

information bulletin

Information initiated under the Climate Change Action Plan

An Early Warning System for coral bleaching on the Great Barrier Reef

Summary

Each summer, as sea temperatures rise, the Great Barrier Reef Marine Park Authority (GBRMPA) implements the Early Warning System component of its Coral Bleaching Response Plan (Figure 1). The objectives under this Plan include determining the risk of a bleaching event occurring, and detecting the first signs of bleaching. Under the Early Warning System, seasonal climate forecasts are used to assess bleaching risk up to several months in advance. As the summer progresses, near real-time sea-temperature information is used to monitor the evolving bleaching risk. The onset of any bleaching on the Great Barrier Reef is reported by the Reef-wide BleachWatch network of trained observers. Reports of severe or extensive bleaching are verified by experienced GBRMPA and Queensland Parks and Wildlife Service (QPWS) staff. These reports trigger a coordinated management response under the Climate Change Incident Response Framework (CCIRF).

Background

Mass coral bleaching occurs when higher-than-normal sea temperatures push corals outside their thermal tolerance limits. The Great Barrier Reef has experienced several mass coral bleaching events, the most severe of which occurred in 1998 and 2002. Severe localised thermal bleaching also occurred in the southern Great Barrier Reef in 2006. Future mass bleaching is inevitable under a warming climate. The GBRMPA uses the Early Warning System to support efforts to monitor, assess and respond to the impacts of coral bleaching.

Seasonal climate

forecasts: early indicators of bleaching risk

Evaluating the likelihood of severe bleaching is essential for effective planning and management. Throughout the Australian summer, the GBRMPA uses forecasting tools to assess the risk of coral bleaching on the Great Barrier Reef over the coming weeks and months. Bleaching

predictions depend on the close link between widespread coral bleaching and elevated sea-surface temperature. Seasonal sea temperature forecasts provided by the Bureau of Meteorology (BoM) are used to assess the likelihood of a widespread bleaching event occurring. The forecast maps (Figure 2) generated by the Predictive Ocean Atmosphere Model for Australia (POAMA) show the likely temperature difference from the long-term monthly average (known as a temperature anomaly). Comparing forecast temperature anomalies with known bleaching thresholds helps reef managers predict and prepare for a bleaching event well in advance.

ReefTemp and weather stations: monitoring the evolving bleaching risk

As summer progresses, sea temperatures are monitored in near real-time to detect the development of any excessive and persistent sea temperature anomalies that are likely to result in a coral bleaching event.

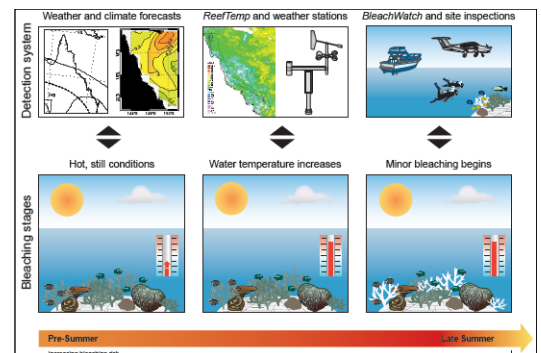


Figure 1: Timeline for detection of the early signs of coral bleaching under the Early Warning System.

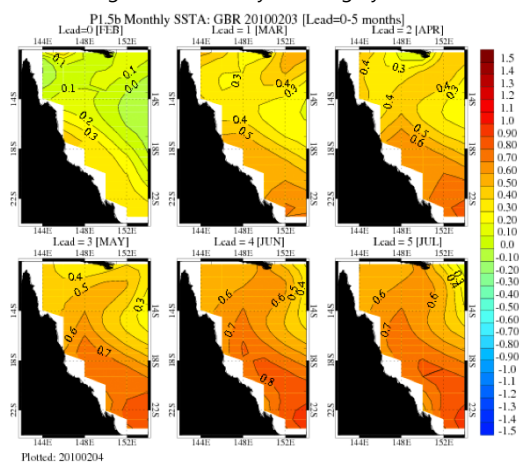


Figure 2: POAMA generates temperature-anomaly forecasts for the Reef up to six months in advance. The predicted forecast scenarios exclude the influence of any potential cooling monsoonal conditions.

