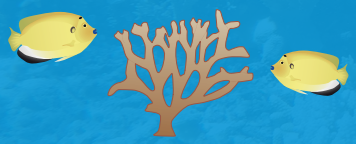
The Great Barrier Reef

AUSTRALIA'S JEWEL



2,900 REEFS - 2,300 KM
WORLD'S LARGEST REEF

CORALWATCH

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

What makes the Great Barrier Reef so special?

Containing the largest collection of coral reefs in the world, the Great Barrier Reef (GBR) is a vibrant and colourful ecosystem stretching 2,300km along the Queensland coastline. The second largest barrier reef is in Belize and it stretches only 290km. The GBR is made up of more than 2,900 individual reefs, 900 islands, 450 species of hard corals, over 1,625 species of fish and 30 species of mammal. Similar in size to Italy or Japan, it is so big it can be seen from space! The GBR was inscribed in 1981 as a World Heritage site for its cultural and natural significance and is the only site to meet all four natural significance criteria. The GBR is a beautiful and fascinating destination.

Why do we need to protect the GBR?

Reefs provide habitats and shelter for many marine organisms and these are the source of nitrogen and other nutrients essential for marine food chains. One-quarter of all marine species live in or around a reef. Healthy reefs produce food for millions of people and help to protect coastal land from cyclones and storm surges. Reefs support local economies, providing employment in tourism and fishing industries. The GBR is the number one reason visitors come to Australia on holiday. Coral reefs and marine animals are a source of new medicines being developed to treat cancer, arthritis, Alzheimer's disease, viruses and other illnesses. Reefs need our protection as one of earth's natural wonders.

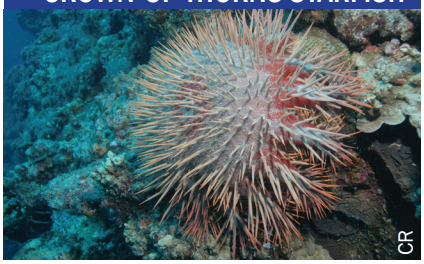
What are the main threats to the GBR?

Coral reefs globally are in decline and this includes Australia's Great Barrier Reef. Scientists have shown that the future of coral reef ecosystems are in danger from both local and global threats. On the GBR the main threats are:

STORMS AND FLOODS

Tropical cyclones can cause extensive damage to corals and the structure of the reef. Floodwaters running off the land and into the Great Barrier Reef lagoon can form reduced-salinity plumes laden with nutrients, sediments and agricultural chemicals such as fertilisers and pesticides, all of which can cause coral reef ecosystems to become stressed or die. Storms and floods are increasing with climate change.

CROWN-OF-THORNS STARFISH



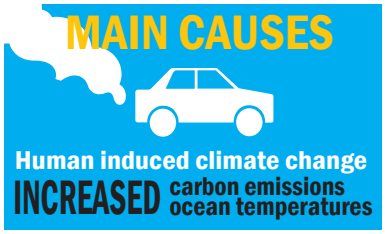
Crown-of-thorns starfish (COTS are marine invertebrates that feed on coral and occur naturally on reefs. COT outbreaks occur when phytoplankton, the COTS larvae food source, becomes more abundant. The abundance is driven by run-off and over-fertilisation of the land. It is estimated that one starfish can eat up to 10m^2 of coral per year, with reefs taking 10-20 years to recover. Single COTS may produce 50 million eggs a year.

CORAL BLEACHING

In healthy coral, symbiotic algae (zooxanthellae) live within the coral tissue, providing the coral with food and energy and give the corals colour. Stressful environmental conditions including climate change and warming of the ocean, can cause the coral to expel the algae, changing the coral colour to white. This whitening of coral is called 'coral bleaching'. Once this occurs, corals may die if the stressful condition persists.

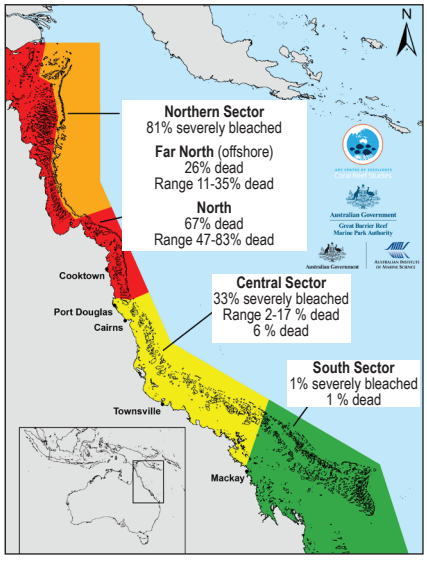
Mass coral bleaching and the future of the GBR

