

# Corals' partnership with microalgae helps in stressful times but there's a trade-off

January 21 2020, by Marcie Grabowski

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Study authors Mario Kaluhiokalani (undergraduate, Humboldt State University) and Chris Wall (Ph.D., Hawai'i Institute of Marine Biology) prepping coral samples for isotope analysis. Credit: Elizabeth A Lenz, University of Hawaii

In the warmer and brighter shallow waters of Kāne'ohe Bay, O'ahu, the Hawaiian rice coral (*Montipora capitata*) hosts more heat-tolerant symbiotic microalgae in their tissues compared to corals in deeper waters. This pattern was demonstrated in a recent study by scientists at the University of Hawai'i (UH) at Mānoa School of Ocean and Earth Science and Technology (SOEST), and they suggest that while this can help corals weather a heat wave, it may have a price—lower nutrition when the heat wave has passed and seawater temperatures cool down.

Kāne'ohe Bay has experienced significant human impacts over the last century related to dredging, sewage pollution, and urbanization, in addition to regional bleaching events due to [climate change](#). Despite this unique and troubled history, corals thrive in Kāne'ohe Bay. In some corals, this enhanced ability to tolerate [environmental stress](#) can in part be attributed to the species of microalgae corals harbor within their tissues.

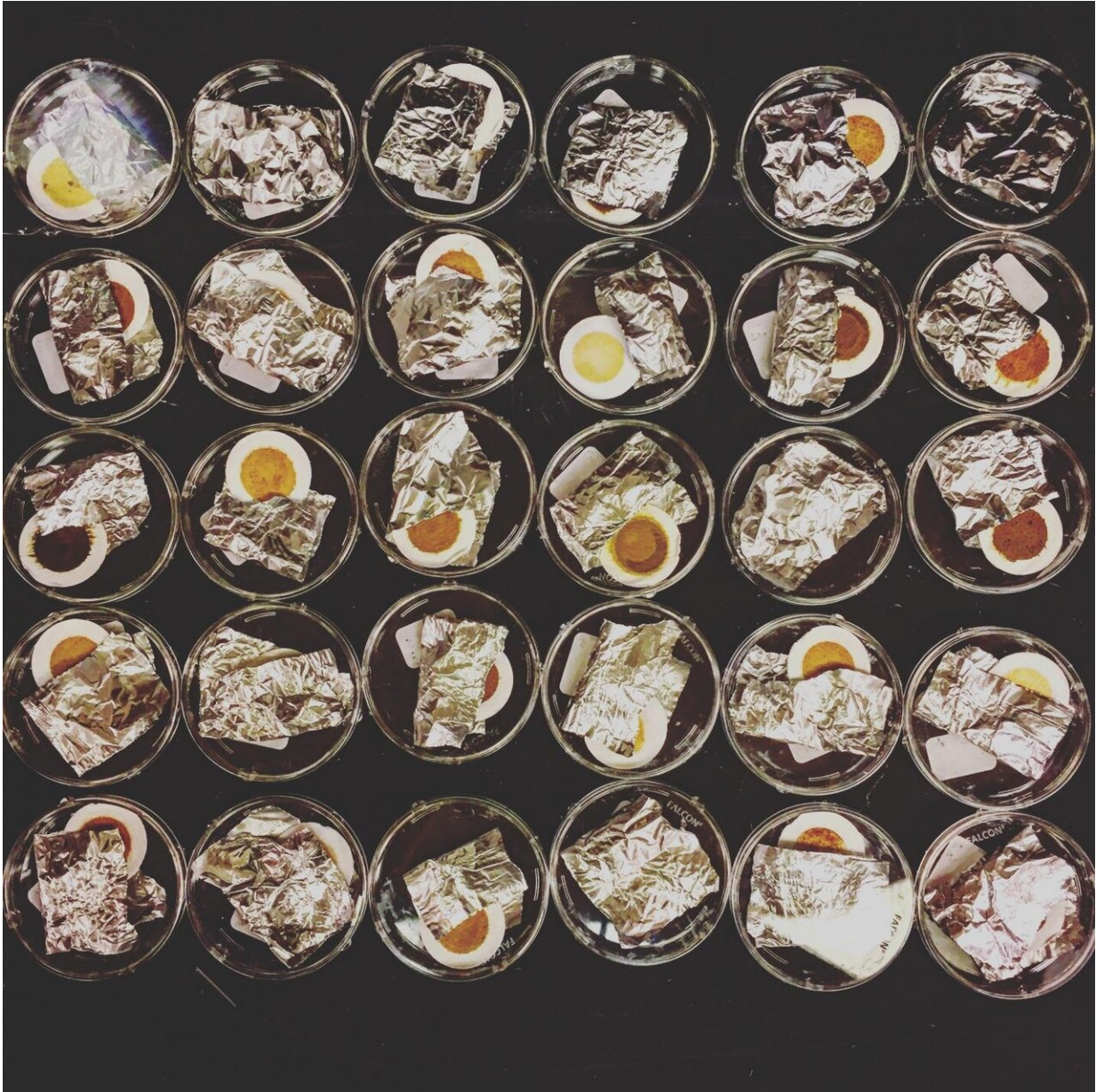
Research over the last two decades has shown that [coral](#)'s symbiotic algae are quite distinct, each group having different abilities and capacities to tolerate stress, like elevated seawater temperatures that cause [coral bleaching](#).

