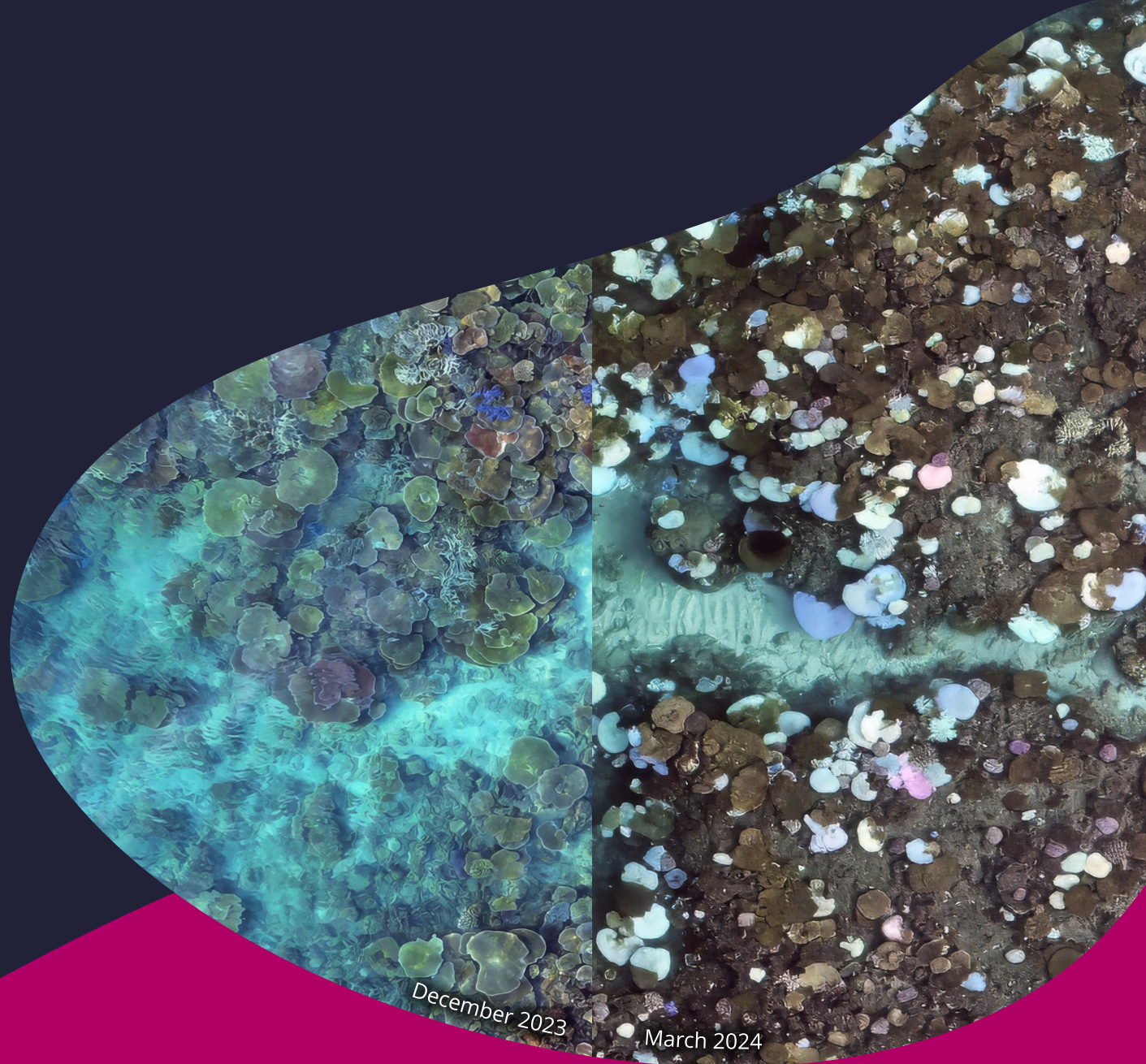


# Reef SNAPSHOT

SUMMER  
2023-24



Australian Government



Reef  
Authority



Australian Government



AUSTRALIAN INSTITUTE  
OF MARINE SCIENCE



# Acknowledgement of Country

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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## Images:

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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](http://www.nature.com/articles/srep26009))

eReefs GBR1 2.0 model river plume data ([https://geonetwork.nci.org.au/geonetwork/srv/eng/catalog.search#/metadata/f9142\\_3105\\_0672\\_4156](https://geonetwork.nci.org.au/geonetwork/srv/eng/catalog.search#/metadata/f9142_3105_0672_4156))

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

Long-Term Monitoring Program survey reports (<https://apps.aims.gov.au/reef-monitoring/sector/list>)

ReefTemp data ([www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml](http://www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml))

CSIRO eReefs Management system ([www.csiro.au/en/research/natural-environment/oceans/eReefs-management-system](http://www.csiro.au/en/research/natural-environment/oceans/eReefs-management-system))

# 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 is not presented.

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 Reef 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.

## Coral monitoring programs



Monitoring the health of the Reef is a joint effort with our monitoring partners.