In Australia, major bleaching events first occurred on the GBR in 1998 and 2002 after which many reefs seemed to recover relatively well. The more recent bleaching events in 2016 and 2017 were far more widespread and more devastating, reducing coral cover over the whole reef by 50% in just two years. Reports indicate that 81% of surveyed reefs in the northern sector and 33% of reefs in the central sector of the GBR were severely bleached. Fortunately, reefs in the southern sector escaped severe bleaching (1%) and, while not pristine, are in good condition. Corals have the ability to recover, are naturally resilient, and reef recovery is underway on the GBR. This will take time, decades in fact to reach the levels of coral present just two years ago and such resilience has its limits. Critically, further bleaching events, if they happen will continue to degrade reef systems around the world. Without rapid action to prevent further climate change in the short time window we have left to act, reefs will bleach again. The reef needs your help now, not later. Don't be confused by misinformation; become informed and make your vote count.

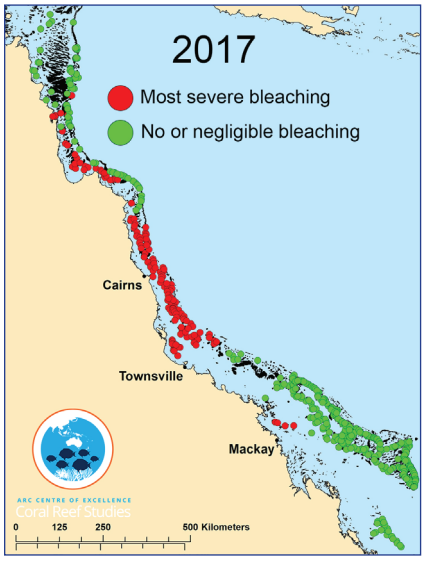


What would happen if coral reefs vanished completely?

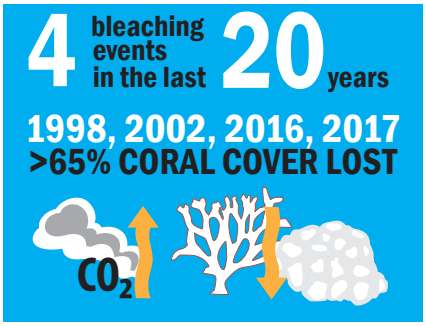
Animals that rely on coral for protection, habitat, breeding and food would become extinct. The main source of protein for over 500 million people would be lost. The fishing industry, employing 38 million people worldwide, would collapse. Nations that depend on the beauty of coral reefs for tourism such as Australia would lose income. Overall the disruption to the food chain and biodiversity of the oceans would have unknown but severe knock-on effects.

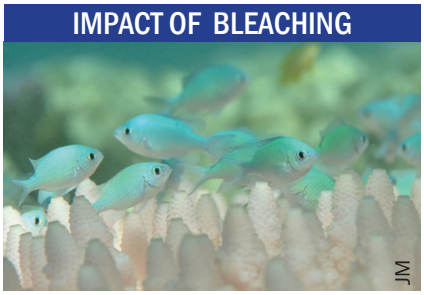


Amended map of coral bleaching in April 2016 and mortality monitored in November 2016. Source: ARC Centre for Excellence for Coral Reef Studies.



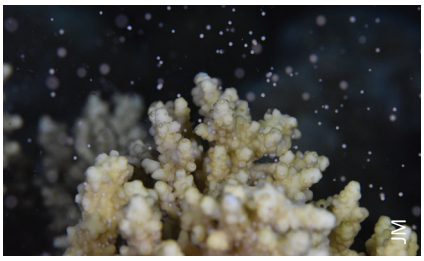
Map of the GBR showing the main areas of coral bleaching in 2017. Source: ARC Centre for Excellence for Coral Reef Studies.





Fish are losing their habitat

The turquoise-blue chromis damselfish form huge clouds or schools over coral heads, and use coral branches for shelter when predators come along. Branching corals that provide the best hiding places for fish, often bleach first and are disappearing. So are the fish.