Project name: Early Warning System: coral bleaching on the GBR
Project number: Various
Outcome: B1.4
Year: 2007–ongoing

Sea temperature data collected by environmental monitoring satellites is collated by the *ReefTemp* project. *ReefTemp* maps temperature anomalies and other measures of temperature stress known to be strongly correlated with past bleaching impacts (Figure 3).

At the scale of individual reefs, the risk of sea temperatures increasing to levels that are stressful to corals depends not only on broad-scale temperature anomalies, but also on a complex interaction of local weather patterns. For example, regional water temperature, local air temperature, cloud cover, wind, rainfall and fine-scale ocean circulation patterns may all increase or decrease the risk of coral bleaching. The various *ReefTemp* stress measures are available at a sufficiently fine scale (1km resolution) to capture this local variability. Current in-water conditions are also monitored closely using a system of remote weather stations maintained by the Australian Institute of Marine Science (AIMS).

BleachWatch: detecting early signs of bleaching

Detecting the early signs of a mass bleaching event requires a wide network of observers on the Great Barrier Reef. This is due to the large size of the Reef and because the initial onset of mass coral bleaching can range from gradual and patchy to rapid and uniform. Regular reports on coral reef health are provided by QPWS staff and the *BleachWatch* network.

BleachWatch is a community-based coral reef health monitoring network that has been designed to provide reliable reports of Reef conditions throughout the summer. Participants fill in reef health survey forms whilst out on the Reef and submit these to the GBRMPA on a regular basis. Established by the GBRMPA in 2002, *BleachWatch* is built on a network of regular reef users, including tourism professionals, environmental groups, researchers, fishers



Figure 3: If widespread bleaching eventuates, detailed surveys are carried out to map the extent of damage and subsequent recovery.

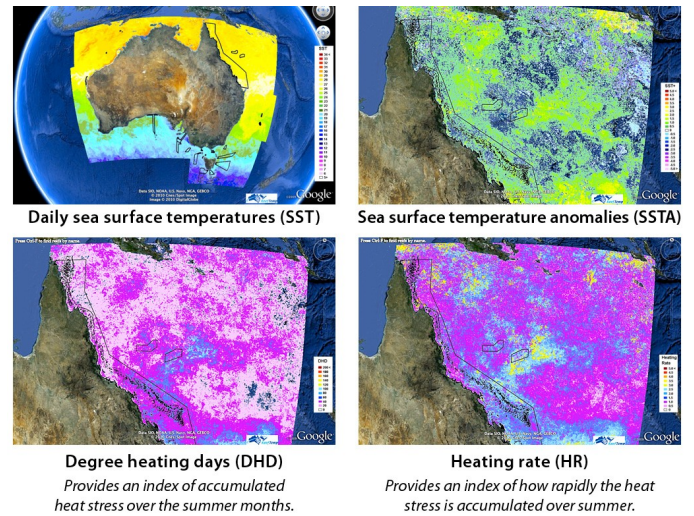


Figure 3: A series of screenshots showing the four *ReefTemp* thermal stress indices (SST, SST anomaly, degree heating days, and heating rate), available as Keyhole Markup Language (KML) layers in Google Earth.

and other recreational users. The volunteer network spans the length of the Great Barrier Reef.

While many of these volunteers spend a large amount of time on the water and know their patch of the Reef well, they do not necessarily have any formal training in marine biology. To bridge this knowledge gap and ensure accurate reports, *BleachWatch* offers training workshops and provides resource kits.

Responding to a coral bleaching incident

If severe or extensive bleaching is reported, the GBRMPA implements a series of assessment and monitoring activities to verify the impact and then measure the extent and severity. In the first instance, *BleachWatch* volunteers in the relevant area may be contacted to determine the nature of the impact. Following this, dedicated assessment teams of GBRMPA and QPWS staff may be deployed to the site. The Climate Change Incident Response Framework (CCIRF) provides a structure to coordinate the governance, finance, planning and reporting procedures required to implement an effective response to a coral bleaching event. Follow-up management actions can support the resilience of affected coral reefs and promote recovery after bleaching disturbance.

For further information contact the:
Climate Change Group
Great Barrier Reef Marine Park Authority
PO Box 1379, Townsville Qld 4810
07 4750 0759
www.gbrmpa.gov.au