The **AIMS Long-Term Monitoring Program** (LTMP) monitors coral reef condition focusing on long-term trends in decline and recovery at between 80 and 130 representative reefs annually.

A further 32 inshore reefs are monitored as part of the **Reef Authority's Marine Monitoring Program** (MMP).

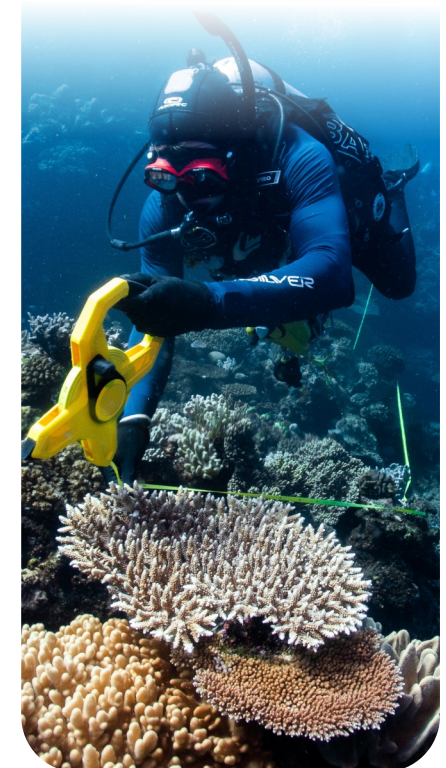
Additional observations are gathered by the multiple organisations and people contributing to the **Eye on the Reef** program, including through the Reef Joint Field Management Program, **Crown-of-thorns starfish Control Program** and by **Traditional Owners** and the **Reef-based tourism industry**.

Learn more about **how we assess coral bleaching events on the Great Barrier Reef** and explore the science used in this report through the **Reef Knowledge System**, the portal for the Reef Integrated Monitoring and Reporting Program (RIMRep).

*Even before the Reef was created, and sea levels rose significantly, the land we see now as the Great Barrier Reef supported our cultural practices, lore and customs. Indigenous culture has evolved to incorporate the Sea Country we see today. Together, we are now working to embed our combined knowledge with the Reef community to protect and sustainably manage the Reef for future generations.*

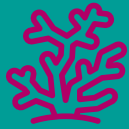
**Troy Johnson**

Indigenous Reef Advisory Committee Chairperson, Wulgurukaba Countryman.



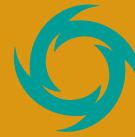
## Summary for 2023-24

At the beginning of the 2023-24 austral summer, the [AIMS LTMP](#) showed regional coral cover levels remained high overall. Increases in coral cover in recent years has been dominated by fast-growing species that are highly vulnerable to disturbances. The recent global pattern of extreme heat, driven by climate change has adversely affected many coral reefs globally, including the Great Barrier Reef.



Prolonged exposure to higher-than-average water temperatures this summer has caused widespread coral bleaching throughout the Reef and subsequently some mortality with the full extent currently under assessment.

Heat stress varies in intensity across different regions, and bleaching is largely consistent with heat exposure. While bleached corals are still alive, they are under considerable stress. Their chances of survival depend on the intensity and duration of heat stress. The extent, prevalence, and potential impacts on bleached corals is currently under evaluation and coral mortality has been observed. For the most current and comprehensive information, please consult the [Reef Authority's Reef Health page](#).



Two cyclones crossed the Reef this summer. In December, Cyclone Jasper crossed the Great Barrier Reef north of Port Douglas as a category 2. Soon after, Cyclone Kirrily crossed the Reef offshore from Townsville as a category 3 in January.

Coral can be damaged or destroyed by the waves generated by cyclones. Damage to reefs due to cyclones depends on the length of time they have been exposed to destructive waves and on the structural vulnerability of the corals present. Based on data collected after the events, both cyclones caused coral damage in the region.



Above average rainfall in the northern and central regions this summer led to multiple rivers reaching minor, moderate or major flood levels. These flows have been sustained throughout the summer, lowering salinity levels and delivering fine sediments in nearshore waters. Low salinity and sedimentation can lead to coral bleaching and coral mortality, particularly for inshore reefs where exposure to flood plumes is greater. Incidents of freshwater bleaching and mortality have been received, although full assessment of coral mortality from flood plumes cannot be assessed until water clarity returns.



A crown-of-thorns starfish outbreak persists in the southern region of the Reef, with localised outbreaks appearing on some reefs in the northern and central regions.

**The Crown-of-thorns Starfish Control Program** targets outbreaking reefs, suppressing starfish numbers to sustainable levels, and protecting coral across thousands of hectares of reef habitat. 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.

