

Project 3.3.1 Quantifying the linkages between water quality and the thermal tolerance of GBR coral reefs

Project Summary

This project will deliver two outcomes: (i) an understanding of how water quality (WQ) exposure affects the ability of corals to resist and recover from bleaching, (ii) a modelling framework to quantify the impact of management options that would mitigate the effects of warming on reefs exposed to WQ pressures. Using targeted experiments in SeaSim and field data from 2016 and 2017, this project will examine which WQ parameters (nutrients/light/turbidity) affect corals' thermal tolerance, and assess how temperature and WQ exposure histories affected coral bleaching and recovery from natural bleaching events. The project will refine the eReefs model to derive WQ management scenarios expected to maximise coral survival in a warming climate.

Problem

Coral bleaching and mortality will likely become more frequent in the future, unless corals become more tolerant to thermal stress. The negative effects of individual water quality agents on coral bleaching are increasingly appreciated but there is a lack of understanding of the main agents of WQ that affect bleaching susceptibility and the capacity to recover. It is not yet clear if, and at what level, WQ improvement would enhance thermal tolerance and coral recovery following a major heat stress event.

How Research Addresses Problem

The research will quantify the links between water quality and bleaching thresholds, to be used for further developing critical thresholds for reef health indicators, early warning tools under the Reef Health Incident Response System, and refining of water quality targets. The experimental work on bleaching and recovery will focus on corals that are long-term acclimatised to different WQ regimes in two catchments (Wet Tropics and Burdekin) and will deliver the knowledge required to better forecast bleaching risk.



Fluorescent blue and white bleached corals on the Great Barrier Reef in April 2016

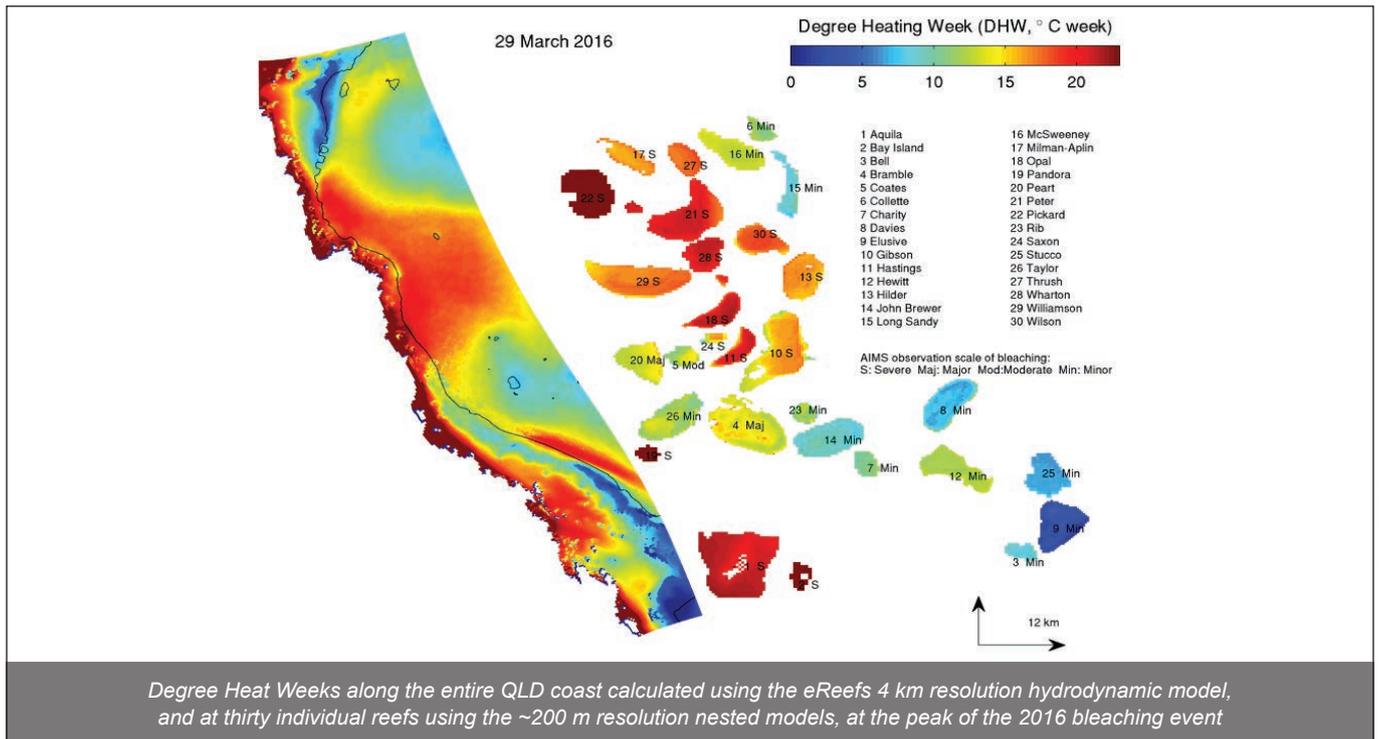


Photo: Mark Baird CSIRO

This project will fill this knowledge gap with a three-pronged approach that includes (i) SeaSim experiments to determine the strength of the relationship between heat tolerance of corals and WQ exposure history, and their recovery trajectories, (ii) analyses of the GBR bleaching and recovery survey data from 2016 and 2017 in the context of local environmental conditions including WQ, determined by direct observations and models, and (iii) incorporation of field and laboratory data into the eReefs models, to compare scenarios of contrasting WQ management actions, and river load reductions required to elevate the thermal tolerance of corals in regions affected by poor WQ, to keep pace with projected temperature increases.

The outcomes of this project include:

- WQ modulated coral bleaching thresholds for key coral species that can be incorporated into bleaching warning tools.
- Quantification of the potential thermal tolerance benefits of improving specific WQ parameters, also supporting future reviews of the GBR WQ Guidelines in the context of coral thermal tolerance and recovery from bleaching.
- Predictions of the impacts of river loads on bleaching tolerance, and regionally specific estimates of reductions in river loads required to enhance thermal tolerance in regions of the GBR that are impacted by poor WQ.
- High-resolution (50 - 200 m) maps of WQ modulated bleaching risk at ~50 reefs in the Central sector of the GBR.

Further information

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