Related coral species differ in how they survive climate change effects

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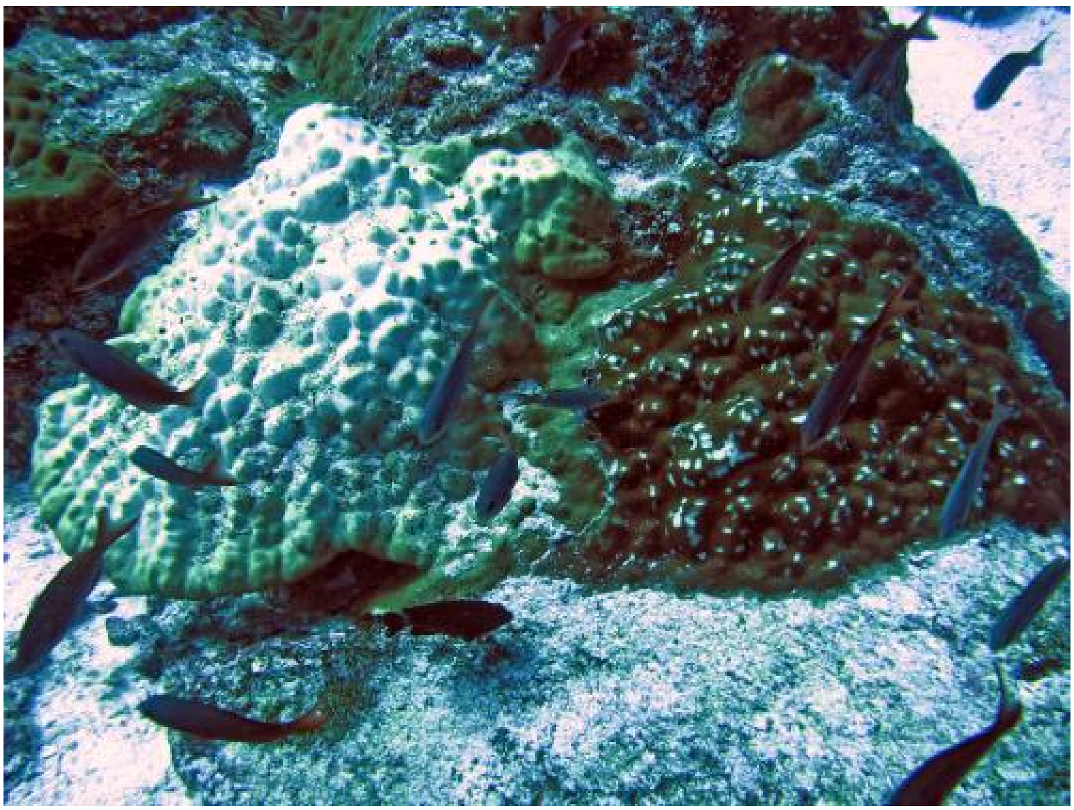

Two species of Porites corals growing side-by-side; the one at left is bleached. Credit: Iliana Baums, PSU

Ocean waters warming from climate change are placing coral reefs in jeopardy, but a new discovery suggests that two similar-looking coral species differ in how they survive.

One withstands warmer ocean temperatures better than the other.

"We've found that a previously unrecognized species was hiding some corals' ability to respond to climate change," says Iliana Baums, a biologist at Penn State University.

Baums led the research team that included Jennifer Boulay of Penn State, Jorge Cortes of the University of Costa Rica and Michael Hellberg of Louisiana State University.

A paper describing the discovery is published today in the journal *Proceedings of the Royal Society B*.

"These scientists have identified a 'cryptic,' or hidden, species in a common group of corals," says Michael Lesser, program director in the National Science Foundation's Division of Ocean Sciences, which funded the research.

"The two corals have very different responses to their environment," says Lesser, "and different interactions with other organisms on coral reefs."

Coral reefs protect shorelines from battering by hurricanes and generate millions of dollars in recreation revenue each year. They also provide habitat for an abundance of species used by humans as seafood and serve as a discovery ground for new medicines.

The researchers sampled the lobe coral Porites lobata in the Eastern Pacific Ocean.

"The environment for reef growth isn't the best in the Eastern Tropical Pacific," says Baums, "due to seasonally cold waters, water chemistry that makes it difficult for corals to lay down their skeletons [low aragonite for calcification], and recurring warm waters from the El Niño Southern Oscillation."

The scientists found an unexpected pattern: two coral species that look deceivingly similar and sometimes live together in the same location.

The samples were not all Porites lobata, as the researchers initially thought. Instead, some belonged to the species Porites evermanni.

"That surprised us," Baums says. "The two look identical, and we thought they were the same coral species, but Porites evermanni has a very different genetic makeup.

Researchers sample lobe corals of the species Porites lobata. Credit: Joshua Feingold, Nova Southeastern University

"We knew about Porites evermanni—it's not a new species—but we didn't expect to find it in the Eastern Pacific. Usually it's in the waters off the Hawaiian Islands."

Boulay wondered if the two differed in the way they live. She found that Porites evermanni was less susceptible to bleaching than Porites lobata.

Bleaching happens when the symbiotic relationship corals have with single-celled algae inside them breaks apart as water temperatures go up.

"If water temperatures continue to rise, coral species that succumb to bleaching more easily will die," Baums says. "We're going to see a shift in the relative abundance, for example, of these two Porites species."

Boulay found other important differences: Porites evermanni had many genetically identical clones, which means that the species is reproducing asexually by breaking apart, although Porites lobata did not.

The clonally-reproducing Porites evermanni also, on average, housed many more tiny mussels that lived in its skeletons. The mussels poked through the surface of the corals and formed keyhole-shaped openings.

The researchers then wanted to determine the connection between Porites evermanni's ability to clonally reproduce and its interactions with mussels and with other members of the reef community.

Jorge Cortes remembered that several years ago a scientist had reported finding that some corals are a target of biting triggerfish.

"That was the missing piece," Baums says. "We realized that triggerfish were eating the mussels inside the coral skeletons. To get at the mussels, the fish have to bite the coral.

"They then spit out the fragments, and those fragments land on the ocean floor and grow into new coral colonies.

"No one had realized how important fish might be in helping corals reproduce. Now there's evidence that triggerfish attacks on Porites evermanni result in asexual reproduction—the coral fragments cloning themselves."

Keyhole-shaped openings in this Porites coral are made by tiny mussels living inside. Credit: Iliana Baums, PSU

The other coral species, Porites lobata, has fewer mussels and reproduces sexually through its larvae.

It takes two to tango, Baums says, so usually you need a partner. "But in areas of the Eastern Pacific Ocean that are so harsh that only a few individuals can survive, it might be easier for the coral to clone itself."

As for the difference in bleaching, there are two possible explanations, the scientists believe.

One is that the symbiotic algae that live in the coral species are different, and one can withstand hotter temperatures. "Just like in your garden: the tomatoes like the heat more than the cauliflower does," says Baums.

Another possibility is that the difference is not in the symbiotic algae, but in the corals themselves.

"There's been a lot of attention given to how different symbiotic algae react to increases in water temperatures and whether, if a coral species could switch to hardier algae, it could survive in hotter waters," Baums says.

But what the researchers found suggests a different scenario. Although the two Porites corals have the same symbiotic algae species, bleaching still differs.

It may be the corals themselves instead of their symbiotic algae that contribute to bleaching.

A tale of two corals, and a tale, perhaps, of more than two factors.

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