UC SANTA BARBARA

THE Current

December 19, 2019
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Adding Insult to Injury

Coral reefs have been around for millennia, but we're still just scratching the surface of the complex interactions and relationships between corals and the other organisms in their communities. Because corals support a diverse array of life in the ocean, a more nuanced awareness of these linkages is vital to our understanding of how corals are affected in a time of global change.

In a paper published in the journal Marine Ecology Progress Series, UC Santa Barbara researchers working on the reefs of Mo'orea, French Polynesia, have found that some events that are part of the normal existence of corals have the potential to become harmful in the presence of one or more environmental stressors.

Take, for instance, the striated surgeonfish, an important detritivore, who grazes on the algae that grow on the reef. For millennia these surgeonfish have evolved alongside their coral communities, grazing, eating and — well, pooping.

"Everybody poops, including fish, which have been going about their business on coral reefs since time immemorial," said postdoctoral researcher Leïla Ezzat, the lead author on the study.

Under normal circumstances the microbes expelled in fish feces have minimal, transient effects — in fact, their fecal matter contains nutrients that could potentially favor coral growth.

"However, fish feces are known to harbor a high abundance of opportunistic bacteria that could potentially alter coral microbiomes," Ezzat said. The idea, she explained,

was to investigate how and to what extent common interactions between reef fishes and corals could alter coral microbiomes and health.

To find out, Ezzat and other researchers in UC Santa Barbara marine ecologist Deron Burkepile's group put lobe coral in separate tanks and placed them under a variety of conditions that could occur in their habitat: an unmanipulated control coral; a coral with a surgeonfish fecal pellet deposited on it; an artificially wounded coral (cut to mimic the action of coral predators such as parrotfish); and a wounded coral with a fecal pellet on it. They sampled the coral three times over the course of the two-day experiment — once at the beginning, at 24 hours and at the end, or 48 hours.

"We found that corals experienced an overall shift in their bacterial community when they were wounded and/or exposed to fecal pellets," Ezzat said. "This included an increase in the abundance and diversity of bacterial species present — a number of which are potential opportunists or coral pathogens."

They also found that by the 48-hour mark the bacterial communities tended to shift back to their original compositions, suggesting that coral microbiomes are resilient to each individual stressor on its own.

"However, we still observed increased numbers of potentially harmful bacteria when corals were exposed to both stressors simultaneously," Ezzat said. This led the team to conclude that microbial impacts may be exacerbated when stressors interact, such as wounding and the deposition of fecal matter. Although surgeonfish are normal and typically benign members of the coral community, in the presence of one or more stressors they could indeed become a vector for opportunistic bacteria via their feces.

The study demonstrates that even a common, local and natural process such as fish defecation can disrupt a healthy coral microbiome when combined with other stressors. More widespread and severe stressors, such as pollution or increased sea surface temperature, may further exacerbate these types of effects on the coral microbiomes.

"Whether it's increased plastic debris that can injure corals or ocean warming that can lead to coral bleaching, we need a better understanding of how different stressors interact with critical reef organisms, such as fishes, to alter microbiomes and overall health of corals," Ezzat said. "Our work is an important step in that direction."

About UC Santa Barbara

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