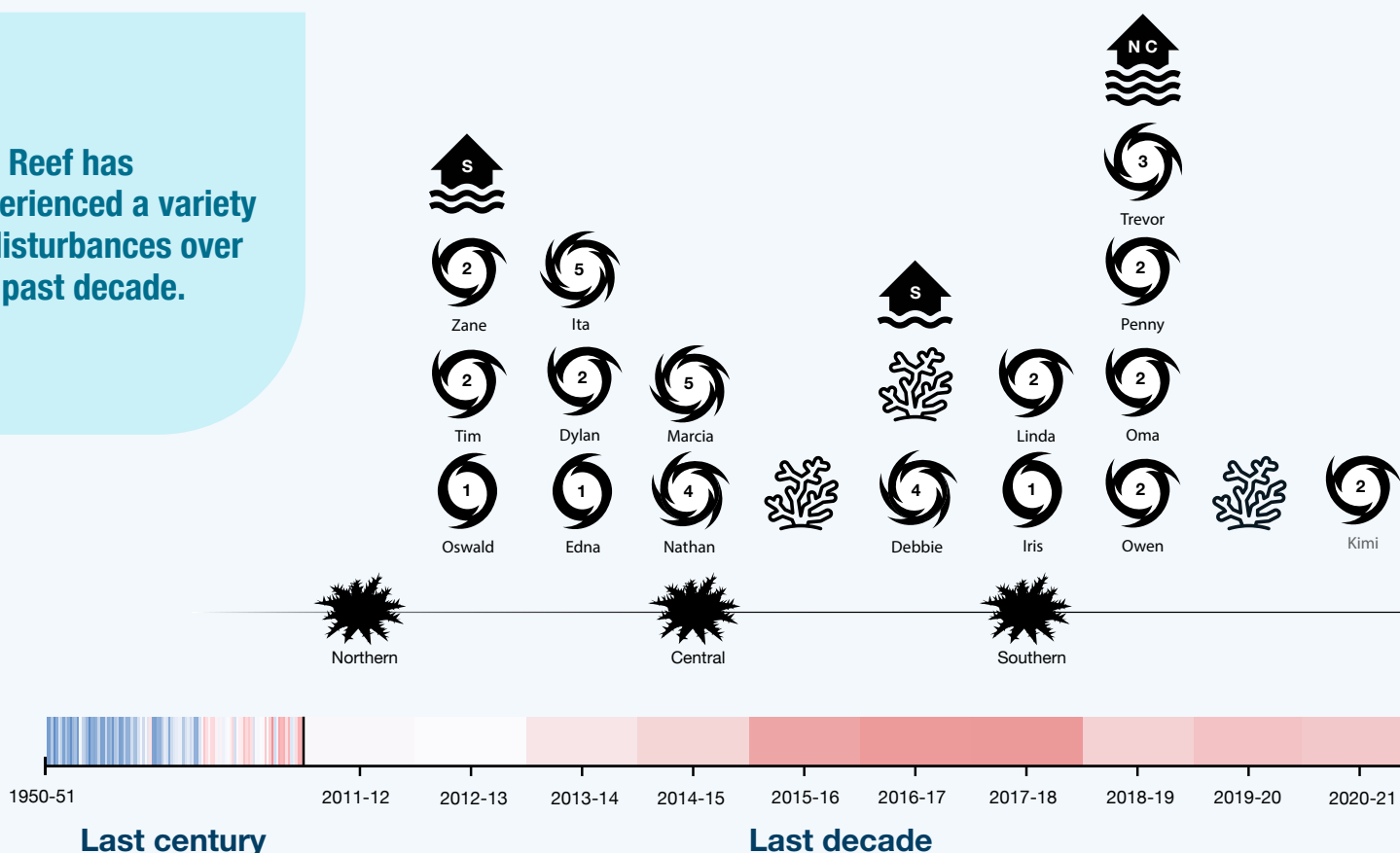
Climate change remains the greatest threat to the Reef. It influences weather patterns and the ocean's temperature, pH level and currents, as well as intensifying the effects of other threats. Climate change is escalating, and the Reef is already experiencing the consequences of this. Unfortunately, the events that cause disturbances on the Reef are becoming more frequent, leaving less time for coral recovery.

