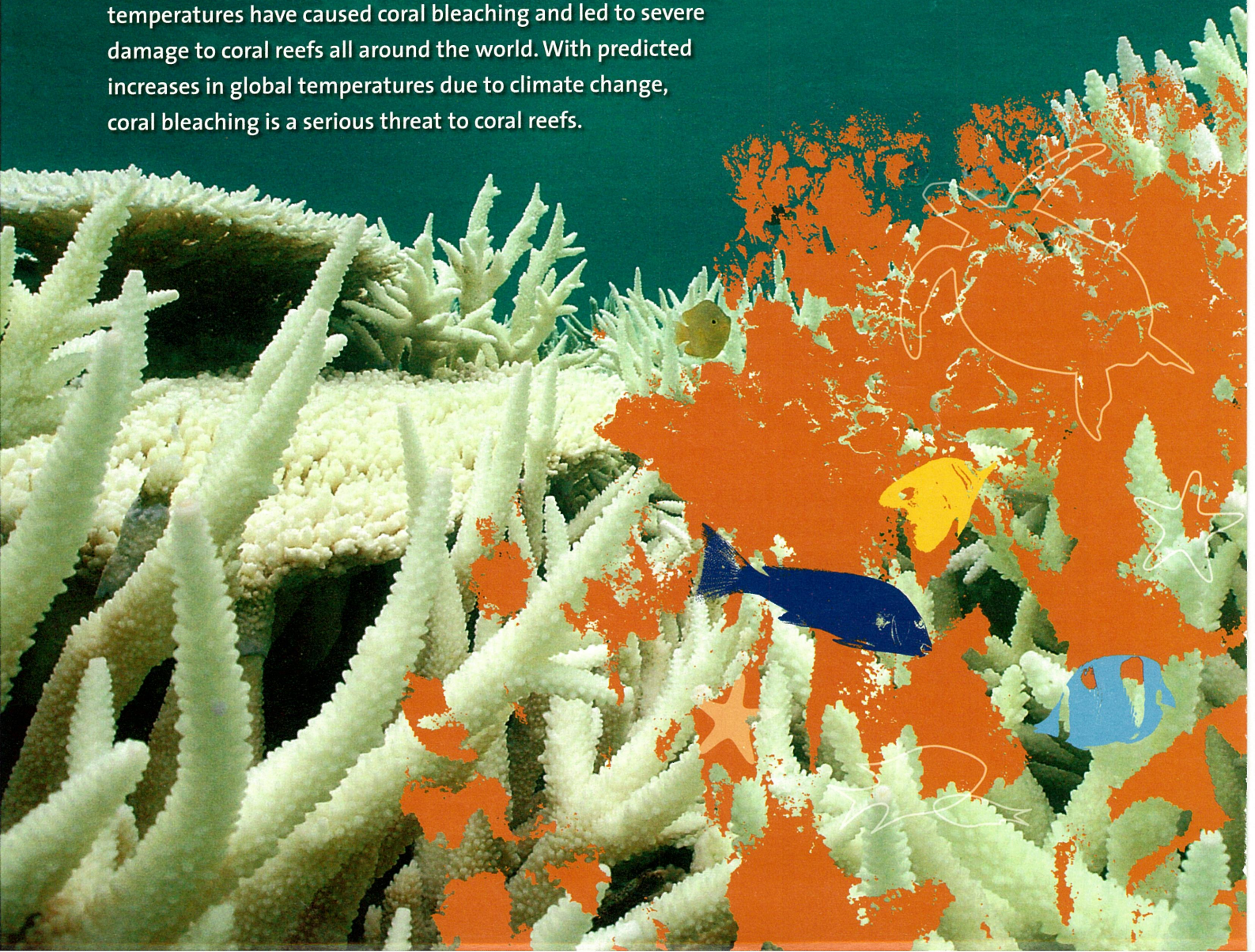
Australian Government
Great Barrier Reef
Marine Park Authority

Coral Bleaching
and the
Great Barrier Reef

Coral bleaching occurs when stressful conditions cause the corals to expel their zooxanthellae (algae that live in the tissue of corals). This makes their tissue mostly transparent revealing the coral's bright white skeleton. Unusually high sea temperatures have caused coral bleaching and led to severe damage to coral reefs all around the world. With predicted increases in global temperatures due to climate change, coral bleaching is a serious threat to coral reefs.