# What has the Reef experienced?

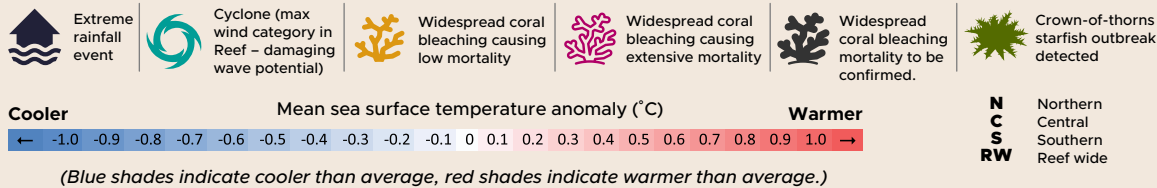
Just like any natural system, the Reef goes through cycles of disturbance and recovery. Given the Reef is very large, disturbances affect it at a range of local and regional scales. This means conditions on the Reef can be variable across different locations.

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. The **World Meteorological Organization** confirmed that 2023 was the hottest year on record, and **NOAA has confirmed a global coral bleaching event is underway**. The Bureau of Meteorology has confirmed this summer as the second hottest for the Reef on record. Compared to previous

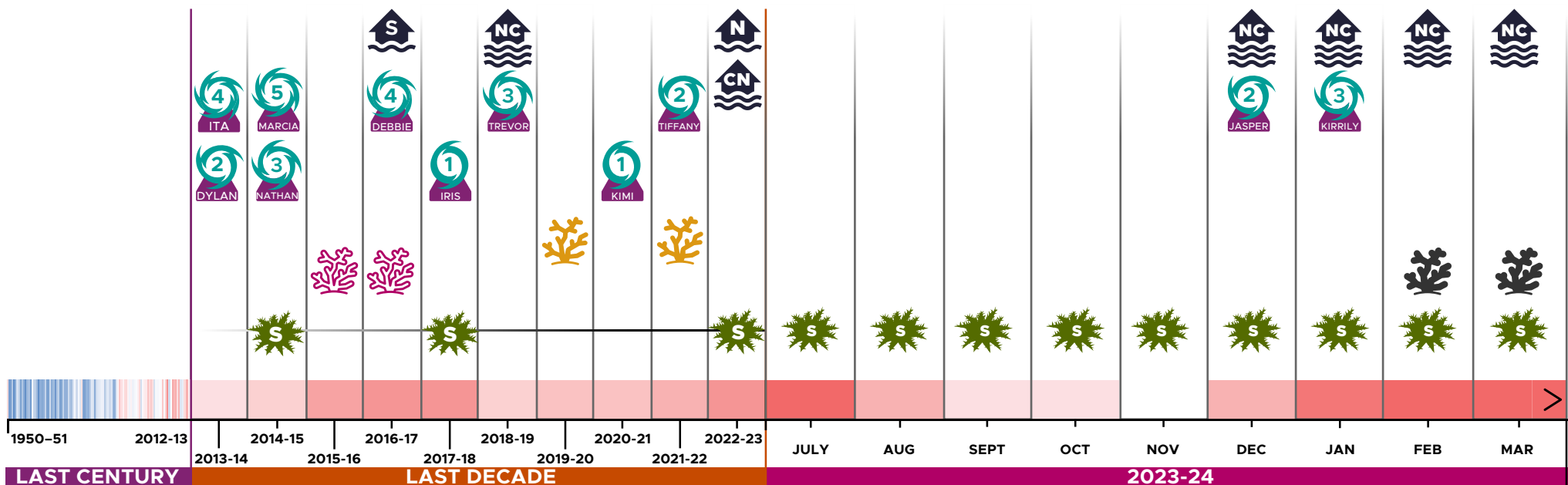
summers, cumulative impacts have been much higher this summer and a widespread bleaching event is still unfolding. Current information can be found on the **Reef Authority's Reef Health page**. Importantly, the Reef has demonstrated its capacity to recover from previous coral bleaching events, severe tropical cyclones, and crown-of-thorns starfish outbreaks if given enough time.