Four key stresses on coral reefs

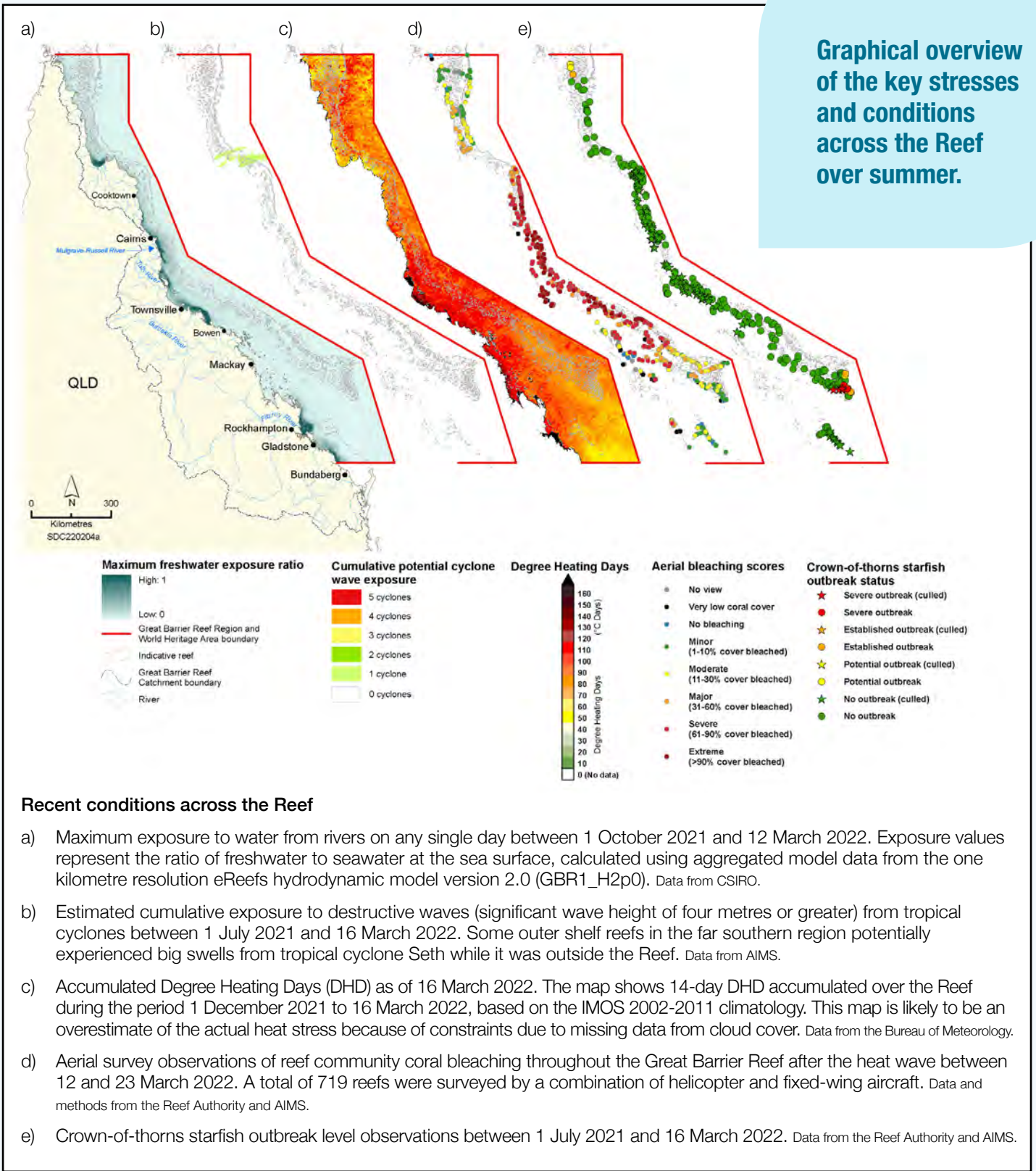
- Above average sea temperatures:** An increase of only one degree Celsius above the average maximum sea temperature for four weeks can trigger coral bleaching and potentially death. The level of bleaching risk is assessed by the number of Degree Heating Days, a measure of the accumulation of heat stress over a period of time.
- Cyclones and storms:** Powerful waves generated during cyclones can seriously damage habitat, particularly coral reefs.
- Flood plumes:** When large volumes of fresh, muddy water flow from the catchment into the ocean after intense or prolonged rainfall, it is called a flood plume. Flood plumes affect water quality, mainly by reducing clarity due to increased sediments and nutrients within the water. This can affect coral health.
- Crown-of-thorns starfish:** Crown-of-thorns starfish are a native coral predator, but when populations reach outbreak status (approximately 15 starfish per hectare), they eat coral tissue faster than corals can grow.