Coral bleaching is a stress response

Corals bleach when zooxanthellae are expelled from the tissue. Usually the tissue is transparent and the coral appears bright white.

Corals get up to 90 per cent of their energy supply from the zooxanthellae that live within their tissues in a symbiotic relationship (a beneficial interaction between the coral and zooxanthellae). Stressful conditions cause the relationship to break down and the corals expel their zooxanthellae. Because zooxanthellae are the major source of colour for most corals, the coral's white skeleton then becomes visible through their tissue.

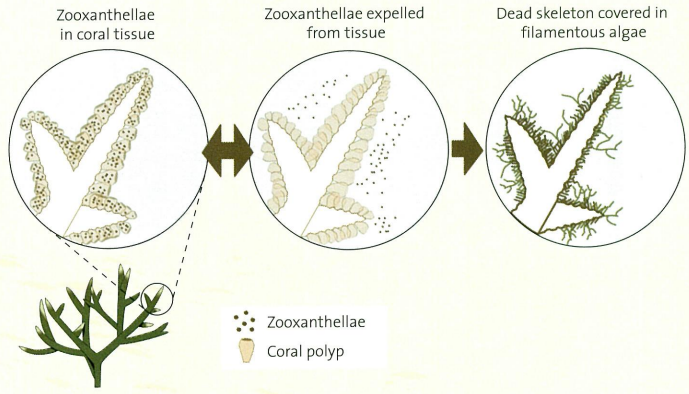
Bleached corals begin to starve once they bleach. While some corals are able to feed themselves by capturing plankton and edible particles from the water, most corals struggle to survive without their zooxanthellae. If stressful conditions subside, corals can regain their zooxanthellae, return to normal colouration and survive. Even then, however, these corals are likely to suffer decreased growth and reproduction, and increased susceptibility to disease.

Corals are made up of many coral polyps that contain symbiotic zooxanthellae in their tissue as seen by the small dots in this coral polyp.

High temperatures cause bleaching

A range of stresses, including disease, sedimentation, pollutants and changes in salinity can induce coral bleaching. However, it is unusually high water temperatures that trigger the mass coral bleaching events that can extend over tens to hundreds (or even thousands) of kilometres. Water temperatures need only increase 1.5–2°C above the normal summer maximum for 6–8 weeks for bleaching to occur. The large scale and potentially devastating effects of mass bleaching events make rising sea temperatures a major issue for the future of coral reefs.

Unusually warm temperatures reduce the ability of the zooxanthellae to cope with normal light levels. As a result, photosynthesis breaks down and the zooxanthellae produce harmful chemicals, called free radicals, rather than the sugars that give corals most of their energy. The coral expels the zooxanthellae to avoid being damaged by these chemicals.



Coral polyps usually contain zooxanthellae in their tissue (left) but when bleaching occurs the zooxanthellae are expelled (centre). If the corals cannot recover, then the corals die, allowing small seaweeds and other algae to grow on their skeletons (right).

Some bleach more easily than others

Not all corals are equally susceptible to bleaching. Fast-growing branching and plate corals are often the first to bleach, and are more likely to die from bleaching. Slower growing massive or boulder corals usually take longer to bleach, and tend to be able to survive for longer in the bleached state. The mix of coral types that inhabit a particular reef site influences how much damage results from a bleaching event.

High susceptibility — Low susceptibility

Recovery can take decades

Bleached corals will die if the temperature stress is extreme or if it persists for about eight weeks. When corals die, new corals (called recruits) must settle and grow on the reef in order for the reef to recover. Recovery of severely damaged reefs can take a long time, even on relatively healthy reefs. Importantly, the corals that repopulate a damaged reef may be significantly different from what existed before bleaching. For example, the reef may become dominated by species that are more resistant to bleaching, resulting in a decrease in coral biodiversity.

Recovery will be slowed if there are other stresses, such as poor water quality, overfishing or disease. Where reefs are already stressed, recovery can take many decades, or even centuries. A healthy, resilient reef, however, will recover more quickly from bleaching. This makes effective management of coral reefs more important than ever before.

Approximately 5 per cent of reefs were seriously damaged during the 1998 and 2002 mass bleaching events. During 2006, there was less mortality across the entire Great Barrier Reef — approximately 3 per cent — and it was confined to the southern region.