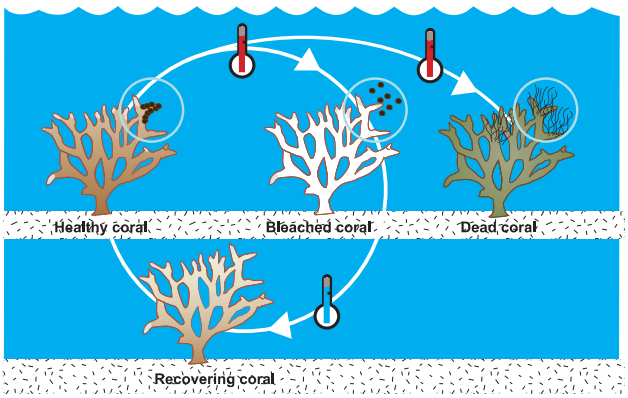
Less baby corals

When corals bleach, they have lower growth rates, lower reproduction, less resistance to disease and are less able to cope with other stressors, e.g. water quality, more bleaching, storms and COTs.

Changing coral communities

Corals do not all bleach in the same way. There are differences within and between species, genera and growth forms. Zooxanthellae populations differ in their heat tolerance. Branching corals tend to bleach first while boulder corals seem more resistant.

THE BLEACHING PROCESS

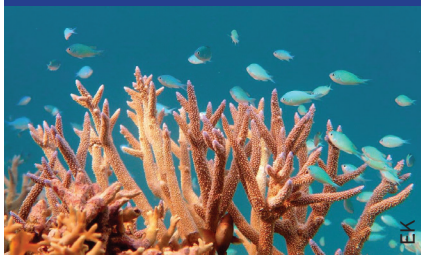


Corals can recover

The primary factor determining whether a coral survives a bleaching event or not is the amount of time that it is exposed to elevated temperatures under high light conditions. The longer the coral is exposed, the greater the chances of mortality. Corals can recover quickly from bleaching events once the sources of stress are removed. In some cases, corals can regain their colour within days. However, each bleaching event weakens the overall health of the coral over time.

Legend: Increasing temperature; Decreasing temperature; Zooxanthallea; Algae

BEFORE BLEACHING



Before bleaching, most corals appear brown or green like those colours you can find on the CoralWatch Coral Health Chart. These colours come from the symbiotic algae (zooxanthellae) that live in the coral polyp. The coral provides a safe home for the algae and in return the algae provide the coral with food and energy and give the corals their characteristic colours.

DURING BLEACHING

During bleaching, the symbiotic algae are expelled. Polyps are transparent and we see only the white calcified skeleton beneath. At this stage the coral is still alive but very sick. Close-up you can still see the coral tissue. Sometimes polyps can be brightly coloured or even appear fluorescent. These colours are pigments present in the coral polyps.

AFTER BLEACHING

Coral that have been stressed may recover slowly by reacquiring its symbiotic friends. If the algae does not return, corals run out of energy normally provided by the symbiotic algae and die. Turf algae then take over and cover the once healthy coral. Soft corals become slimy, dissolve and completely disappear when they bleach, due to the lack of a skeleton.

Other reasons for corals to appear white

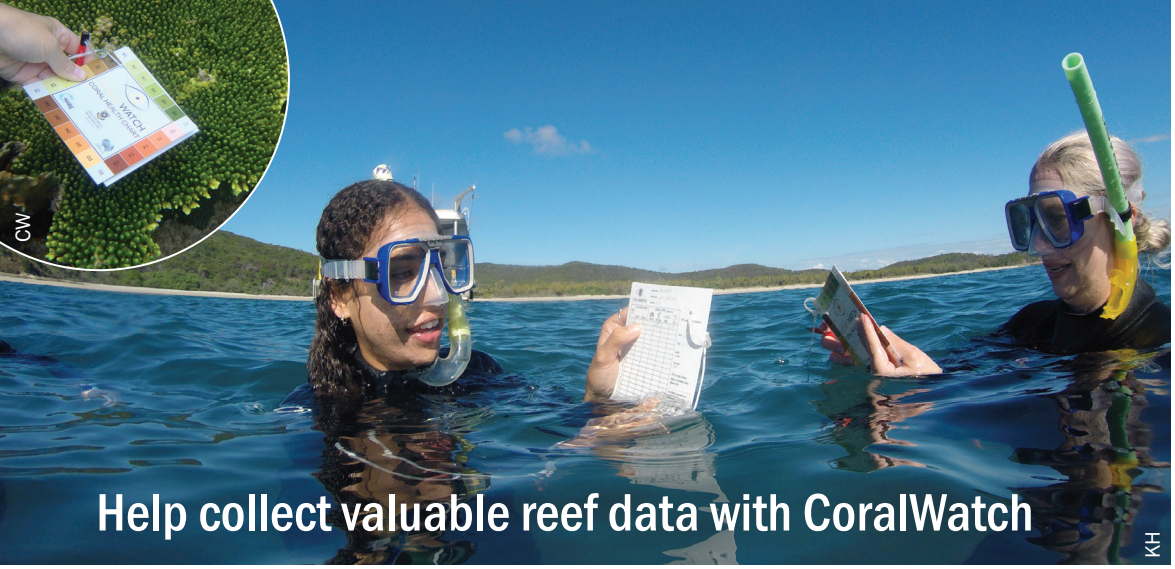
Mass coral bleaching is directly related to global warming and an increase in sea temperature. There are other reasons for corals to become stressed and expel the zooxanthellae or turn white.

