New study sheds light on corals' susceptibility to temperature change

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An international team of marine biologists has found that existing diversity in some coral populations may significantly influence their response to extreme temperature disturbances — such as those predicted from climate warming. The team demonstrated that natural selection acting on the species of algae living within corals may determine which partnerships will survive when confronted with extreme temperatures changes. The results will be published online in the May 5 issue of the journal *Proceedings of the Royal Society B*.

Corals form symbiotic relationships with photosynthetic algae in order to survive. The algae provide the corals with nutrients and energy, while the corals provide the algae with nutrients and a place to live. According to the scientists, this delicate symbiosis is sensitive to changes in the environment, and especially to changes in temperature. "A change in sea-surface temperature of just a few degrees above the summer high or below the winter low can cause many coral-algal symbioses to break down and the algae to be expelled," said Mark Warner, an associate professor of marine biosciences at the University of Delaware and one of the team's leaders. This process is known as bleaching because it leaves behind the translucent animal tissue and the white skeleton underneath.

The scientists — which include Todd LaJeunesse, an assistant professor of biology at Penn State University, and Hector Reyes-Bonilla, a professor at Universidad Autonoma de Baja California Sur — found that corals harboring certain species of symbiotic algae survived a severe

cold-water event that took place in 2008 in the Gulf of California (eastern Pacific Ocean), while corals harboring a different species of algae died.

The team focused their research on a genus of coral called Pocillopora that comprises approximately 95 percent of the coral community in the Gulf of California and the larger eastern Pacific Ocean. "In this region, Pocillopora corals typically harbor one of two types of symbiotic algae: a species that is sensitive to environmental changes or another species that is stress-tolerant," said LaJeunesse. The team found that colonies of Pocillopora corals harboring the sensitive species of algae were bleached following the 2008 cold-water event, which led to a high mortality rate in these corals. In contrast, Pocillopora colonies harboring the stress-tolerant alga were virtually unaffected by the episode.

In addition to their work in the Gulf of California, the team also surveyed reefs along the western coast of Mexico and into Panama. Pocillopora corals were significantly impacted at several of these sites during substantial warming and cooling when there was a particularly strong El Niño/La Niña in 1997 and 1998. In fact, up to 90 percent of all corals died after bleaching. Much like their work further north, the team noted that the majority of corals growing in these locations contained the more tolerant species of algae. "The differential mortality that we witnessed suggests that the relationship between certain populations of Pocillopora and the species of algae they associate with is quite stable," said Warner. "And this stability, ultimately, is an Achilles heel for Pocillopora. The inability of the corals to shuffle their symbionts or to establish symbioses with different species of algae means that we may see a significant loss of coral populations in the future, especially if extreme temperature disturbances, such as the cold anomaly we documented in 2008 or the hot anomaly that took place in 1997, become more frequent or severe."

Provided by University of Delaware