Not enough: Protecting algae-eating fish insufficient to save imperiled coral reefs, study concludes

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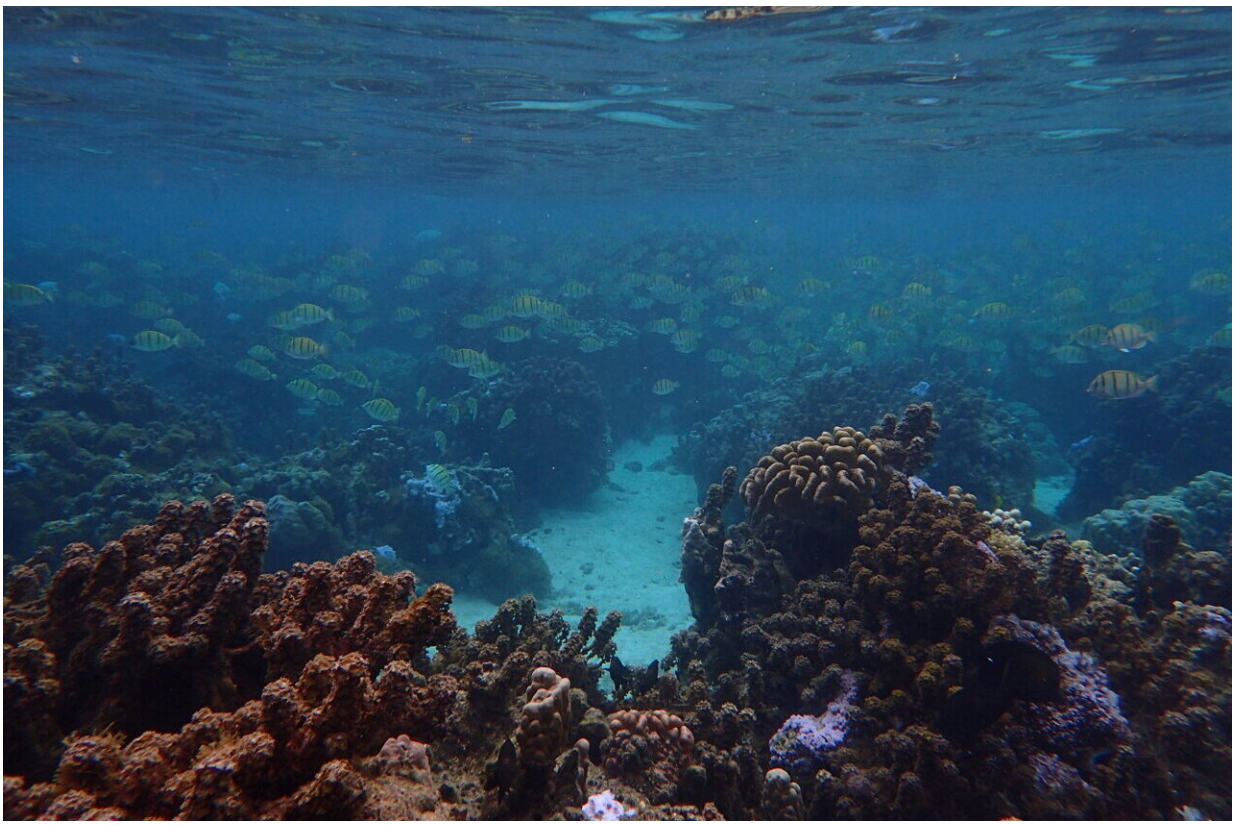

Turbinaria algae coat the corals, foreground, at a north shore reef on the French Polynesian island of Mo'orea. Turbinaria is a genus of brown algae found primarily in tropical marine waters. Yellow-and-black convict tangs, an algae-eating fish, are in the background. Credit: Kelly Speare.

How can we boost the resilience of the world's coral reefs, which are imperiled by multiple stresses including mass bleaching events linked to climate warming?

One strategy advocated by some researchers, resource managers and conservationists is to restore populations of algae-eating reef fish, such as parrotfish. Protecting the fish that keep algae in check leads to healthier corals and can promote the recovery of distressed reefs, according to this idea, which is known as fish-mediated resilience.

But a new study that analyzed long-term data from 57 coral reefs around the French Polynesian island of Mo'orea challenges this canon of coral reef ecology.

The study, scheduled for online publication Oct. 3 in the journal *Nature Ecology & Evolution*, provides compelling new evidence that fish don't regulate coral over time, according to University of Michigan marine ecologist and study co-senior author Jacob Allgeier. The other author is former U-M postdoctoral researcher Timothy Cline.

"This paper very well might radically change how we think about the conservation of coral reefs," said Allgeier, assistant professor in the U-M Department of Ecology and Evolutionary Biology.

"People have been saying for years that we can protect coral through fisheries management, and our work on Mo'orea reefs shows that this is unlikely to work—there are too many other things going on. There is functionally no measurable effect of fishes on coral cover over time."

Support for the idea of fish-mediated coral reef resilience has led to calls for moratoriums on fishing for algae-eating reef fish to prevent algae overgrowth and reef degradation. Such well-intentioned but misguided management strategies could have huge implications for the millions of

people who depend on coral-reef fisheries for food and income, according to the authors of the new study.

Instead, it makes more sense to support strategies that promote the conservation of diverse habitats and coral reef types at various stages of degradation, the researchers said.

"We do need to manage fisheries in these ecosystems, but instead of things like wholesale restrictions on parrotfish, we should consider management efforts that promote sustainable harvest throughout the food web to disperse the impacts of fishing," Allgeier said.

Coral reefs are among the most biodiverse and productive ecosystems on the planet, but they are also among the most imperiled and rapidly changing.

Threats to coral reefs include predatory species, nutrient pollution, ocean acidification, overfishing, sedimentation and coral bleaching, which is caused by sustained, warmer-than-average sea surface temperatures. As the climate warms, mass bleaching events are lasting longer, becoming more frequent, and are affecting reefs that are completely protected from all human impacts other than climate change, Allgeier said.

The new study involves a series of statistical analyses of coral reef data collected between 2006 and 2017 by two long-term monitoring projects: the Mo'orea Coral Reef Ecosystem LTER and the Centre de Recherches Insulaires et Observatoire de l'Environnement.

The Mo'orea coral reef datasets contain some of the longest continuous observations of fish populations and algae growth on coral reefs.

Macroalgae, commonly known as seaweed, compete with corals for seafloor space and can smother them if they grow too dense. If corals are

weakened by a bleaching event or some other disturbance, macroalgae often move in and displace them.

During the 2006-17 data-collection period analyzed in the study, Mo'orea coral reefs were significantly impacted by two major disturbances: an outbreak of the coral-eating crown-of-thorns starfish and a direct hit from Cyclone Oli in winter 2010.

The two events allowed Allgeier and Cline to study the degradation and subsequent recovery of the Mo'orea reefs and to assess the factors that contributed to the recovery. They used mathematical models to test the hypothesis that the rate at which corals recovered correlated with various attributes of the fish community, including species diversity, biomass and richness.

"We found no evidence that the substantial variation in fish community biomass and diversity had any influence on how sites recovered from disturbances," Cline said. "Instead, we suggest additional location-specific attributes are critical in recovery, and the fish community is just one component of a suite of variables that must be considered."

More information: Timothy Cline, Fish community structure and dynamics are insufficient to mediate coral resilience, *Nature Ecology & Evolution* (2022). DOI: 10.1038/s41559-022-01882-0. www.nature.com/articles/s41559-022-01882-0

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