These include:

- Changes in salinity – this can occur after heavy rainfall during a cyclone;
- Increased sedimentation – due to coastal runoff;
- Disease or infection;
- Ocean acidification – caused by elevated CO_2 levels;
- Pollutants – especially those commonly found in sunscreens;
- Extreme low tides;
- Ecological changes caused by overfishing and boat traffic; and
- Reduced water temperatures.

Nemo's home is impacted too

Anemones, close relatives of corals, are also prone to bleaching. This affects clown fish in two ways. One is the loss of their habitat as clown fish protect themselves from predators by sheltering among the anemone's stinging tentacles. Secondly, the fertility of clown fish is reduced as they lay their eggs at the base of the anemone. If anemones die due to bleaching then so will Nemo!



Help collect valuable reef data with CoralWatch

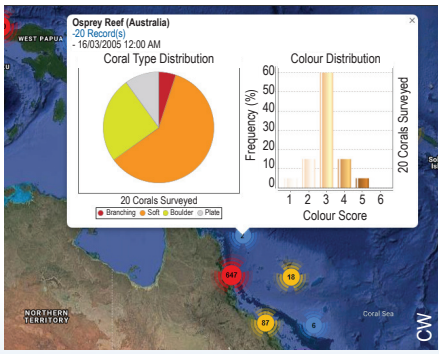
CoralWatch uses the Coral Health Chart to measure changes in coral colour associated with coral bleaching. The chart is easy to use and allows anyone to get involved in the project without the need for special training. Simply match the colours on the chart with the colours of the reef and record your coral type on a waterproof data slate. To upload your data, you can use the CoralWatch Data entry App and contribute to our global coral bleaching database. Get started today by ordering your Coral Health Chart and downloading a 'Do It Yourself Kit' at **www.coralwatch.org**

Why the reefs needs your help

There are not enough scientists to monitor all the world's reefs, all of the time. This is why we need your help! By participating in volunteer monitoring programs, citizen scientists, just like you, can help gather important data that scientists otherwise do not have access to. Your data will help answer questions about patterns and severity of coral bleaching and how corals and reefs recover after bleaching. You will also have the opportunity to improve the evidence used to make decisions about how our reefs are managed. All CoralWatch data is publicly available and our data has been published in over 150 scientific papers. Visit the world map online and search to find out more about your local reefs.

Interpreting data

Some corals are naturally lighter than others. Regular surveys are needed to look at health over time or pick up trends of bleaching and recovery. Coral colour is just one indicator of coral health. Other indicators could be percentage coral cover, species diversity and richness, and the amount of macroalgae.



The piechart on the left shows the percentages of coral types that have been surveyed. The bar graph explains the distribution of colour scores. A healthy reef has a majority of scores of 3 and more.

SAVING REEFS STARTS FROM HOME - WHAT ACTION COULD YOU TAKE?

Reducing the impact of climate change on reefs starts from home. The easiest way to save money and minimise your impact on the planet is to reduce and think carefully about what you buy. By buying less, you'll spend less money and use fewer resources which decrease negative impacts associated with pollution and landfills on the health of oceans and reefs.

There are many things you can do, check out the CoralWatch factsheet to save $$ and the reef.

FOOD WASTE
Think before you buy
Save up to $3800 yr

ENERGY
Change electricity to solar
Save up to $760 yr

CLOTHES
Buy fewer and revive to reduce landfill
Save at least $2000 yr

CW

Photos: Karen Hofman (KH), Emma Kennedy (EK), Justin Marshall (JM), Chris Roelfsema (CR) & CoralWatch (CW).
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CORALWATCH

GLOBAL DATABASE STATISTICS FROM 2002 - JULY 2019

6,962 members
FROM 133 COUNTRIES

2,130reefs
IN 78 COUNTRIES

12,562 surveys

260,920 corals

Media and outreach

4,877 3,448 1,086

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