Australian Government
Great Barrier Reef Marine Park Authority

Reef Authority

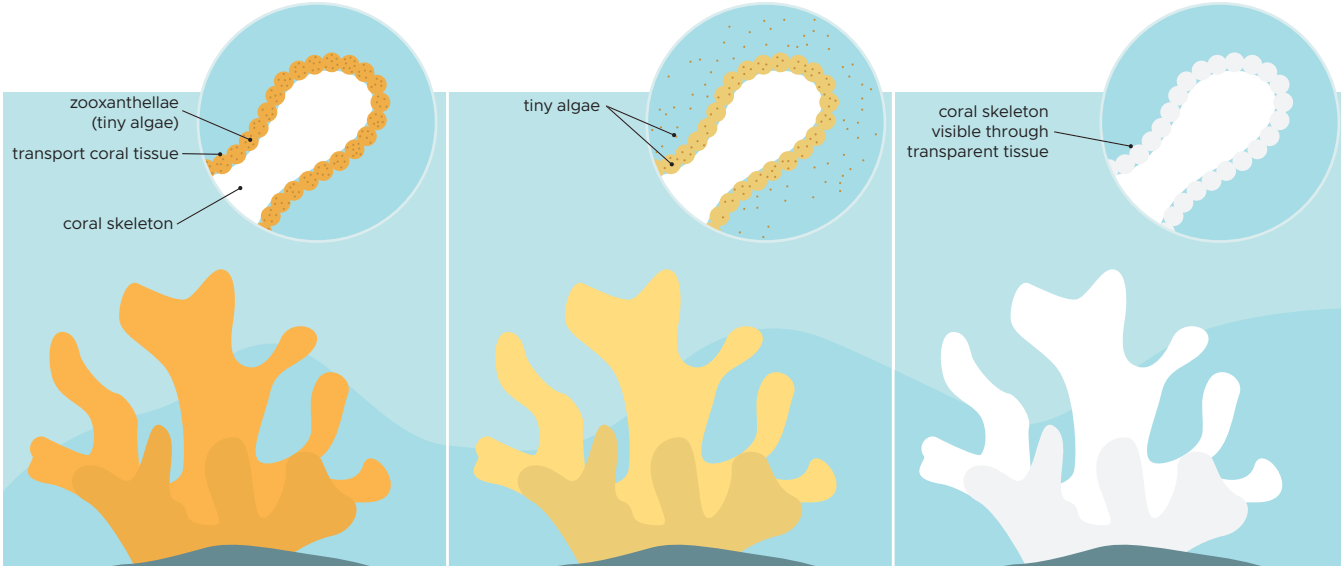
CORAL BLEACHING FACT SHEET

What is coral bleaching?

Bleaching is a sign corals are under stress.

Hard corals are the builders of coral reefs. They are made up of colonies of tiny animals that look like upside-down jellyfish, each cupped in a white, limestone skeleton. Some colonies produce chemicals that act like sunscreen and flourescent light which makes the coral look bright yellow, pink, blue or purple. As well as these colours, most corals have an underlying brown colour because tiny brown algae called zooxanthellae live in their tissue.

Like plants on land, the algae use photosynthesis to convert sunlight into food, and they feed their coral animal host as well. In fact, corals would not be able to build their reef-forming limestone skeletons without this extra food source. Environmental stress can cause corals to expel or lose their algae. The corals lose their brown colour and either look white from their limestone skeleton, or bright yellow, pink, blue or purple from the sunscreen chemicals. These are what we call 'bleached' corals. Fully bleached corals are very stressed, and because the algae provide most of their food, they are also starving.



Tiny algae produce food for healthy corals.

Corals under stress start to lose their algae

Fully bleached corals have lost their algae

What causes coral bleaching?

The most well known cause of coral bleaching is water that is too hot.

Corals can also bleach from water that is too cold, if they get too much chemical pollution, exposure to air, or exposure to water that is less salty than normal — for example, after a lot of rain.

Corals in warm, shallow water are more exposed to sunlight and therefore more at risk of stress and bleaching.

The biggest cause of coral bleaching in the past 20 years has been rising water temperatures.