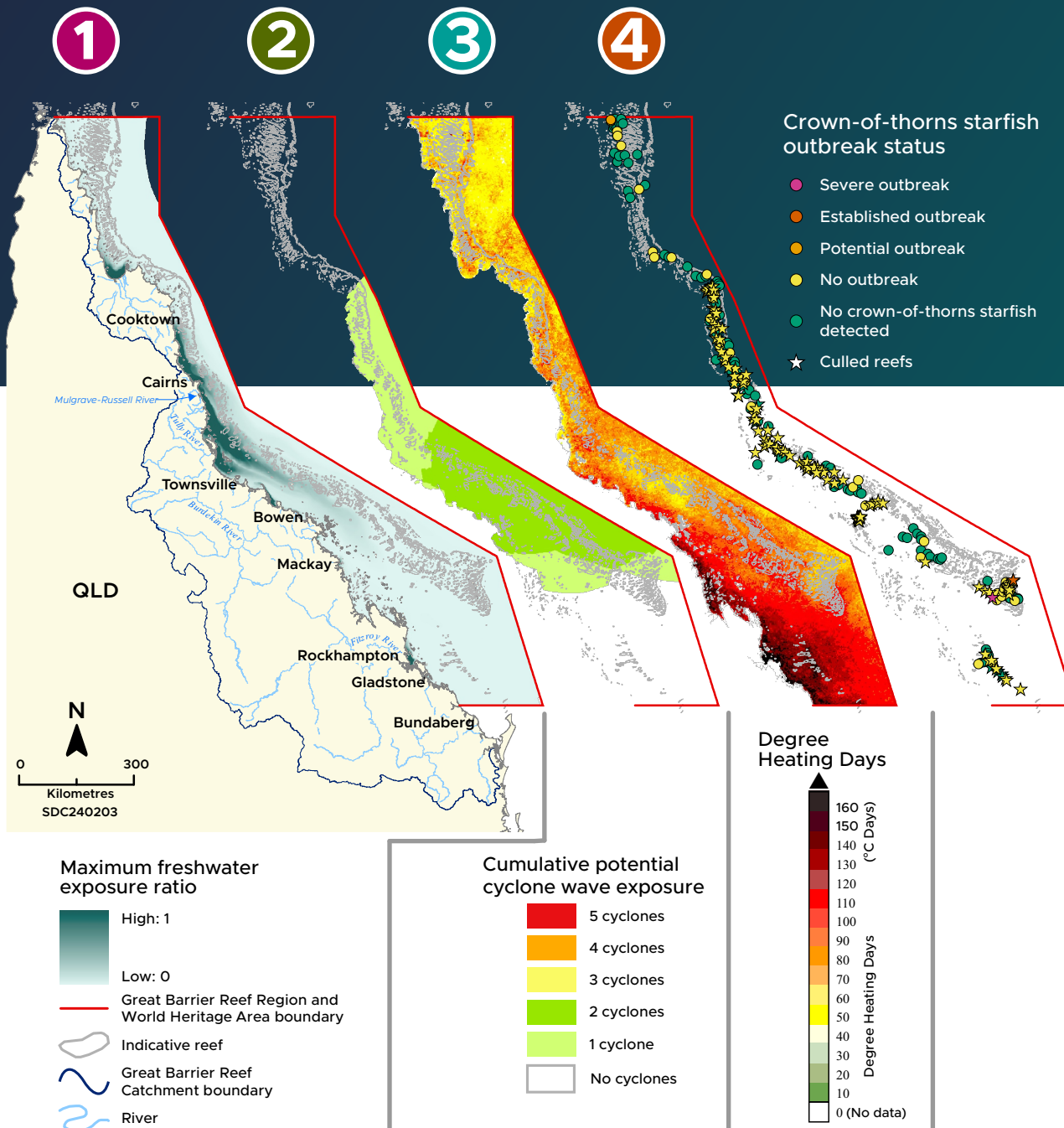
## Timeline key



## Four key stressors on coral reefs:

- Above average sea temperatures
- Cyclones and storms
- Flood plumes
- Crown-of-thorns starfish





## Graphical overview of the key stressors and their variation across the Reef over summer

**1** Maximum exposure to water from rivers on any single day between 1 October 2023 and 18 January 2024 (at which time floods destroyed the Normanby flood gauge). Exposure values represent the ratio of freshwater to seawater at the sea surface, calculated using aggregated model data from the one-kilometre resolution eReefs hydrodynamic model version 2.0 (GBR1\_H2p0). *Data from CSIRO.*

**2** Estimated cumulative exposure to destructive waves (significant wave height of four metres or greater) from tropical cyclones between 1 July 2023 and 16 March 2024 that influenced the Reef. *Data from AIMS.*

**3** Accumulated Degree Heating Days (DHD) as of 16 March 2024. The map shows 14-day DHD accumulated over the Reef during the period 1 December 2023 to 16 March 2024, based on the IMOS 2002-2011 climatology. This map is likely to be an overestimate of the actual heat stress because of constraints due to missing data from cloud cover. *Data from the Bureau of Meteorology.*

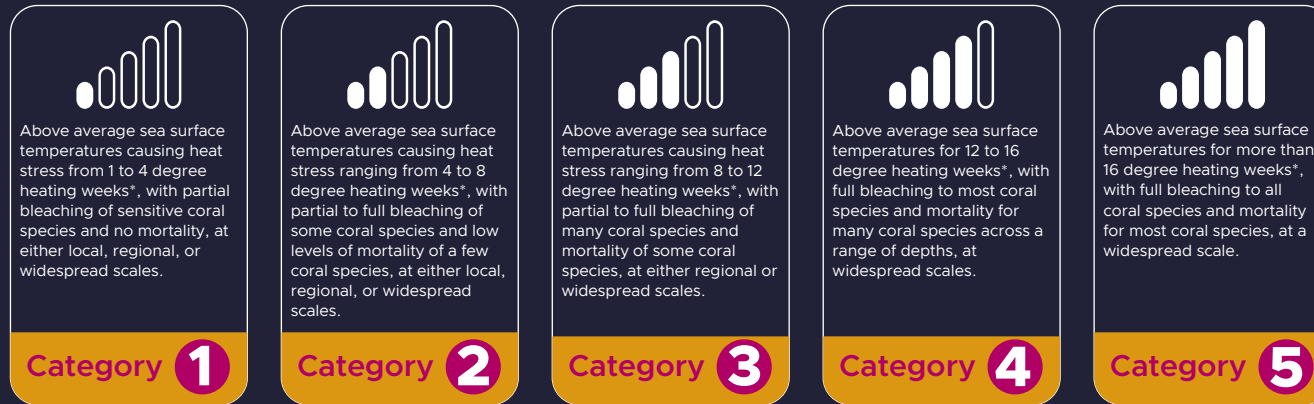
**4** **Crown-of-thorns starfish** outbreak status observations between 1 July 2023 and 16 March 2024. *Data from the Reef Authority and AIMS.*

