Adult coral can handle more heat and keep growing thanks to heat-evolved symbionts

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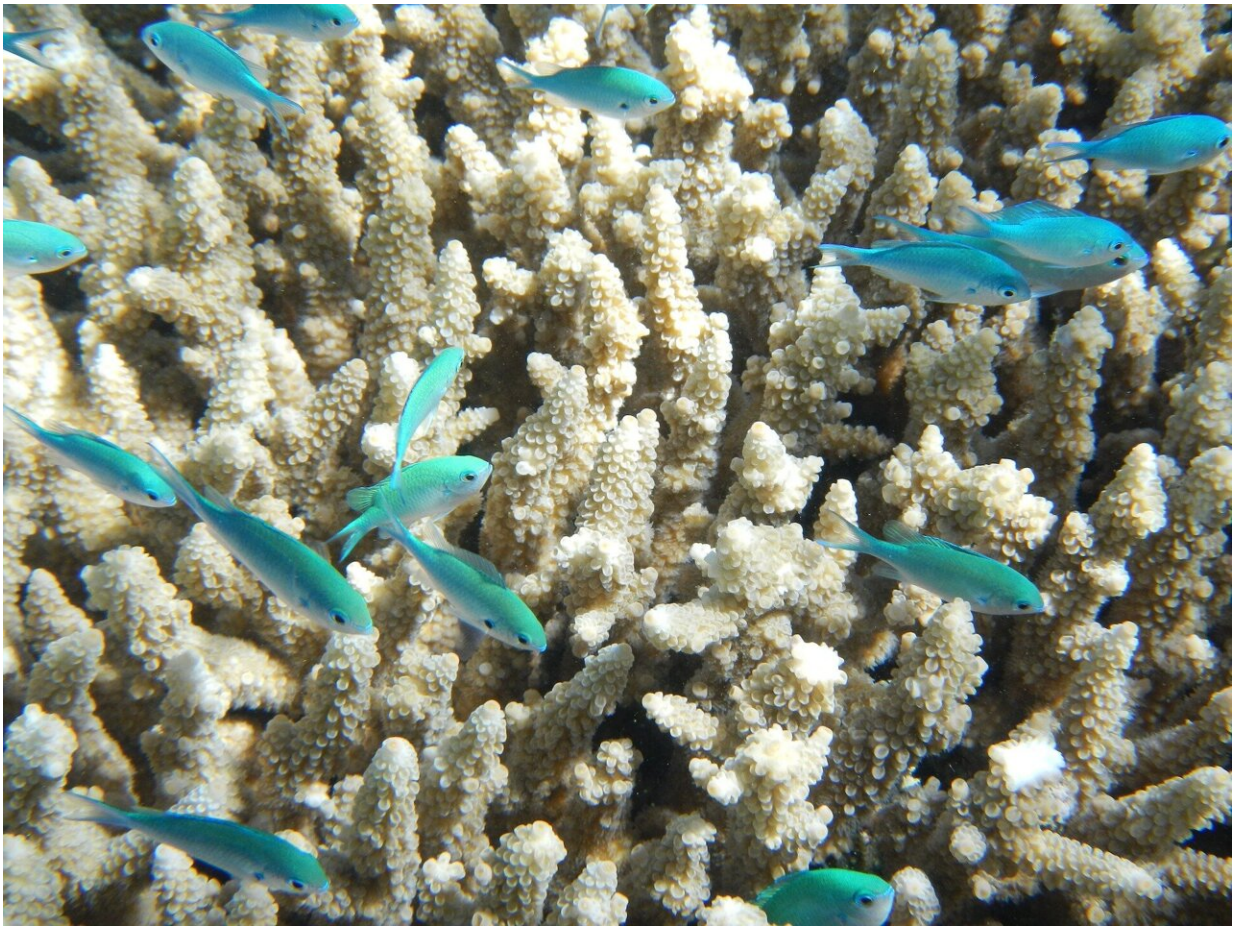

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Adult fragments of a coral species can better tolerate bleaching and

recover faster when treated with tougher heat-evolved symbionts, new research from the Australian Institute of Marine Science (AIMS) and the University of Melbourne indicates. The work is published in *Global Change Biology*.

The study also found that treatment with the heat-evolved symbionts did not compromise the coral's ability to grow. This differs from previous studies on Great Barrier Reef corals, which found that naturally heat-tolerant symbionts could enhance heat resistance in adult corals, but at a cost to its growth.

Symbionts are the tiny cells of algae that live inside the coral tissue, providing corals with energy to grow. The survival of reef-building corals depends on this mutually beneficial relationship.

The symbionts used in this study had their heat tolerance bolstered in the lab by exposing multiple generations to elevated temperatures for 10 years. Adult coral fragments of a single species called Galaxea fascicularsis, that had been chemically bleached, were then offered the heat-evolved symbionts. The scientists found that the symbionts were able to maintain a symbiosis with adult corals for two years, promoting faster coral recovery from bleaching and enhancing their heat tolerance without trading off on growth.

Lead author on the study Dr. Wing Yan Chan from AIMS and the University of Melbourne said the new findings suggest that heat-evolved algal symbionts are a potentially valuable resource for reef restoration applicable across coral species and life stages.

"These symbionts were still detected in the corals in moderate abundance two years after the corals were first inoculated, suggesting long-term stability of this symbiosis and potential long-term benefits to coral heat tolerance," she said.

"Strategies to enhance coral heat tolerance can buy time for reefs, which are threatened by climate change-driven marine heat waves causing bleaching and sometimes mortality. The long-term stability of the symbiosis offers hope they may be able to provide benefits to their coral hosts for many years."

Professor Madeleine van Oppen from AIMS and the University of Melbourne, who is the senior author on the research, said earlier work in her group had shown the benefits of associating heat-evolved symbionts with coral larvae and juveniles.

"These new findings on adult coral close the circle and demonstrate the advantages are not lost in adulthood," she said. "This approach is one of several referred to as 'assisted evolution,' which involves active interventions to accelerate the rate of naturally occurring evolutionary processes."

Dr. Chan said the next critical step of this research will be controlled field trials before it can be determined whether the intervention could work outside of the laboratory, with more than one coral type and at scale.

Dr. Line Bay, a Research Program Director from AIMS who oversees AIMS's coral-focused work within the Reef Restoration and Adaptation Program (RRAP), said the work was an important step in the research on enhancing heat tolerance in corals.

"This study is part of the extensive work AIMS, our partners and collaborators are doing to protect corals from climate change," she said.

"To give coral reefs the best chance of survival, we need to reduce emissions, ensure coral reef systems are managed well, and develop interventions like heat-evolved symbionts to help boost climate tolerance

and resilience for reefs."

The research was a collaboration between AIMS, the University of Melbourne, Monash Institute of Pharmaceutical Sciences and the Melbourne Centre for Nanofabrication.

More information: Heat evolved algal symbionts enhance bleaching tolerance of adult corals without trade off against growth, *Global Change Biology* (2023). DOI: 10.1111/GCB.16987

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