MEDIA RELEASE
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Reef and Rainforest Research Centre - Cairns, Australia
For immediate release

New paper shows nutrients play vital roles in coral bleaching

Key Points

- Coral bleaching involves the **break-up of symbiosis** between corals and their algal partners and has resulted **in rapid and severe reductions to coral cover and recruitment** on the Great Barrier Reef
- This break-up is currently and almost exclusively explained by damage to photosynthesis **by elevated temperatures and light exposure**
- Recent research indicates that **the availability of nutrients in reef waters** also alters the level of co-operation between corals and their symbiotic algae
- **Not all nutrients are the same**. Ammonium and phosphorus could help corals to maintain a healthy relationship with their algal partners, but nitrate may turn the symbiotic algae into coral parasites and increase the likelihood of coral bleaching
- **Controlling nitrate run-off could therefore be critical** in helping the Great Barrier Reef resist and recover from coral bleaching

Controlling nutrient availability could be critical to increasing corals' ability to resist and recover from bleaching, according to a new study produced as part of Project 3.3.1 under the Australian Government's National Environmental Science Program Tropical Water Quality Hub.

A synthesis of the literature by Luke Morris, a James Cook University PhD student working at the Australian Institute of Marine Science (AIMS), found that the forms and ratios of nutrients available on reefs can affect the critical relationship between coral polyps and the symbiotic algae that provide most of their food.

This famous symbiotic relationship between the coral animal and their algal partners can switch from mutualistic (benefiting both organisms) to parasitic (benefiting the algae at the expense of the coral) when exposed to thermal stress, and Luke Morris explained the same may also happen when nutrient conditions are unfavourable.

"Previously it was thought that bleaching results almost exclusively from damage to photosynthesis, but our review demonstrates that nutrients also play a vital role," he said.

"When certain nutrients are elevated, they can disrupt the relationship between corals and their algal partners, resulting in bleaching.

"Laboratory studies suggest that high nitrate availability can drive algal symbiont parasitism, however, there is still much to learn."

The review, featured on the cover of the August 2019 issue of *Trends in Microbiology,* finds that access to a balanced diet of nutrients such as ammonium, nitrate and phosphorous may help corals to discourage parasitic behaviour from their algal partners.

Experiments at the AIMS National Sea Simulator, the world's most advanced research aquarium, will manipulate nutrient conditions before and after thermal stress, to unravel how different nutrient combinations impact both coral bleaching and recovery.

NESP project leader and AIMS coral biologist Dr Neal Cantin said the link between water quality and coral bleaching would be further investigated on natural reefs.

"This work contributes to our understanding of how water quality can affect the coral bleaching process," he said.

"The team at AIMS is now looking to see if water quality gradients influence the patterns of coral bleaching observed during the 2016-2017 Great Barrier Reef bleaching event.

"We surveyed reefs across a range of distances from land, including inshore and mid-shelf reef sites that are differently exposed to land-based inputs of nutrients."

NESP Tropical Water Quality Hub science leader Prof Damien Burrows at JCU's TropWATER facility said that it highlighted the importance of improving water quality in Great Barrier Reef catchments.

"This research highlights how water quality may play an even greater role in determining corals' ability to resist and recover from severe bleaching," he said.

"While this in no way reduces the urgent need for global reductions in greenhouse gas emissions, it's further evidence that research and action at regional and local scales can be leveraged to lessen the pressure on the Great Barrier Reef and increase its chances of recovery."

The Tropical Water Quality Hub is hosted by the Reef and Rainforest Research Centre, based in Cairns.

Coral displaying bleaching symptoms near Russell Island. Image: Neal Cantin

Flood plumes at the mouth of the Burdekin River. Images by Matt Curnock. Support for the aerial footage was provided by TropWATER JCU, the Marine Monitoring Program - Inshore Water Quality through the Great Barrier Reef Marine Park Authority, the Queensland Government, the Landholders Driving Change project led by NQ Dry Tropics, CSIRO and the National Environmental Science Program Tropical Water Quality Hub.

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