# A framework for assessing coral bleaching events for the Reef

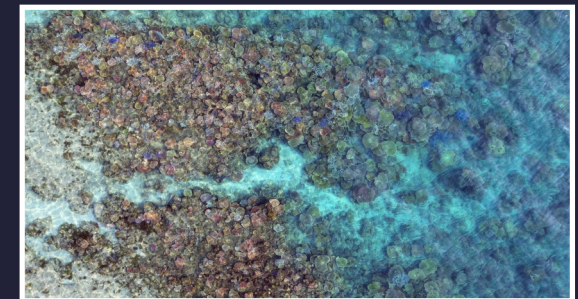
As part of the summer Reef health response, marine managers and scientists from the Reef Authority, Australian Institute of Marine Science, and James Cook University developed a framework to describe and categorise coral bleaching on the Great Barrier Reef.

This framework describes bleaching events in a clear and consistent way — and enables comparisons to be made between years, over time, and across the Reef. An Event Impact Category will be assigned once the full extent of this summer's impacts are fully known.

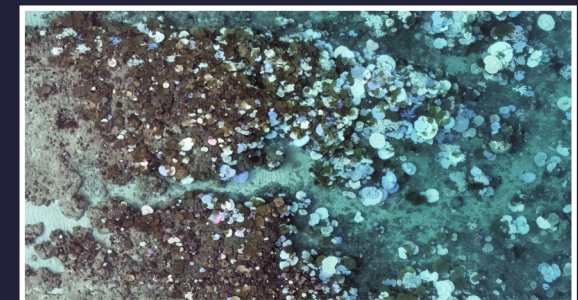
## Great Barrier Reef bleaching event impact categories



## Before and during bleaching event recorded at Eyrie Reef

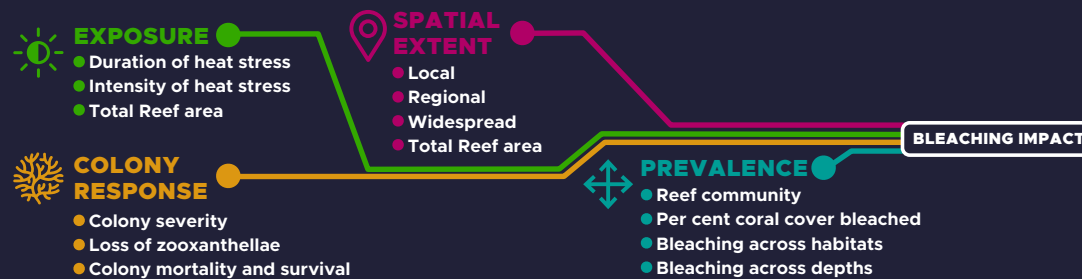


▲ December 2023 - before event



▲ March 2024 - during event

## Four key factors for assessing bleaching impact



\*The NOAA Degree Heating Week product (DHW) is a measurement of thermal stress on coral reefs above the historical summer maximum temperatures. The degree heating week tool includes both the intensity (how hot) and duration (how long) that a reef location is exposed to heat stress i.e. 1°C above the summer maximum over 1 week = 1 degree heating week, while a more intense warming period up to 2°C above the summer maximum over 1 week = 2 degree heating week and would increase the risk of coral bleaching.





# Assessing bleaching above and below water

Ongoing actions

Aerial surveys are a crucial tool for measuring the spatial extent of a bleaching event across this very large marine ecosystem and capture the shallow coral reef community bleaching response to heat stress.