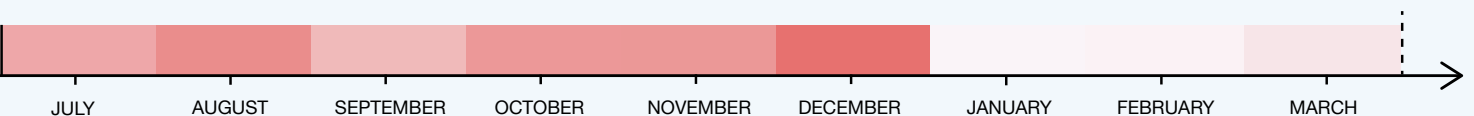
The Reef has experienced a variety of disturbances over the past decade.



Graphical overview of the key stresses and conditions across the Reef over summer.



Ongoing crown-of-thorns starfish outbreak southern region



2021-2022

What does this mean for coral?

Between September and March, routine in-water surveys were conducted on the Reef to help us understand how corals have been faring in different regions during the summer. The Reef's water temperatures warmed unseasonably early in December and continued to accumulate heat late into the summer until the end of March. This prolonged heatwave prompted targeted Reef-wide aerial surveys of coral bleaching in the second half of March. Aerial surveys are an important method to provide a broad assessment of coral bleaching across a large area. The percentage of bleached shallow-water corals (in the top six metres) within the healthy coral community was recorded. In-water surveys, undertaken after the summer heatwave, supplement the aerial surveys and will be important to fully assess the extent of community level bleaching across the Reef. The information below summarises the current coral condition up to the end of March 2022. More comprehensive analyses and summaries will be available later in the year and a timeline of key monitoring reports appears on the back page of this snapshot. References for the information below are on the inside cover.



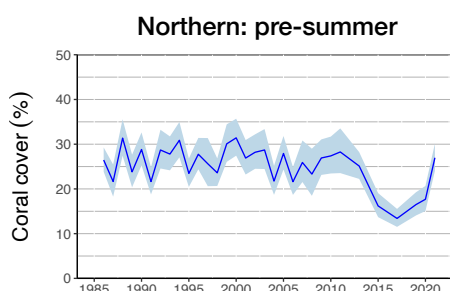
Northern

The northern region includes coral reefs from Cape York down to Cooktown.

In-water surveys (September to October): Overall, hard coral cover within the northern region continued to recover from recent declines caused by mass coral bleaching, cyclones and crown-of-thorns starfish. Hard coral cover increased at most reefs, although a few experienced slight declines since last surveyed. On average, surveys conducted this summer found high levels (30 to 50 per cent) of reef-wide hard coral cover in the Cape Grenville and Princess Charlotte Bay areas. However, within the Cooktown-Lizard Island area, coral cover was only moderate (10 to 30 per cent).

Within the Cape Grenville area, an incipient outbreak of crown-of-thorns starfish was detected at one reef, with potential outbreaks at two other reefs.

Aerial bleaching surveys (March): Many communities were dominated by temperature-tolerant massive *Porites* sp., some of which showed signs of bleaching at the more impacted sites in the southern Princess Charlotte Bay. The pattern of shallow-water coral community bleaching varied from minor (1 to 10 per cent) to severe (60 to 100 per cent). Severity generally increased from the northern tip of Cape York down towards Princess Charlotte Bay. Coral cover and the community composition were important factors influencing bleaching severity throughout this region.



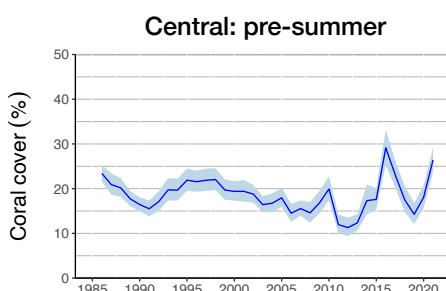
Central

The central region includes reefs from Cooktown, south to the southern Whitsundays. This summer, reefs off Townsville and the Whitsunday areas were sampled. Survey data from Cairns, Innisfail and Cape Upstart areas were not yet available.