At the height of an average summer, most corals are operating at their upper temperature limit. If it gets hotter than normal, the corals experience heat stress and the algae's food production system starts to break down. Both temperature and sunlight are key parts of the process.

If the temperature is high enough or lasts for a long time (a marine heatwave), the heat stress accumulates to the point where the coral animal protects itself by expelling its algae.

Why is bleaching so variable?

Lots of factors can lead to big differences regarding when, where and which corals bleach on a reef.

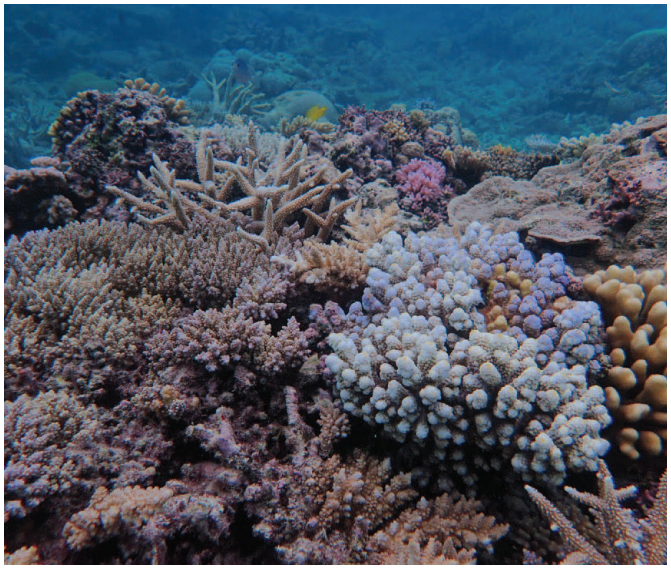
Not all types of coral react the same way to heat stress, some can handle much more than others. Fast-growing branching and plate corals often bleach first and are more likely to die from bleaching. Slower growing boulder corals usually take longer to bleach and have higher survival rates. Corals growing in shallow water are most at risk, where water warms up quickly and they are more exposed to intense sunlight. The complex structure of reefs and currents can also affect the mixing of warm and cool water, so not all corals on the same reef get exposed to the same amount of heat stress.

Do corals die from bleaching?

Corals can recover from bleaching if conditions return to normal.

The algae may slowly repopulate the coral tissue once conditions return to normal. But if the water temperatures are much higher than normal or continue for several weeks, bleached corals can die from stress or starvation. Bleached corals are also prone to disease and other stresses.

Media coverage and reports which only focus on "how much of the Reef has died" are often too simple and can be misleading. There are more than 3000 reefs within the Great Barrier Reef Marine Park and each one is a dynamic system of many coral colonies and other life forms. Even a severely affected reef can recover over time as surviving corals grow and new coral larvae settle on the reef.



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Bleaching can have a cascading effect on other marine life.

How does climate change affect coral bleaching?

Climate change is increasing ocean temperatures.

Increases in carbon dioxide and other gases are producing a greenhouse effect which heats air and water temperatures.

The average sea surface temperature on the Great Barrier Reef has risen by more than 0.8°C since 1880. This might not seem like much, but a vast amount of heat has been absorbed by the world's oceans to produce this change.

Most of the warmest years have been in the past 20 years. Scientists predict global bleaching events will occur every year by 2050 — or earlier — if greenhouse gas emissions are not drastically reduced.

1929: First scientific record of bleaching at Low Isles on the Great Barrier Reef, from air exposure due to extreme low tides.

1980, 1982, 1987: Widespread, but uneven bleaching is observed on the Great Barrier Reef, also reported on some other reefs around the world.

1998: The first recorded major global mass bleaching event. The Great Barrier Reef was also affected, but sea temperatures dropped in time for most corals to recover.

2002: Mass bleaching occurred on the Great Barrier Reef with similar impacts to the 1998 event.

2006: Localised bleaching occurred in the southern section of the Great Barrier Reef.

2014–2017: Period of global mass bleaching, including two consecutive years of mass bleaching to the Great Barrier Reef in 2016 (affecting mainly reefs in the northern section) and 2017 (northern and central sections).

2020: Widespread but variable bleaching occurred across the Great Barrier Reef, this time including southern areas that mostly escaped bleaching in 2016 and 2017.