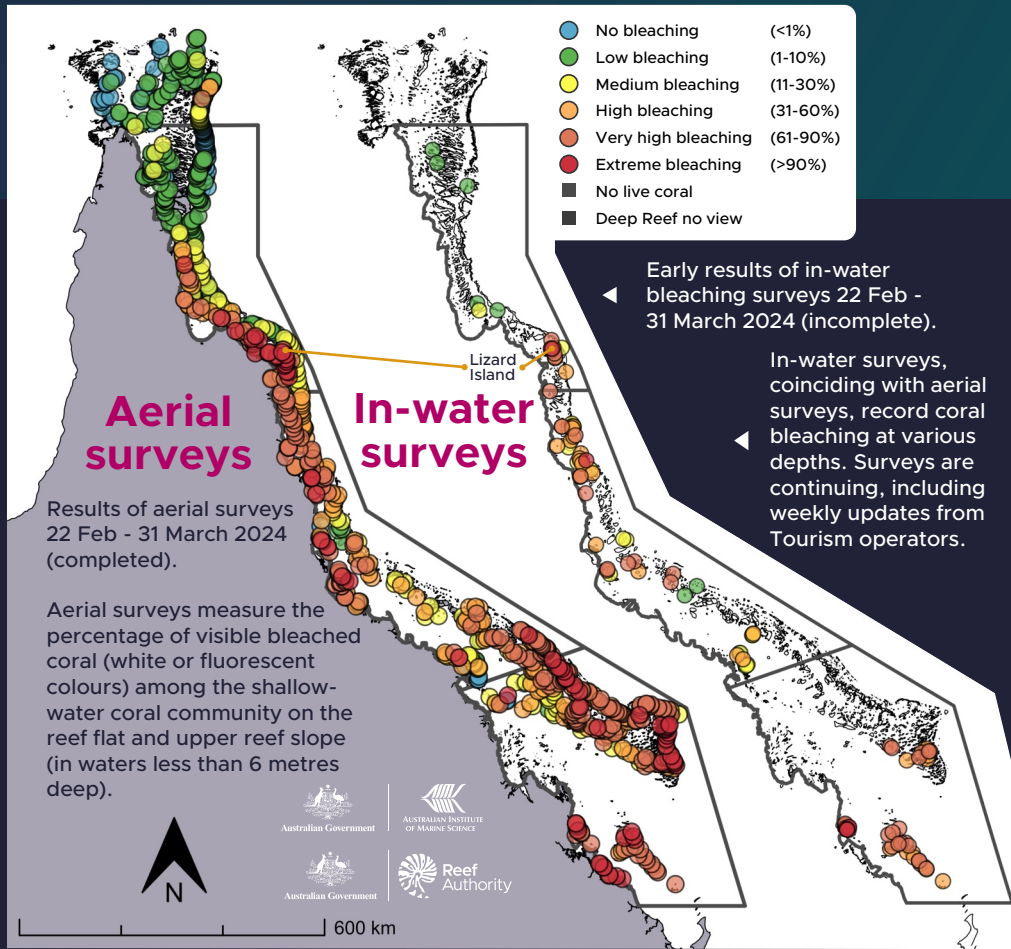
These **aerial surveys** have been completed for 1080 reefs across the entire length of the Reef, including Torres Strait, with prevalent bleaching (>10% coral cover bleached) observed on 6% of surveyed reefs in the Torres

Strait and 73% in the Marine Park. Very high (61-90% coral cover bleached) and extreme bleaching (>90% coral cover bleached) was observed on 39% of surveyed reefs within the Marine Park, occurring in all three regions but to concentrated in most of the southern and parts of the central and northern regions.

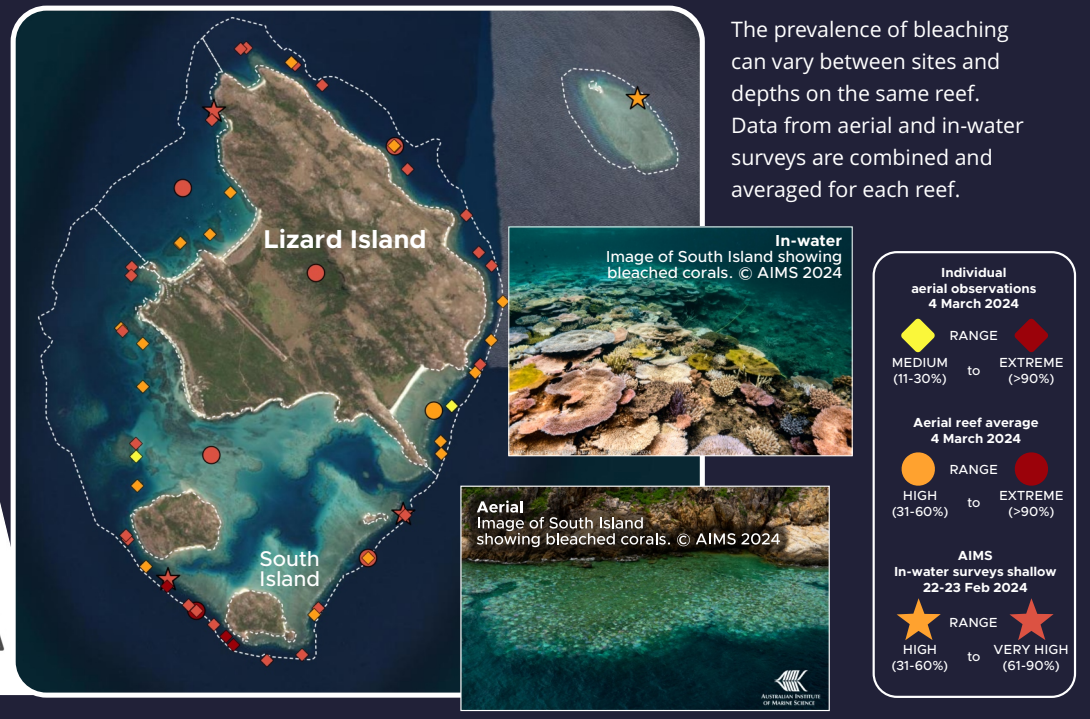
bleaching among different coral types, habitats, and depths. In-water surveys are critical to quantify coral mortality due to bleaching and heat stress over the coming months. These assessments help us understand the overall severity of the impact to the ecosystem.