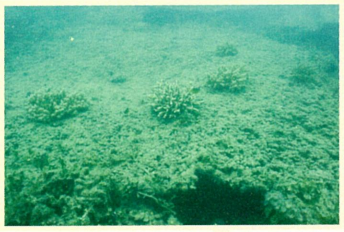
Bleaching has affected the Great Barrier Reef

The Great Barrier Reef has been affected by mass bleaching events. Widespread bleaching occurred in 1998 and again in 2002. In both of these years, bleaching was recorded on 50–60 per cent of reefs. Fortunately, most corals survived these events, however, approximately 5 per cent of reefs were seriously damaged in each year.

More recently in the summer of 2006, reefs in the southern part of the Great Barrier Reef were affected be bleaching. Unusually high sea temperatures around inshore reefs caused 40 per cent of corals to die at these reefs. Across the entire Great Barrier Reef, however, there was less mortality in 2006 than in 1998 or 2002.

From this state it can take years to decades to recover to a healthy reef.

Bleached corals are still alive and can quickly recover if they are not stressed.



If the corals die, the corals can either start to recover straight away or the reef structure will erode becoming coral rubble and algae.

They will die if the stress continues and algae start to grow over their surface.

Mass bleaching has affected reefs worldwide

Mass bleaching has now affected every reef region in the world. A particularly severe, worldwide bleaching event occurred in 1998, effectively destroying 16 per cent of the world's reefs. Some areas lost 50-90 per cent of their coral in this single event.

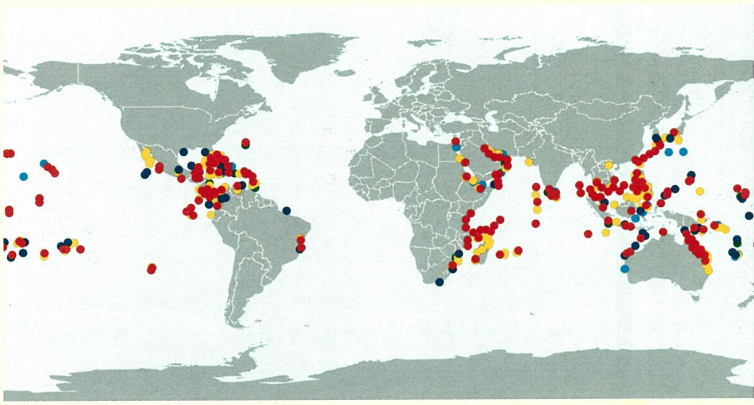
The extent and severity of coral bleaching events have been increasing throughout the world over the last few decades. Projected increases in global temperatures under climate change scenarios suggest that this trend will continue over coming decades, placing greater stress on reefs globally. This also has significant implications for the millions of people who depend on reefs for food, income and protection from ocean waves.

We are working to protect the reef

The Great Barrier Reef Marine Park Authority (GBRMPA) is recognised as a world leader in managing reefs affected by coral bleaching. In conjunction with leading experts and BleachWatch volunteers, the GBRMPA closely monitors sea temperature and coral bleaching each summer. Initiatives such as the Reef Water Quality Protection Plan and the new Marine Park Zoning, are important steps toward increasing the resilience of the Reef to coral bleaching. The GBRMPA has also recently published a book 'A Reef Manager's Guide to Coral Bleaching' about what reef managers can do about coral bleaching.

The GBRMPA closely monitors coral bleaching each summer using SCUBA diving surveys. This diver is photographing bleached corals that have fluorescent tissue instead of transparent tissue that usually makes bleached corals appear white.

Coral bleaching has become common all around the world. Every region has now experienced some bleaching.



You can help

Everyone can help make a difference to the health of the Great Barrier Reef.

The first step is to minimise your contribution to climate change by **reducing your greenhouse gas emissions.** See **www.greenhouse.gov.au** for details on how you or your business can improve energy efficiency.

Secondly, ***help to ensure that the Great Barrier Reef is healthy.*** This makes it easier for the Reef to recover from bleaching. Visit **www.gbrmpa.gov.au**, phone (07) 4750 0700 or email info@gbrmpa.gov.au for more information on how to look after the Reef.

BleachWatch
observe to conserve

Finally, ***join BleachWatch and let us know if you see bleaching***. BleachWatch is a volunteer network of people who regularly visit the Reef and report on its health. This information is used to help guide protection of the Reef.

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