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Is Bleaching Coral's Way of Making the Best of a Bad Situation?

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For an organism that can't move, coral turns out to be pretty nimble.

Coral has a critical partnership with certain algae that absorb sunlight and convert it to energy needed to feed the complex array of life found in a reef ecosystem. The loss of these algae, a common consequence of pollution or climate change, leaves a reef "bleached" and unable to produce energy from sunlight.

Coral bleaching has increased widely in recent decades. Because it often precedes coral death and the loss of the reef itself, conservationists are naturally concerned that many of the world's reefs are in trouble.

But new findings suggest that when coral is threatened, bleaching may be part of the solution.

It now appears that coral colonies, when confronted with dramatic environmental changes, may purge themselves of existing algae to make room for other algae more capable of thriving in the challenging conditions. Bleaching, then, may not signify coral's imminent demise, but its ability to tough out new conditions.

In one set of experiments, marine scientist Andrew C. Baker of the New York Aquarium found that corals that undergo bleaching after being exposed to sudden environmental change are more—not less—likely to survive in the long run.

"This counters conventional wisdom that bleaching is detrimental from all perspectives," Baker said.

Many Threats

Although many corals look bony and durable, reefs are highly fragile ecosystems, sensitive to human disturbance and environmental stress. Coral reefs all around the world are threatened by water pollution, soil erosion, fertilizers, fishing with explosives, careless diving, and other assaults.

Rising global air and water temperatures are another threat. Although warm tropical waters are ideal for reef development, excessively high sea temperatures can harm or kill algae.

Global warming may accelerate the melting of polar ice caps, causing sea levels to rise. Sunlight doesn't penetrate deep water, so reefs—and their algae—may be deprived of a critical source of energy.

"The frequency of coral bleaching will increase dramatically during this century as a result of increased global warming," said Malcolm McCulloch, a geochemist at Australian National University in Canberra.

At an international conference last month in Edinburgh, Scotland, McCulloch noted that the total area of Earth's coral reefs has shrunk by 30 percent in the past three decades. The Caribbean, for example, has lost as much as 90 percent of its reefs.

Encouraging Findings

Recent studies by McCulloch and Baker offer hope that imperiled corals are flexible enough to survive.

In Edinburgh, McCulloch drew on geological records to demonstrate the resilience of coral during periods of significant climate change over the past 500,000 years. According to his data, eras of warm global temperatures—when sea levels rose by as much as 18 feet (6 meters) above today's level—were periods in which reefs flourished rather than suffered.

Explaining the results, McCulloch said rising sea levels provide "space for corals to grow, and warmer ocean temperatures allow expansion of reefs to sub-tropical regions."

Future warming won't necessarily spell the end of reefs, but "it's all a matter of timing," he said. "[Reefs] could do well in a warmer world—as long as the rate of warming is no faster than they can cope with, and assuming that our pollution doesn't kill them off first."

The experiments by Baker, reported in the June 14 issue of the journal *Nature,* also suggest that coral is remarkably adaptable, thanks in part to its cunning use of algae.

Baker transplanted dozens of coral colonies in the San Blas archipelago of Panama to depths that were shallower or deeper than those in which the corals had naturally developed. The study was designed to simulate the environmental change that stationary reefs would be exposed to as a result of rising or falling sea levels.

Coral colonies at different depths host different types of algae. So Baker monitored the transplanted corals to see whether their algae would survive at the new depths, and whether the coral colonies themselves would ultimately live or die.

The colonies that shed their original algae, he found, were able to attract different species of algae that were more suited to living at the new depths. Of the 11 coral colonies that experienced significant bleaching, none died during a 12-month follow-up period. In comparison, seven colonies that had kept their original algae species after being transplanted eventually died.

Artificially changing the depth at which a coral colony lives is one thing. But it remains unclear whether the adaptive process of bleaching will be enough to save coral reefs bombarded with pollution or slowly roasting in ever-warming waters.

McCulloch said: "We should be refocusing our efforts to reduce the effects of direct human-caused stresses on reefs, rather than be too sidetracked by coral bleaching."
