Extracts

Genetically Unique Atlantic Coral Threatened

The discovery that many Caribbean corals are only distantly related to their counterparts in the Pacific Ocean makes the threats of pollution and global warming even more serious, according to a University of Florida zoologist.

Gustav Paulay, a member of the team that made the new and surprising discovery published in the journal *Nature*, says the finding means loss of the colorful underwater "gardens" could lead to the extinction of an entire coral family.

"In the past, people have viewed the Atlantic coral fauna as a poor version of the Pacific fauna," said Paulay, a UF zoologist and a contributing author of the study. "Our findings show Atlantic corals are very distinctive — not just superficially different — but with a long and independent evolutionary history. If we lose them, we're really losing a very distinct and ancient group of organisms."

Overturning decades of previous scientific thought that differences between Atlantic and Pacific coral were limited, DNA analysis revealed that about one third of the corals in the Western Atlantic — mostly near popular tourist spots in the Caribbean — form a unique group only remotely related to Pacific corals.

Compared to the richly diverse and abundant reefs of the Indian and Pacific Oceans, which host 90 percent of the world's coral species, scientists have not realized the great distinctiveness of the less diverse Atlantic corals, Paulay said.

But coral reefs in the Caribbean, which have declined by about 80 percent over the last three decades, are more vulnerable than their Pacific and Indian Ocean counterparts largely because greater human impact, such as overfishing and increased nutrient runoff from sewage and fertilizer, have greatly degraded the Caribbean reefs, Paulay said.

The biggest danger is global warming, however. A summer ocean temperature increase of as little as a single degree Celsius — about 2 degrees Fahrenheit — in these relatively warm ocean waters can upset the delicate balance between reef corals and their tiny, symbiotic algae, he said.

With the stress of high temperatures, the algae that live within the coral suddenly leave it, causing the coral to lose color, turn white and die if the stress is prolonged, he said.

"We hope people will recognize that the Caribbean corals are not just poor cousins of those in the Pacific but a unique treasure, and that they will take greater measures to protect them," said Paulay, who also is a curator of malacology and invertebrate zoology at the Florida Museum of Natural History at UF.

The research shows that if a large portion of the Caribbean corals were to become extinct, there are no close relatives to replace them, he said.

"The other implication is our understanding of the relationship of coral species to each other, and the scientific system for classifying corals will have to undergo a major overhaul," said Paulay. "Aside from the particular discovery of this one significant lineage in the Atlantic, the work has also outlined other important discrepancies between what we thought we knew about coral relationships and what the data reveal."

Although typical techniques used to analyze DNA have been applied to other organisms, they have been less successfully applied to corals, Paulay said.

"The problem is that for some reasons that are not fully understood, the rate of evolution in the genetic code of corals is particularly slow," he said. "As a result, differences among coral species are fairly small compared with differences among species in other organisms. This makes resolution as to who is related to whom — the unraveling of their genealogy or tree of life — much more difficult."

Paulay, a coral taxonomist who has done extensive work in the Pacific Ocean, suggested particular Pacific coral species to use in making comparisons with Atlantic corals, and he helped collect some samples from the Palau islands off Micronesia. In addition to the Caribbean reefs, samples were collected from a variety of locations worldwide, including reefs off the coasts of Brazil, Taiwan and southern Japan.

The research was conducted by an international team of scientists led by the Scripps Institution of Oceanography at the University of California, San Diego and the Smithsonian Tropical Research Institute in Panama. Paulay said the scientists isolated and sequenced the DNA using standard techniques and compared their genetic sequences with analytical software.

"The more (genetic) changes you see, the more distant those corals are because the more mutations have had to accumulate over time to set them apart," Paulay said. "From these events, computer programs can construct a genealogy of these corals that basically creates a tree of life. You can see who is related to whom and to what degree. The surprising result was that corals from different families were more closely related to each other than to corals thought to be from the same family.

"The first time I heard about these results when I became involved with this team of scientists, I was totally

blown away," he said. "It was really counterintuitive."

The study was led by Nancy Knowlton of the Center for Marine Biodiversity and Conservation at the Scripps Institution of Oceanography. Other authors included those at the University of Iowa, Federal University of Rio de Janeiro, Institute of Zoology at the Academia Sinica of Taiwan and the Akajima Marine Science Laboratory of Japan.

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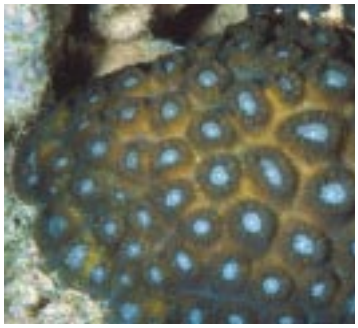

Although these Favia coral from the Atlantic, left, and Pacific, right, are similar looking, researchers have found they are only distantly related, meaning pollution and global warming could lead to the extinction of an entire coral family.