"We wanted to know more about how these symbionts affected corals and whether trade offs existed for corals harboring different [symbiont](#) species," said Chris Wall, lead author of the study and postdoctoral researcher at SOEST's Pacific Biosciences Research Center.

Rice corals form partnerships with two distinct communities of symbiotic microalgae. Using genetic sequencing, the research team found that light availability is shaping the distribution of these symbiont communities in corals sampled from Kāne'ohe Bay, with the heat-tolerant symbionts being more common in shallow depths. Interestingly, although the heat-tolerant microalgae were present in much greater



abundance inside the coral's tissues relative to other symbiont species, they were providing less energy to their shallow coral hosts.



The isolated tissues of corals and their symbiont algae in preparation for stable isotope analyses. Credit: Chris Wall, University of Hawaii





The shallow reefs of Kāne'ohe Bay with a large colony of *Montipora capitata* in center-right. Credit: Chris Wall, University of Hawaii/ SOEST.

Reef corals rely on two sources of energy: from their symbiotic microalgae that live harmoniously within the coral, and food in the surrounding water, such as microscopic shrimp-like animals.

"What was surprising was that corals did not compensate for less food from their symbionts by eating more food in the water column," said Wall. "This was a very cool finding, because we confirmed for the first time that the symbiont species living in corals were affecting nutrition in the field."

Together, the dark water and greater frequency of disturbances may have allowed stress-tolerant coral symbionts, thought to be more opportunistic and 'selfish', to proliferate within the local coral population. This study shows that while stress tolerance may be favorable during challenging periods, these symbionts provide less food to their corals, which may not be as beneficial to the corals in the long term.

"Climate change and ocean warming are changing the costs and benefits of these interactions between corals and their symbiont algae," said Wall. "As we consider techniques for assisting corals in their ability to tolerate environmental stress, our work highlights the need to consider how symbiont communities influence corals beyond stress tolerance. Our findings are also important for people in Kāne'ohe Bay, considering the corals with these stress-tolerant algae are found at higher abundance in the shallows. Any damage from anchors and boat-strikes could seriously harm these coral populations."

**More information:** Christopher B. Wall et al, Divergent symbiont communities determine the physiology and nutrition of a reef coral across a light-availability gradient, *The ISME Journal* (2020). [DOI: 10.1038/s41396-019-0570-1](https://doi.org/10.1038/s41396-019-0570-1)

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