We now need to combine aerial survey prevalence of bleached reefs with in-water surveys to further assess

[Watch how we conduct aerial and in-water surveys to assess the extent, prevalence, and severity of coral bleaching events on the Great Barrier Reef.](#)



## Combined aerial and in-water survey results for Lizard Island's reefs.



The prevalence of bleaching can vary between sites and depths on the same reef. Data from aerial and in-water surveys are combined and averaged for each reef.





# Assessing colony response and prevalence

Ongoing actions

Scientists from the Reef Authority and AIMS have completed aerial surveys, and are continuing in-water surveys to assess colony response and prevalence.



given their access some of the most isolated areas of the Reef.

This summer, AIMS have completed their largest delivery of targeted bleaching science on the Reef during a mass bleaching event. Around 40 scientists carried out detailed in-water surveys and research across 40 reefs spanning from the Torres Strait in the north, through to the Capricorn Bunker Group in the south. This was in addition to **AIMS' routine long-term monitoring**. Scientists from James Cook University have been engaged to survey remote northern reefs, identified as spatial gaps.

Temperature data from AIMS, Bureau of Meteorology and CSIRO is also analysed to determine the duration, intensity, and total Reef area – or Exposure - affected by the marine heatwave.



This collection of in-water data will be used to assess the severity of coral bleaching against key indicators outlined in the *Bleaching Impact Framework* (see page 7). Once surveys are completed, a Bleaching Event Impact Category will be assigned.

A partnership approach to Reef health and in-water monitoring also allows scientists from all agencies to collect information and further their understanding of coral ecology and rehabilitation research, which helps to inform long-term targeted management actions.



▲ Time series images taken in 2020 off South Molle Island provides an example of the time required for coral to recover from coral bleaching when conditions improve.

In-water surveys complement aerial surveys by providing data on fine-scale impacts of heat stress, such as the severity of coral colony responses, the prevalence of bleaching in different habitats and depths, and any coral mortality at the time.

Reef monitoring is a collective effort. During the critical summer months when the Reef is more vulnerable to disturbances, strong partnerships are vital to ensuring a swift and united response.

To help further understand the impacts of the mass bleaching event currently unfolding across the Reef, Australia's leading Reef management and research agencies and key partners depend on each other to document in real time what they're seeing. **Tourism operators** have conducted 15,450 surveys and taken 65,000 images at 272 high value tourism sites using the **Eye on the Reef system**. Rangers from the Reef Joint Field Management Program, regarded as 'the eyes and ears' on the Reef, as well as divers from the **Crown-of-thorn starfish Control Program**, also use the **Eye on the Reef system** to document impacts,

# Learning from natural disasters

Cyclone Jasper brought plenty of destruction to north Queensland over the summer causing severe flooding, isolation for communities and widespread power outages.

But for a group of CSIRO scientists it also brought the opportunity to build partnerships, view how major cyclones impact water quality and mangroves, and to test new technologies.



▲ The crew on board for the two-week voyage to southeast Cape York. The crew image is in Lizard Island Lagoon.



▲ The team found that some areas of these mangroves have partially recovered while others have not. Pictured is mangrove dieback south of the Starcke River, Juunjuwarra country.

Led by CSIRO, scientists embarked on a two-week sea voyage in southeast Cape York early this year. The voyage was also attended by Cape York Water Partnership (CYWP) along with Indigenous Rangers from the region and international collaborators. Cape York is one of the least studied regions of the Reef and was impacted by unprecedented flooding after Cyclone Jasper.

During the trip, the group observed major erosion of riverbanks combined with sediment deposition in wetlands downstream. Extensive landslides were spotted along the coast and debris continued to be reworked by tides and transported along the coast.

The group compared impacts of a 'wet' storm like Jasper to a 'windy' storm like Cyclone Ita (2014). They surveyed areas

of mangrove dieback that occurred following Cyclone Ita. The team found that some areas of these mangroves have partially recovered while others have not. Identifying the factors that support mangrove recovery is now a focus of long-term collaboration between CSIRO researchers and local collaborators.

The team tested new technologies for autonomous observations. Meanwhile remote sensing and hydrographic survey data were integrated to assess storm impacts and inform future water sampling efforts.

