

Novel eDNA method provides real-time insight into coral reef health

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Coral reef ecosystems rely on microorganisms to recycle organic matter and nutrients. These cells also help feed corals and other organisms that depend on coral reefs. Researchers from WHOI studied microbes in coral reef water by examining eight reefs in the U.S. Virgin Islands over a seven-year period, including periods of hurricanes and coral disease.

“Coral reefs have been declining for decades,” said Cynthia Becker, first author of the study. Climate change, storms, disease, and other stressors play important roles. Coral reefs provide habitat for about 25% of all marine species, but they also support billions of tourism and fishing activities. It's important that we monitor changes in coral reefs as they're happening, and microbes in their environment can really help us do that.”

The study, “Microorganisms uniquely predict stony coral tissue loss and hurricane impacts on coral reefs in the U.S. Virgin Islands,” was published in the journal *Environmental Microbiology* explain the effects of coral reef disturbance on bacteria.

During the two major events studied, hurricanes Irma and Maria in 2017 and the stony coral tissue loss outbreak that began in 2020, ammonium concentrations in the water increased, leading to a 34% decrease in *Prochlorococcus* bacteria.

Prochlorococcus is a small photosynthetic bacterium that brings new carbon into coral ecosystems, supporting coral health but also generating oxygen for our atmosphere.

“Much of how we study coral reefs is done at the macro level,” said Amy Apprill, a microbial ecologist at WHOI and an author of the study. However, changes in coral and aquatic communities may not be seen for months or years. This makes it difficult to monitor the condition of these vulnerable coral reefs in real time. Bacteria grow rapidly and respond quickly to nutrients, temperature, pH and other conditions. By sampling water, we can see the immediate impact of disturbances and intervene to support coral reefs ahead of the situation.”

Researchers used eDNA to analyze the coral reef’s microbial community.

This genomic technique involves collecting samples of coral reef water, which contains approximately 1 million microbial cells per milliliter, and sequencing the microbial DNA in the samples to identify the microorganisms. This provides scientists with a non-invasive method to gather near real-time information about the health of coral reefs.

“Understanding the composition of healthy coral reef microbial communities is important,” Becker said. Without a balance between microbial and macrobiotic health, you cannot have a healthy functioning ecosystem. Another benefit of this progress is efforts to restore coral reefs. Microorganisms can provide assessments of ecosystem health. This can complement visual assessments to determine whether reef health has been restored.”

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