In-water surveys (January to March): Overall, both the Townsville and Whitsunday areas had high levels of reef-wide hard coral cover (30 to 50 per cent). All reefs surveyed within the Townsville area increased in coral cover (since last surveyed), as did the majority of reefs surveyed within the Whitsunday area. There was variable bleaching across the central reefs, ranging from no bleaching to severe levels.

Overall, there were low levels of crown-of-thorns starfish within the central region, with starfish recorded at two surveyed reefs within the Whitsunday area.

Aerial bleaching surveys (March): Surveys of inshore, mid and outer-shelf reefs from Lizard Island to Townsville had increasing tabular *Acropora* corals on the shallow reef flats and crests. *Acropora* corals are more sensitive to heat and are therefore more susceptible to bleaching. The pattern of bleaching varied from major (30 to 60 per cent bleached) to severe on the shallow parts of reefs from Cooktown to the Whitsundays. The most severe bleaching occurred on inshore and offshore reefs between Townsville and the Whitsundays.



Southern

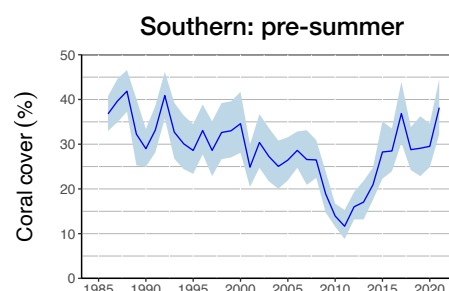
The southern region includes reefs from the southern Whitsundays area down to the Capricorn-Bunker area and out to Swain Reefs.

In-water surveys (December to January): Overall, reef-wide hard coral cover was high within the Pompey area. However, over half the surveyed reefs only had moderate coral cover. Since last surveyed, hard coral cover increased slightly at all reefs, except one. Crown-of-thorns starfish were present at two surveyed reefs, with a potential outbreak occurring at one of them.

Overall, hard coral cover was very high (50 to 75 per cent) in the Capricorn Bunker area, with slight increases at all surveyed reefs (since last visited). Low densities of crown-of-thorns starfish were recorded at one surveyed reef.

The Swain Reefs area had moderate hard coral cover overall, but it had declined since last surveyed. The overall decline reflected decreases at over half the reefs surveyed. Coral cover at the other reefs remained stable, however these reefs have not yet recovered from declines caused by previous crown-of-thorns outbreaks. Starfish were found at almost two-thirds of surveyed reefs.

Aerial bleaching aerial surveys (March): Within the southern region, the pattern of bleaching was highly variable, with shallow-water corals responding differently to heat stress depending on their location. Some areas, particularly around the Capricorn Bunker area, showed no signs of bleaching, whilst major and severe community bleaching was observed offshore of Mackay (southern Whitsundays).



Trend in coral cover for the northern, central and southern regions from 1985 to June 2021. Data from AIMS.

What are we doing to help coral?

Supporting coral reef resilience and recovery is vital. A combination of preventative and restorative actions, as well as ongoing research and management, are needed to protect coral and the species and communities that depend on it. Below are three examples of actions taken to help protect the Reef.

Understanding the Reef

Scientists are diving into the details of the 'how, when and where' of natural reef recovery. The research is part of the Australian Government's Reef Restoration and Adaptation Program and focuses on understanding the details of coral and community changes, identifying what limits natural recovery and adaptation, and how this differs between regions. Each year a team of more than 20 scientists collect fine-scale information from 70 locations on 16 reefs throughout the Reef. Information is collected using a range of tools, including high-resolution 3D mapping, and will help assess the likely success and effectiveness of restoration approaches. Understanding heat stress on corals over a large area is also critical. This summer, the Reef Authority, together the Australian Institute of Marine Science, undertook aerial surveys across 719 reefs to record community-level bleaching. These large-scale monitoring projects are critical to informing management decisions and investigating large-scale restoration solutions (over 100's and 1000's of square kilometres).



Diver with 3D mapping cameras



Before and after stars installation

Trialling restoration techniques

In November 2020, the Reef Joint Field Management Program partnered with industry, tourism and Traditional Owners to undertake a small-scale (200 square metres) restoration project at Green Island Reef. The reef was in poor condition after a series of impacts. Coral fragments, lying loose on the seabed, were collected from nearby healthier reefs and secured onto 'reef-stars' (small metal structures designed to support living coral) and hard substrate using 'coral-clips'. By May 2021, coral cover had increased from 15 per cent to almost 25 per cent at the site and fish species had increased by 25 per cent. By November 2021, coral cover and the number of fish species continued to increase, with biannual monitoring occurring at the site for five years. These types of projects can assist natural recovery processes in small, high-value areas of reef, such as popular tourist sites or areas of high ecological value.