2022: The first mass bleaching event caused by heat stress during La Niña conditions, which historically produce cooler summer conditions on the Reef, occurred in 2022. Worst affected was the central region of the Reef, where the most heat stress occurred.

How does the Reef Authority identify a mass bleaching event?

We work with international, national and local partners to forecast and assess bleaching events.

Most of the conditions that cause coral bleaching occur at relatively local scales. Only marine heatwaves cause a mass coral bleaching event where many reefs experience severe bleaching over a widespread area.

We work closely with the Australian Bureau of Meteorology and the National Oceanic and Atmospheric Administration in the United States of America to forecast weather conditions using satellite technology.

The Australian Institute of Marine Science (AIMS) deploy in-water temperature loggers to provide updates on actual sea surface temperatures throughout the Marine Park.

Long-term coral monitoring by AIMS provides important information about local reef health and conditions.

Marine Park rangers, Traditional Owners, marine tourism staff, fishers, researchers and recreational visitors also report on conditions at reef sites through the Eye on the Reef program, which includes the free Eye on the Reef app.

If there is mass coral bleaching, we work with researchers, marine park rangers and other partners to conduct aerial and in-water surveys to assess the extent and impacts of the bleaching.

Researchers and rangers assess the extent of bleaching.

How long do reefs take to recover?

Reefs usually re-establish in 10 to 15 years — but they need minimal disturbance.

Reefs can recover over time as surviving corals grow and nearby corals spawn, producing larvae which settle locally or drift in currents to new areas.

Repeated bleaching events or other impacts like cyclones narrow the window for corals to recover. Scientists have reported that the loss of adult corals on some reefs during the 2016 and 2017 bleaching events affected coral larval production on these reefs. This is thought to have led to the decrease in new corals seen in 2018.

How is the Reef Authority responding?

Our focus is to protect the Reef and its resilience so it copes better and recovers faster from disturbances.

On-water management

The Australian and Queensland governments' Reef Joint Field Management Program has expanded to increase on-water management and compliance, with a special focus on reef and island restoration activities.

Reducing anchor damage

The Reef Joint Field Management Program has installed 309 public moorings to reduce anchor damage at popular sites. Reef protection markers have also been placed around sensitive fringing reefs to restrict anchoring on coral.

Ramping up crown-of-thorns starfish control

Efforts to control outbreaks of the coral-eating crown-of-thorns starfish have been increased.

Reef restoration and adaptation

We are working with Australia's leading researchers to investigate ways to help the Reef resist, repair and recover from coral bleaching. Options include increasing the rates that corals settle and grow, and assisting corals to adapt faster to a warming climate.

Capturing knowledge and data

We are developing a cutting-edge knowledge and data system to monitor dynamic reef systems and strengthen management decisions.

Climate change is the greatest threat to the Great Barrier Reef. Only the strongest and fastest possible actions to decrease global greenhouse gas emissions will reduce the risks and limit the impacts of climate change on the Reef.

What can you do to help corals recover?

All actions — big or small — are vital to build the resilience of the Great Barrier Reef.

The first step is to reduce your greenhouse gas emissions:

- ✓ adjust your air conditioning to 25°C
- ✓ support renewable energy
- ✓ drive less or carpool
- ✓ reduce, reuse, recycle
- ✓ choose energy efficient appliances and light bulbs
- ✓ swap single-use plastics for sustainable products
- ✓ print less
- ✓ use less water, grow your own veggies and start a worm farm
- ✓ consider fitting your boat with a trolling motor with anchor lock to reduce the need to anchor

The second step is to help protect your special patch of the Reef:

- ✓ download the free Eye on the Reef app and report any sightings of coral bleaching
- ✓ avoid taking herbivorous fish when spear fishing – they keep algae in check and create places for new corals to grow
- ✓ use public moorings and don't anchor on coral
- ✓ volunteer for beach and waterway clean-ups
- ✓ be Reef smart and follow the responsible Reef practices on our website – such as observing good snorkel practices and accessing islands at high tide to minimise coral damage
- ✓ know the zoning rules, follow them, and report suspected illegal activity to 1800 380 048.

Visit our website
www.gbrmpa.gov.au
for updates about Reef health.

Information source: Great Barrier Reef Outlook Report 2019