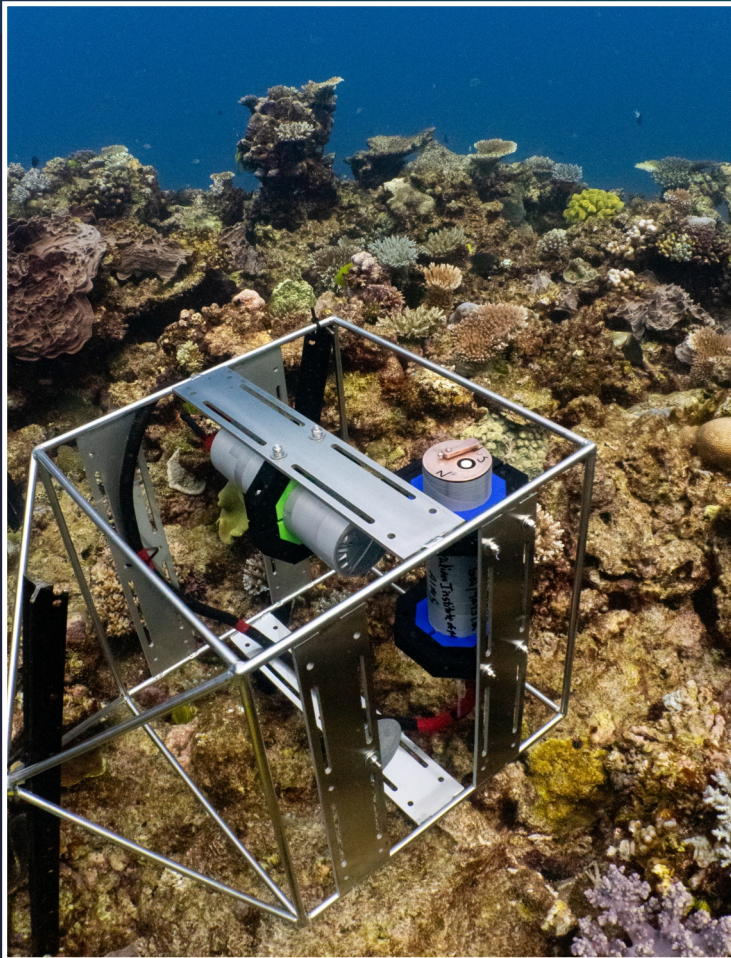
This voyage was part of **eReefs** 'critical observations' work. These type of field activities are planned periodically to ensure that eReefs data and modelling continues to evolve alongside growing threats to Reef resilience and associated management challenges.

# Boosting in-water data with tourism operators

Case study

AIMS scientists and tourism operators, as part of the Tourism Reef Protection Initiative, are working together to learn more about how coral communities respond to summer conditions.

Specialised data loggers have been installed at key tourism reefs in Port Douglas, Cairns and the Whitsundays to collect data on water temperatures and collect new information on how sunlight affects reefs.



▲ Logger positioned for data capture / Rib Reef

Prolonged exposure to elevated sea temperatures can cause corals to bleach, but bright sunlight also plays a role in coral bleaching, especially on calm days.

Unfortunately, measuring sunlight underwater is difficult. The light sensors become covered in algae when left for extended periods, compromising the data.

Now, scientists have extra sets of hands at sea thanks to local tourism operators. Tourism staff visit these reefs regularly and are helping to maintain the loggers through cleaning, operational checks and battery replacements ensuring continual operation and accurate, high-quality data. This teamwork is facilitated through the **Reef Authority's Eye on the Reef Program**.

Tourism staff are also downloading the data regularly to fast-track our understanding of conditions on each reef, which may be influencing what they see during their

weekly Eye on the Reef surveys. Usually, loggers remain at sea for one to two years before being brought back to shore where the data is downloaded.

The addition of light sensors will help scientists better understand the relationship between bright light, temperature stress and coral bleaching, and the future of coral reefs under climate change.

The loggers expand AIMS' existing network of temperature sensors which provides large-scale, long-term information on sea temperatures across the Great Barrier Reef. Scientists and managers also monitor sea temperatures on the Reef using satellite data provided by the Bureau of Meteorology, in-water measurements from **AIMS weather stations**, underwater gliders as part of the Integrated Marine Observing System and ship-borne sensors aboard AIMS research vessels.

# Everyone's role in reef protection

Spanning over 2,300 kilometres, the Great Barrier Reef, a hub of unparalleled biodiversity, urgently requires our protection through reduced carbon emissions, water conservation, and the avoidance of pollutants. This includes ways to reduce your consumption habits by transforming your transport, walk, ride or use an electric vehicle, rein in your power use at home and in the workplace, and reduce food waste. Such collective actions are essential for ensuring the reef's preservation for future generations.

Visit the [Reef Authority](#) for actions you can take to help love the Reef.

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

# For a healthy Great Barrier Reef

## When heading out on the water

- [know your zone](#) (the best places to undertake Reef activities)
- fish sustainably and [know your limits](#)
- [know where to anchor and use public moorings](#)
- record your observations and sightings on the [Eye on the Reef](#) App
- [choose a High Standard Tourism Operator](#).

## Take action

- how to help [Protect the Reef](#)
- contribute your ideas to better look after the Reef and [have your say in how it's managed](#).

# Reef health monitoring and updates

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 are 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 survey report	Pre-summer workshop (annual)		Post summer Reef snapshot (annual)
Marine Monitoring Program reports (annual)			
Reef health updates			
5 Years			
Outlook report			

Information and data for the above is available on the [Reef Knowledge System](#).



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