Strengthening Reef management

Management and protection of the Reef is based on strong foundations with a comprehensive Zoning Plan, cutting edge compliance, and strong partnerships. The Reef Authority and partners are enhancing Reef resilience through innovation, management, regulation and in-field programs, such as the Crown-of-thorns Starfish Control Program. Reducing the impact of crown-of-thorns starfish predation is one of the most scalable and feasible direct management interventions to improve the Reef's health and resilience. Innovative technology is being used to maximise control effectiveness, including improving lethal injection technology and planning control efforts. Science, mathematical modelling and remote sensing data, are used to identify and strategically target culling to 'priority reefs'. These reefs support 99 per cent of the Reef tourism activity and are also areas well connected by water currents, with currents dispersing crown-of-thorns starfish and coral larvae between reefs. Targeting 'priority reefs' is thus important to Reef-wide coral recovery.



Snorkeller removing a crown-of-thorns starfish

What can you do?

See the Reef. Love the Reef. Protect the Reef.

The Reef is big, beautiful and diverse and its astounding biodiversity continues to inspire people. Like all reefs around the world, the Reef faces challenges and is under pressure. Actions taken now, big or small, will matter. Regardless of where you live, you can take actions at home and work. Actions include reducing your electricity, recycling, reusing plastics and reducing your emissions when getting around, such as walking or riding instead of driving. These all contribute to a healthy marine environment. We want you to be inspired by the Reef and tell others how they can help, as together, we can all make a difference. We ultimately want everyone to see the Reef, love the Reef and most importantly, protect the Reef.

Visit gbrmpa.gov.au for actions you can take to help love the Reef.

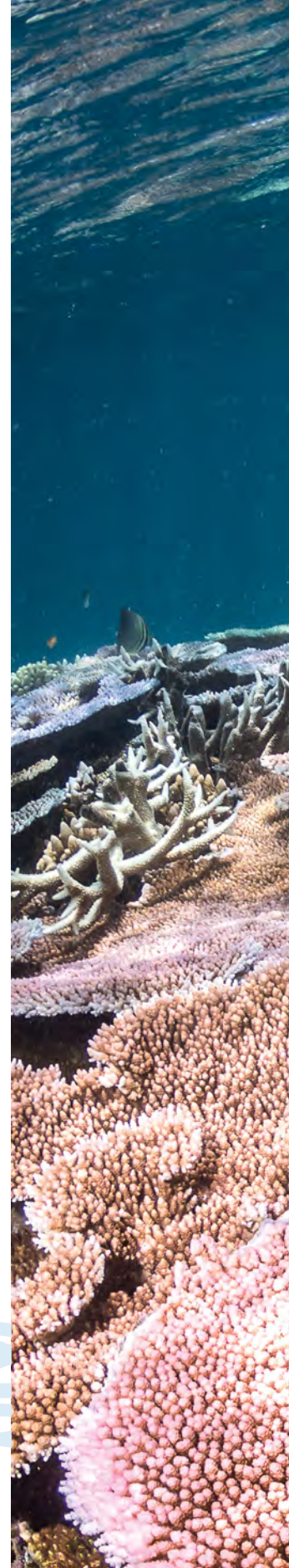
Understand and follow protection rules for the Reef.

Measures like zoning (e.g. access restrictions), permits, no anchoring areas, and extraction limits protect the Reef for the long-term. Before heading out to the Marine Park, ensure you know your zones by using tools such as the free Eye on the Reef app. By taking a little extra care when anchoring, and using moorings where available, you will help protect this delicate underwater landscape.

Reef health monitoring

Each year, data on the health of the Reef's corals are collected, analysed, and shared. The timing of data collection periods, report releases and related workshops is shown below.

Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun
Marine Monitoring Program surveys (inshore reefs)	Long-term Monitoring Program surveys (mainly mid and outer shelf reefs)		Marine Monitoring Program surveys (inshore reefs)
Eye on the Reef (surveys/submissions)			
Long-term Monitoring Program annual summary report (annual)	Pre-summer workshop (annual)		Post-summer Reef snapshot (annual)
Marine Monitoring Program reports (annual)			



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